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COMMISSION STAFF WORKING PAPER

REPORT

OF THE SUBGROUP ON THE MEDITERRANEAN SEA (SGMED)

OF THE
SCIENTIFIC, TECHNICAL AND ECONOMIC COMMITTEE FOR FISHERIES
(STECF)

European Union Mediterranean Fisheries and exploited resources

Brussels, 24 - 29 March 2003
Brussels, 16 - 20 February 2004

This report has been endorsed by the Scientific, Technical and Economic Committee for Fisheries (STECF) in its 18th plenary session of 29 March - 2 April 2004.

This report is to be considered as the collective result of the two subgroup meetings.

The fishing fleets and other technical data provided by each expert for the different geographic areas, due to their huge amount and format diversity, should be considered under each one own scientific responsibility.

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1 - **BACKGROUND**

Scientific advice for the Mediterranean fisheries calls for control of fishing effort and improvements of exploitation patterns through technical measures.
To this end, it is fundamental an updated listing and description of the different fisheries currently undertaken in the various areas by E.U. fishermen, irrespective of their legal status and of the fact that they catch shared or national stocks.

The STECF was asked by the Commission to give an overall knowledge of both the fishing activity of the E.U. Mediterranean Countries and the status of the stocks in the Mediterranean.

Three SGMED meetings were proposed (14th STECF Report; SEC (2003)288) to have an overview over the Mediterranean Fisheries.

A first subgroup on shared stocks was celebrated in September 2002 and the results reported on a document (SEC (2002) 1374) already approved by STECF.

This second subgroup was assigned the task to update the description of the EU Mediterranean fisheries, to summarise the applied and potential technical regulations and pros & cons of different alternative management options.

Besides, as a complement of the work done during the first subgroup on major shared stocks**,** STECF should provide biological and technical knowledge of other important shared stocks and fisheries not addressed during the first SGMED (SEC (2002) 1374).
STECF is requested to provide either trends or point estimates along time of the main relevant variables.
STECF is requested to deliver operative advice which could be eventually translated into effective management actions for sustainable fisheries.

2 - TERMS OF REFERENCE

The terms of reference, previously defined by the STECF were as follows:

1. Classify the Mediterranean fleets in E.U. Countries;
2. Describe the fishery features [i.e. fleet, gear characteristics (mesh size, hanging ratio for active and passive gears, hook sizes etc.), fishing seasons and areas, main target species, catch composition and discards] etc.;
3. Specify where the fleet is located and how operates over the time;
4. Summarize the needs of fishing effort reduction for different stocks in different GFCM geographical sub-areas;
5. Evaluate the relationships between fishing effort, fishing mortality, catch rates and fleet capacity for the most important fisheries;
6. Indicate alternative options of fishing effort reduction to achieve equivalent reduction of fishing mortality to keep the stocks status within precautionary safe biological limits;
7. Evaluate and comment, as appropriate, inconsistencies of current mesh sizes and minimum landing sizes;
8. Identify the desirable length of first capture for major stocks.
9. Predict short and long-term results in catches, biomass and economic consequences under the assumption of increase selectivity in appropriate

Mediterranean fisheries catching shared stocks, to respect the current minimum landing size and to set the length at first capture to the length at first maturity.

They have been duly modified in order to focus the group on the fisheries description and to take the opportunity of gaining as many information as possible on shared stocks. So the ultimate ToRs on which the sub-group operated were the following:

1 Identify the current Community Mediterranean fisheries *[fishing fleets + fishing gear + target species or mix of species + area(s) + season(s)]* catching either shared or national stocks and irrespective of the number of interested fishing vessels. STECF is requested to be as much precise as possible in terms of fisheries identification, *e.g.* fisheries using bottom trawl gears with very different structure should be considered as separate fisheries even though they might target the same mix of species.

2 Describe comprehensively the various fisheries: fleets involved, number and type of vessels, gear characteristics [*e.g. dimensions, number of gears per boat, mesh size and shape, twine thickness, use of lastridge/lacing ropes, use of lifting or round straps, use of strengthening ropes, type of codend closure, hanging ratios for active (codend/lengthening piece; ratio between the lastridge rope and the length of the stretched net attached to it, ratio at codend closure between the transversal lashing rope and codend size, chains, rock hopper devices etc.) and passive gears, number of hooks, hooks size, etc.*], number of fishing days per year, fishing regime (seasons, fishing grounds, distance from the coastline), main target species or group of species, size and species composition, catch rates, species and size composition of discards, etc. Distinction should be made between fisheries catching shared stocks and those catching local stocks of only national interest. All technological interactions between fisheries should be highlighted. Multi- and single-species fisheries should be clearly distinguished.

3 Provide, by fishery, possible changes (either trends or point estimates and both by major stocks and overall) of overall production, catch composition, catch rates and size composition occurred along time.

4 Provide the state of exploitation and the status of the stocks other than those already analysed in the first meeting. STECF should provide its opinion on sustainability of crustaceans fisheries using fixed gears with a soaking time lasting several days. An explicit ranking of fisheries and stocks, with respect both to the different level of suitable exploitation and risk of collapse, should also be provided. Such an analysis should consider all scientific evaluations available, even though undertaken outside GFCM framework (national labs, etc.). Whenever robust scientific information is not yet available, STECF is requested to provide its expert judgement.

5 Provide, for the stocks analysed at point 4, information and mapping on nursery and spawning grounds.

6 Summarise the needs of fishing effort reduction for the various fisheries by different GFCM geographical sub-areas if necessary. For mixed fisheries provide an integrated overview of the figures referring to different species giving greater weight to the most relevant or sensitive key species.

7 Report, evaluate and comment as appropriate the relationships between fishing effort, fishing mortality, catch rates for the most important fisheries;

8 Evaluate whether there are alternative options to fishing effort reduction to achieve equivalent reduction of fishing mortality to keep the stocks in healthy conditions;

9 Provide a comprehensive and updated overview of length at first maturity for the main species caught by the different fisheries. Type and size of sexual inversion should be highlighted for hermaphroditic species.

10 Provide, based only on biological considerations, the desirable length at first capture for major stocks with particular attention to hermaphroditic species

11 Provide a comprehensive and updated overview of length at first capture and selectivity parameters (by mesh size and shape, hook size, hanging ratios, twine thickness, etc.) for the main species caught by the different fisheries. Results of selection panels and square mesh size trials should be reported and commented as adequate. STECF should evaluate and comment as appropriate inconsistencies between current minimum landing sizes and specifications of legally used fishing gears.

12 Explore and evaluate different ways of ameliorating substantially selectivity in different trawl fisheries either by modification in the rigging of the net and/or by increasing and modifying mesh size and shape. In particular, STECF should :

a. predict short and long-term results in yield, biomass and economic consequences under the assumption of increase selectivity of fisheries catching shared stocks, either to respect the current minimum landing sizes or to set the length at first capture, for some key-stone stock, to other dimensions still compatible with sustainable use of the resources. Mesh sizes increase up to 65 mm for the various bottom trawl fisheries (*e.g.* mixed fishery, red-shrimps fishery, etc.) should be explored

b. advice on the desirable length at first capture, both at the current fishing effort and other suitable sustainable effort levels, for major stocks. STECF should identify the corresponding gear specifications which are consistent with the results depicted above (*e.g.* mesh size/shape, hook size, max. n° of meshes in the lengthening piece and codend, hanging ratios between lengthening piece and codend, minimum dimension of round and lifting straps, dimension of lashing rope upon which the rear part of the codend is closed, selections panels, etc.)

c. advice on the feasibility to implement the regular use of lastridge/lacing ropes in Mediterranean bottom trawl fisheries, by providing also the adequate hanging ratio, in order to reach the expected selectivity of 40 mm mesh size or other mesh size as considered adequate by the STECF for trawl fisheries

d. evaluate whether and how the current devices attached, either internally or externally, to the towed gears create prejudice to the opening and dimension of suggested mesh size with consequent reduction of expected selectivity of the lengthening piece and codend (e.g. type of codend closure currently used in Andalucian bottom trawlers, etc.)

3 - LIST OF THE PARTICIPANTS

This report has been produced as a conclusion of two working groups. The first meeting was held from 24 to 29 March 2003 in Brussels and was attended by the following scientists.

Abella	*Alvaro*	*Mortreux*	*Serge*
Adamidou	*Angeliki*	*Murenu*	*Matteo*
Ardizzone	*G.D. (STECF member)*	*Oliver*	*Pere*
Baro	*Jorge*	*Petrakis*	*George*
Cau	*Angelo*	*Piccinetti*	*Corrado*
Cingolani	*Nando*	*Polet*	*Hans (STECF member)*
Fabi	*Gianna*	*Politou Chrissi Yianna*	
Ferretti	*Mario*	*Sacchi*	*Jacques*
Fiorentino	*Fabio*	*Sbrana*	*Mario*
Gil de Sola	*Luis*	*Somarakis*	*Stylianos*
Martin	*Paloma*	*Spagnolo*	*Massimo*
Messina	*Gaetano (STECF member)* chairman	*Ungaro*	*Nicola*
Miniconi	*Roger*		

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Biagi Franco (European Commission)

A second meeting was held from 16 to 20 February 2004 mainly to consolidate the draft report already produced during the first meeting and to integrate its geographical coverage. Mr. Gaetano Messina chaired also the second one that was attended by the following experts:

Adamidou	*Angeliki*	*Garcia*	*Mariano*
Ardizzone	*G.D. (STECF member)*	*Kavadas*	*Stefanos*
Arneri	*Enrico*	*Messina*	*Gaetano (STECF member)* chairman
Baro	*Jorge*	*Petrakis*	*George (STECF member)*
Chilari	*Anna*	*Sacchi*	*Jacques*
Di Natale	*Antonio(STECF member)*	*Sbrana*	*Mario*
Ferretti	*Mario*		

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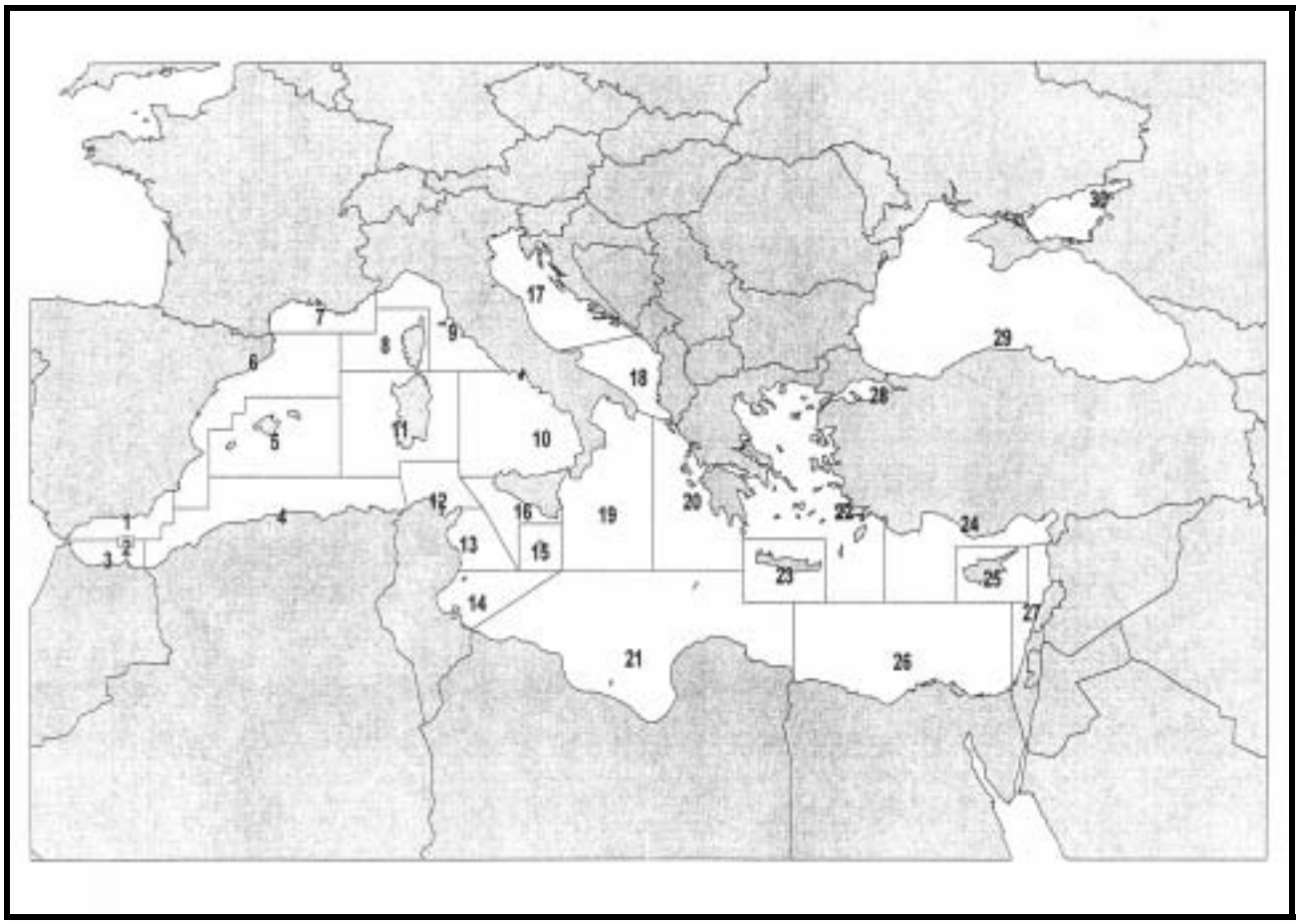
4 - STRUCTURE OF THE REPORT

According to the terms of reference, the report has been structured as showed in the following table:

A	**FISHERIES**	**CAP. 1**	**TOWED GEAR FISHERIES**
		CAP. 2	**PURSE SEINE FISHERIES**
		CAP. 3	**FIXED AND DRIFTING NET FISHERIES**
		CAP. 4	**SUMMARY OF SPECIAL FISHERIES**
B	**RESOURCES**	- summary of the biological characteristics of various species - status of fishing stocks and management advises - Integrated View by Fishery – mapping the nursery areas by species	
C	**GEAR TECHNOLOGY AND SELECTIVITY**	Outcomes of selectivity experiments.	
D	**SUMMARY OF NATIONAL AND REGIONAL LEGISLATION RELATIVE TO TECHNICAL MEASURES AND SPECIAL FISHERIES**		
E	**SUMMARY OF ADVICES AND FINAL CONSIDERATIONS**		

The fisheries listed in the report are considered operating in specific FAO-GFCM geographical sub-areas (GSA) of the Mediterranean Sea, as specified in the following table and map:

SPAIN	GSA 1 – Nothern Alboran Sea
	GSA 2 – Alboran Island
	GSA 5 – Balearic islands
	GSA 6 - Catalan coast-Nothern Spain Subarea
FRANCE	GSA 7 – Gulf of Lions
	GSA 8 - Corsica
ITALY	GSA 9 – Liguria,Tuscany,Lazio
	GSA 10 – Nothern Sicily, Campania, Calabria
	GSA 11 – Sardinia
	GSA 16 – Southern Sicily
	GSA 17 – Northen and Middle Adriatic
	GSA 18 - Apulia
	GSA 19 – Eastern Calabria and Sicily
GREECE	GSA 20 – Ionian Sea
	GSA 22 - Aegean sea
	GSA 23 – Cretan Sea



The following concept of fishery was used by the subgroup ***" A fishery is intended as a fishing fleet targeting the same species or group of species within a given area, using a similar gear type or a similar fishing pattern".***

Each GSA was considered subdivided in:

- continental shelf
- slope
- deep water

The classification of fisheries was done taking also into consideration the above criteria.

For each fishery, the following information was requested:

- general
- fishing ground
- fleet concerned (number, main dimensions, power, GT)
- fishing time over a year
- fishing equipment (characteristics of net, mesh size,…)
- deck layout and machinery involved (trawl whinch, net drum….)
- electronic equipments
- data on catch (species, quantity,…..)
- Technical interactions with other fisheries
- special features
- relationship between fishing effort, fishing mortality and catch rates

A first draft report was produced and submitted at the April 2003 STECF plenary meeting (SEC(2003)843).
Due to the amount of information requested and to the limited time between the working group meeting and the 16th STECF plenary session, it was not possible to finalize the report. Therefore the STECF agreed to examine the provisional report and invited the coordinator of SGMED to finalize the report, in the following weeks, taking into consideration the comments done by the STECF and to present it for the November 2003 plenary session.
The STECF acknowledged the huge amount and quality of the work accomplished by the SGMED and suggested the following:
"

1) STECF notes that it should be useful to have in the report some summary tables of data by fisheries. These tables should show analogies and differences between various fishing gear used in the Mediterranean countries, technical characteristics and related target species.
2) STECF stresses the importance of a common definition of "fishery" in order to avoid different approaches in the various GSA. For example bottom trawling on continental shelf and slope are considered one, two or more fisheries in this first draft report.
3) The WG uses in the report the geographical sub-areas (GSA) adopted by the GCPM for management purposes. The WG should add in the introduction a map of different GSA in the Mediterranean Sea, providing all the information according to these areas.
4) The WG report contains some biological information not included in the first Mediterranean report (September 2002). To avoid any repetitions, the coordinators of the two working group should review the second report in order to remove all the information already provided in the first SGMED report.
5) The STECF reviewed the annexes provided by the working group and considered that they contain very useful information. Nevertheless, considering the aim of the report, recommends including in the text only the most useful data.
6) STECF remarks that there is a lacking of information for some geographical sub-areas in the four countries. The STECF recommends filling these gaps in the near future.
7) The STECF recommends reviewing the editing of the report in order to avoid redundant information.
8) Due to the fact that this is one of the first occasions where all the Mediterranean fisheries are compiled in a document, the STECF recommends to produce a summary of each chapter for a better understanding of the contents and to include the bibliographic references for the data reported.
9) STECF notes that most of the selectivity information presented deals with bottom trawling. For the other fishing methods, little data were available and consequently the conclusions for these methods are rather insubstantial.
10) STECF also considers that, except for bottom trawling, not enough information is available in the report on means to improve the selectivity, i.e. not enough for sound recommendations on possible technical measures. Publications or grey literature should be further explored. Research should fill the gaps in knowledge where needed.
11) STECF notes that the recommendations in the draft report are rather vague. STECF recommends that the final recommendations in the report should be much more explicit and be tailored to guide the Commission in making future proposals for regulation or management.
12) The STECF recognizes the complexity or the TOR and remarks that the report does not contain answers for some issues. As a new step for the improvement, the STECF

recommends not to consider this document as exhaustive so that further contributions could answer the pending issues. "

Not all the items were solved at the time of the November 2003 STECF plenary meeting. So, due to the importance and the complexity of the involved matters, STECF asked the Commission to allow for a second meeting of the subgroup to be held early in 2004.

SECTION A - FISHERIES

CAP. 1 -TOWED GEAR
1.1 - Bottom trawling

SPAIN

General
The Spanish bottom trawl fleet mainly operates in the Spanish fishing grounds, although a limited number of units traditionally go fishing to the Gulf of Lions. In a general way, the fleet can be segmented in two groups: trawlers developing their activity mainly in the continental shelf ("Arrastreros de plataforma") and those operating in the continental slope ("Arrastreros de talud"). The Spanish continental shelf and continental slope support demersal and small pelagics fisheries of great importance for the economy of the region.
The Spanish Mediterranean coast length is 2.600 km., from the border with France to Gibraltar, Balearic Islands included.

Surface (in) between isobaths of 0 and 400 meters

		km^2	km^2
Levante-Norte		22.300	
	Cataluña		4.600
	Valencia		10.600
	Alicante		5.800
	Cartagena		1.300
Surmediterránea		4.500	
Baleares		9.500	

According to the width and relief, two types of continental shelf can be defined:
- The narrowest, in the Northern Catalan area (GSA 6) and in the Northern Alboran sea (GSA1) (between 3 and 11 nautical miles wide).
- The remainder coast and the Balearic Islands have a wider platform (of 11 to 20 miles).

Within the global fishing activity, bottom trawling fishery obtains the highest catches of demersal species. The catches consists of a wide diversity of species, but only some of them are considered target species, either due to the volume of their landings or to their high economic value. The main target species are: blue whithing (*Micromesistius poutassou*), hake (*Merluccius merluccius*), octopus (*Octopus vulgaris; Eledone cirrhosa*), Norway lobster (*Nephrops norvegicus*), red shrimp (*Aristeus antenatus*), red mullets (*Mullus* spp).
According to Spanish regulation, trawling is carried out in fishing grounds deeper than 50 m depth, and the activity is limited to a maximum of 5 days per week and some 12 hours per day. The gear used is a typical otter trawl. The stretched mesh size in the codend is 40 mm that is the minimum allowed for the whole Spanish Mediterranean waters. The trawl fleet has undergone an important modernization in the last years.
In <150 m depth fishing grounds, the catches are characterized by the dominancy of species as red mullet, hake, sparids, scorpenids, triglids and cephalopods as *Octopus vulgaris* and *Eledone cirrhosa*. All of them have a great economic importance and are not discarded.
Between 150 and 350 m depth, catches are characterized by the abundance of hake and blue whithing, *E. cirrhosa* and *Nephrops norvegicus*. Other species as *Parapenaeus longirostris*, *Lepidopus caudatus*, *Trisopterus minutus*, *Lophius spp* and *Zeus faber* are also abundant.

The > 350 m depth fishing ground is characterized by the capture of decapods as Norway lobster and red shrimp. Other species as *Phycis blennoides* and big-sized hakes are also caught. Two kinds of trawling are carried out:

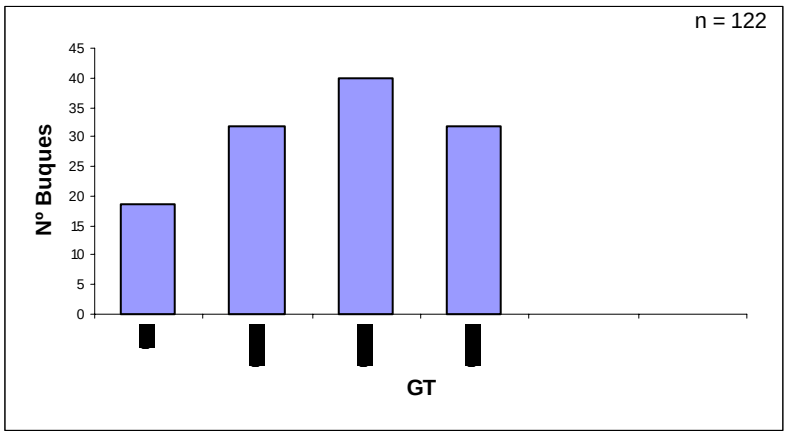
- **Continental Shelf Trawl (Arrastreros de plataforma)**. This fleet uses two types of traditional trawl gear: “frances” and “huelvano”, targeting a wide spectrum of demersal species. The main differences between these two trawl gear concern the wings shape. The “frances” trawl is more frequently utilized in the continental shelf.
- **Continental Slope Trawl (Arrastreros de talud)**. As the previous one this fleet also uses the two traditional trawl gear, mainly targeting deep crustaceans, although the “huelvano” gear is more commonly used. In some periods of the year this fleet fish in the continental shelf as well.

GSA 1 –NORTHERN ALBORAN SEA

FISHERY 1 – CONTINENTAL SHELF

Fleet

There are 122 trawlers operating in shallow and medium waters. The medium size is 11.5 m length. The medium power is about 100 HP, but this value is subestimated since the official power recorded is lower than the real power. The GT values range from less than 20 to 80. The number of vessels by GT size is as follows:

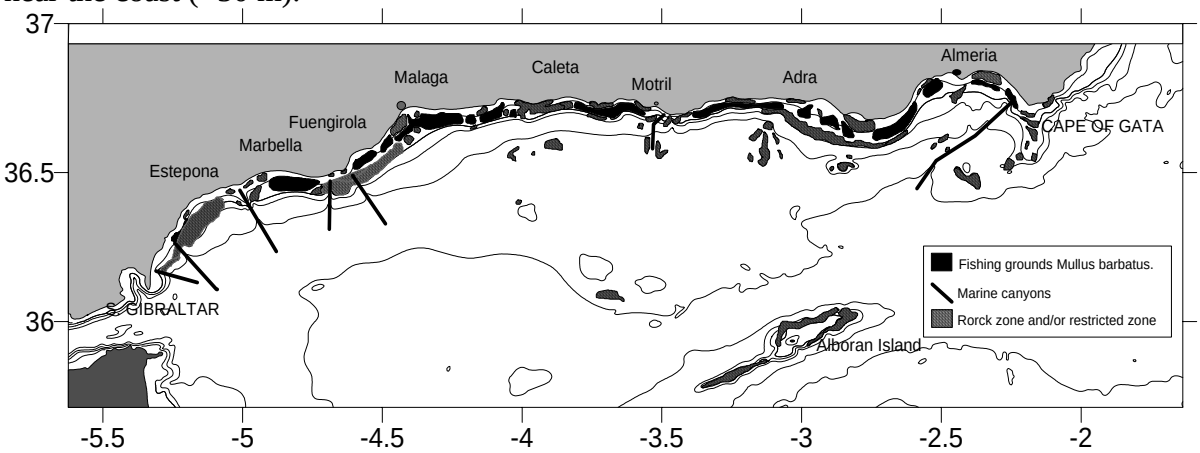


Number of vessels by classes of GT

This segment of the trawl fleet is the oldest and most of the boats are wooden made. The number of fishermen is habitually 4 or even 3.

Fishing ground

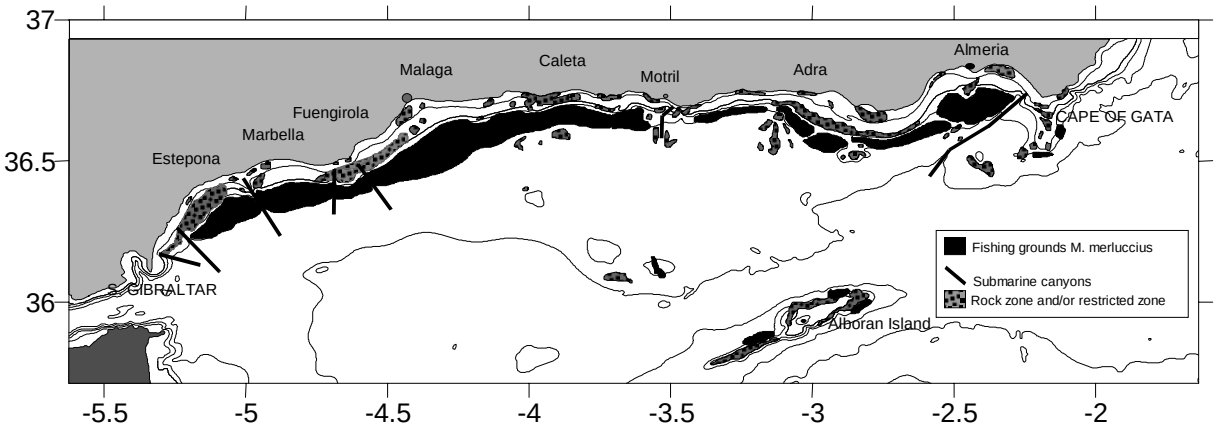
Mullus barbatus is exploited in all trawlable areas (muddy and sandy bottoms) from Gibraltar straight to Cape of Gata. It's caught from shallow waters about 50m depth to maximum depth exploited 200m. It's normally caught by trawl fleet from 50 m to 100 m and by artisanal fleet near the coast (<50 m).



Fishing grounds Mullus barbatus in GSA 1 **(***Source: I.E.O.***)**

Hake is exploited in all trawlable areas from Gibraltar straight to Cape of Gata, including the deep-bottom fishing grounds about GSA 2. Commonly small hakes are caught from shallow

waters about 50 m to 300 depth, whereas adults reach the maximum depths exploited, 800 m, associated with red shrimp (*Aristeus antennatus*) fishery.



Fishing grounds M. Merluccius in GSA 1 **(***Source: I.E.O.***)**

Fishing time over a year

The fleet operates during the whole year except for a closed season of two months in the first half of the year. The time in which the closed season is implemented can change among years. Spanish legislation in the Mediterranean limits the trawl activity for 12 hours during the day and only from Monday to Friday.

Fishing equipment

The gear is a typical otter trawl, which is occasionally rigged with chains in the footrope. The vertical opening in Alboran trawl gear ranges from 0.2 to 1.4 m. Net sensors are not employed. Otter boards are usually oval, steel made with a maximum weight of 400 kg each.

Deck layout and machinery involved

Most of the vessels have open deck and are equipped with gantry.

Electronic equipment

Most of the vessels have a GPS and additional electronic equipment for navigation.

Data on catch

The fishery is multispecific, targeting fish, cephalopods and crustaceans. Main target species are: hake (*Merluccius merluccius*), axillary seabream (*Pagellus acarne),* (*Octopus vulgaris*) and pink srimp (*Parapenaeus longirostris*).

Some interactions occur with artisanal fisheries, particularly in the case of traps fishery targeting commom octopus (*Octopus vulgaris*). By-catch species are squid (*Loligo vulgaris*), red mullet (*Mullus barbatus*) and other sparids and cephalopods (*Sepia officinalis, Sepia elegans, Ilex coinditei, Alloteuthis* spp.)

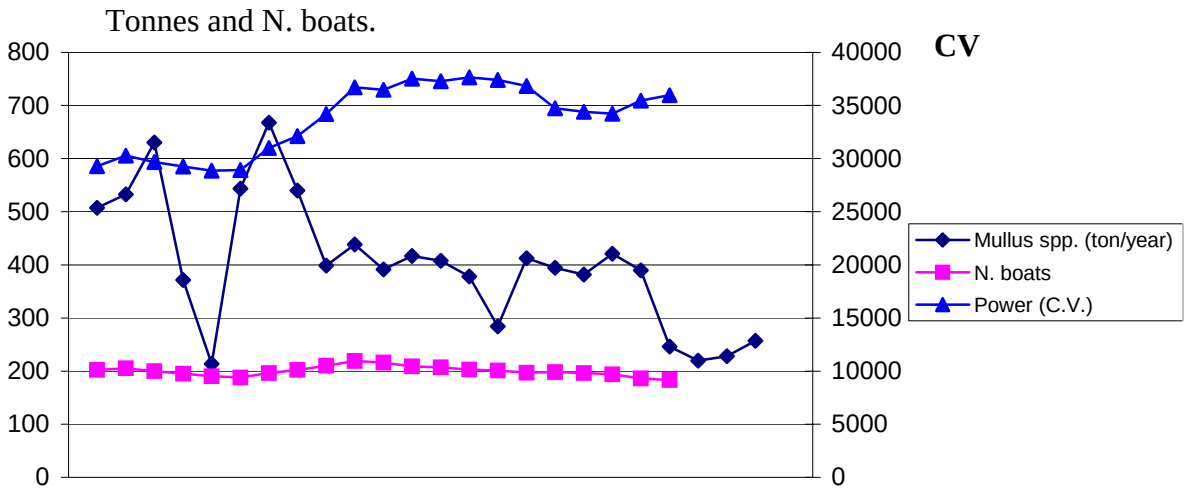
Two semipelagic species, *Micromesistius poutassou* and *Trachurus spp*. represent the 23 % of the total catch in weight, though they have a low economic value. Cephalopods are an important group, with 25 % of the catch, mainly represented by *Octopus vulgaris* (20%) and *Sepia spp*.

Crustaceans get the highest values in the market representing the 24 % in the total catch, although *Nephrops norvegicus* and *Parapenaeus longirostris* do not contribute a lot to the total capture in weight (6%).

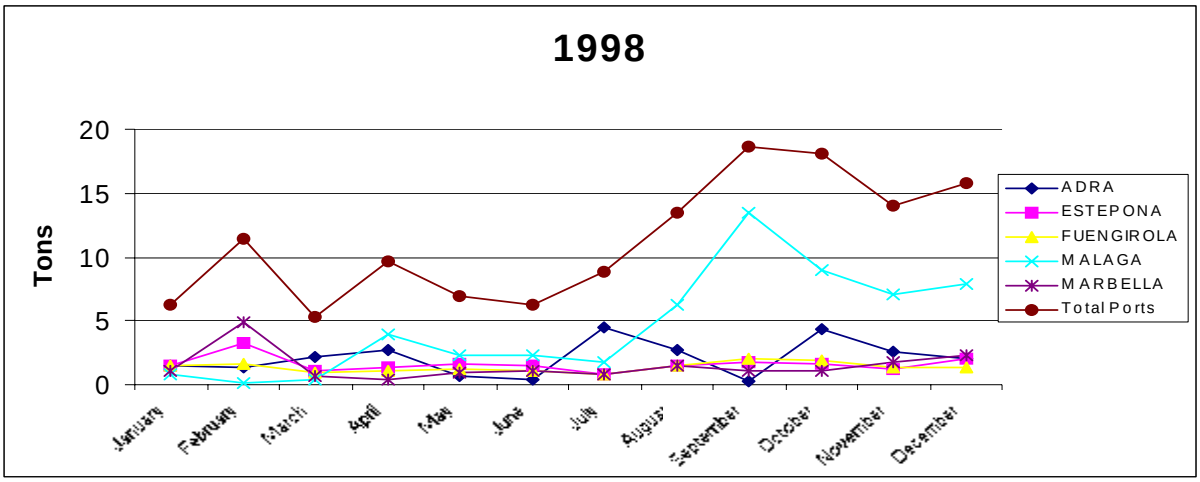
	W (tons)	P (euros)	W %	*P %*	euros/kg
M. merluccius	72	299614	7	*9*	**4**
Mullus spp.	39	185541	4	*6*	**5**
Pagellus acarne	37	87644	4	*3*	**2**
M. poutassou	182	213314	18	*6*	**1**
Trachurus spp.	50	70136	5	*2*	**1**
Octopus vulgaris	202	344655	20	*10*	**2**
Sepia spp.	49	107966	5	*3*	**2**
N. norvegicus	26	476958	3	*14*	**19**
P. longirostris	30	326586	3	*10*	**11**
Others	319	1245208	32	*37*	**4**
Total	**1006**	**3357621**			

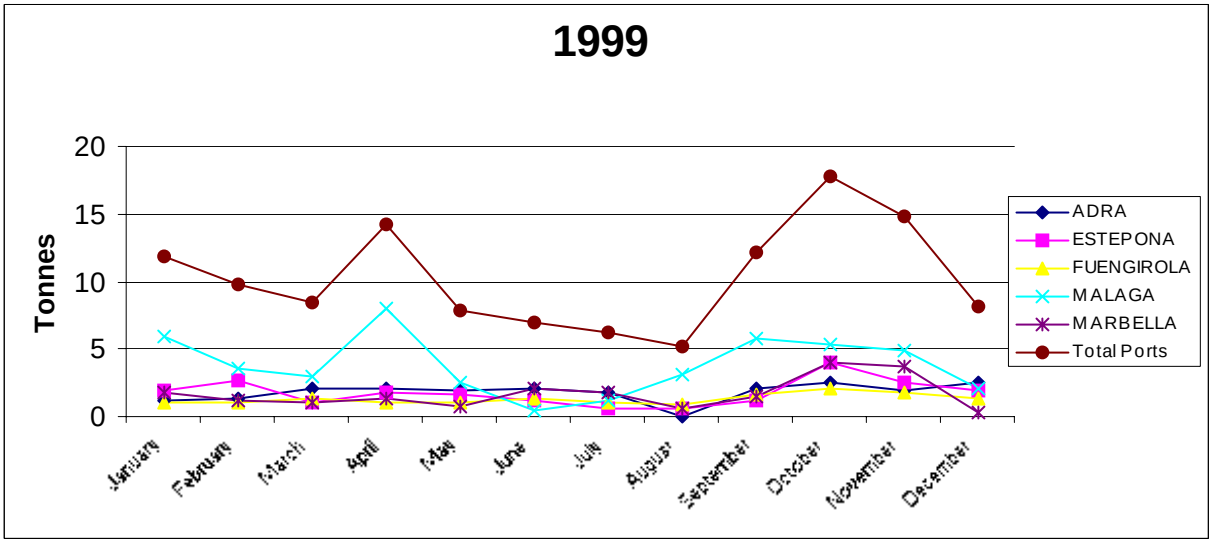
Source: IEO (MEDLAND)

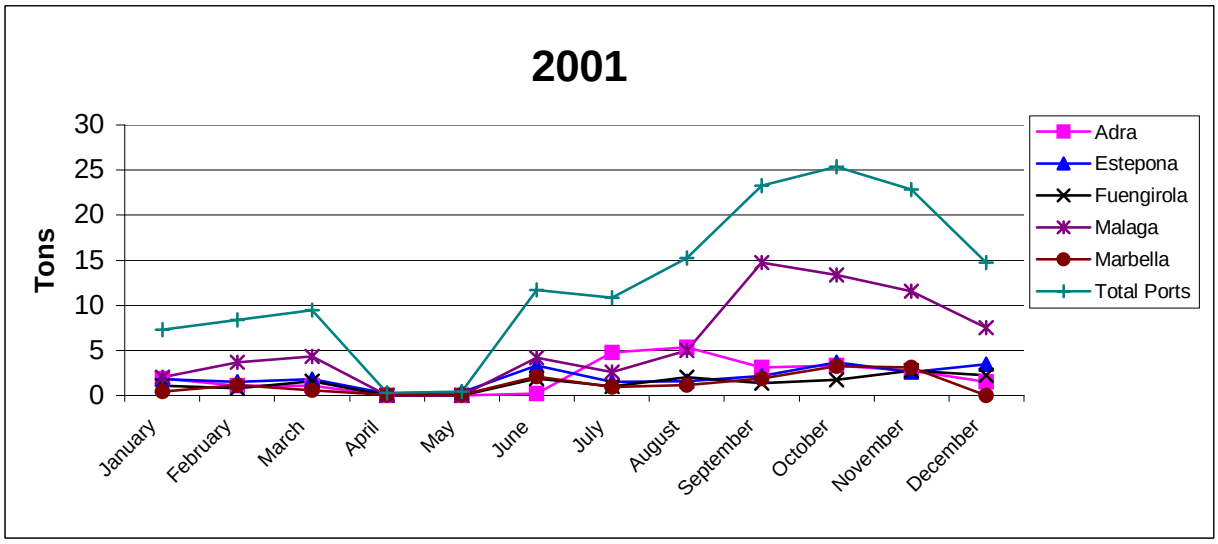
Red mullet catches in GSA 1, from 1970 to 1994, ranged from 667 to 219 t in 1976 and 1991 respectively.



Landings Mullus barbatus in GSA 1 (1970- 1994). **(***Source: I.E.O.***)**

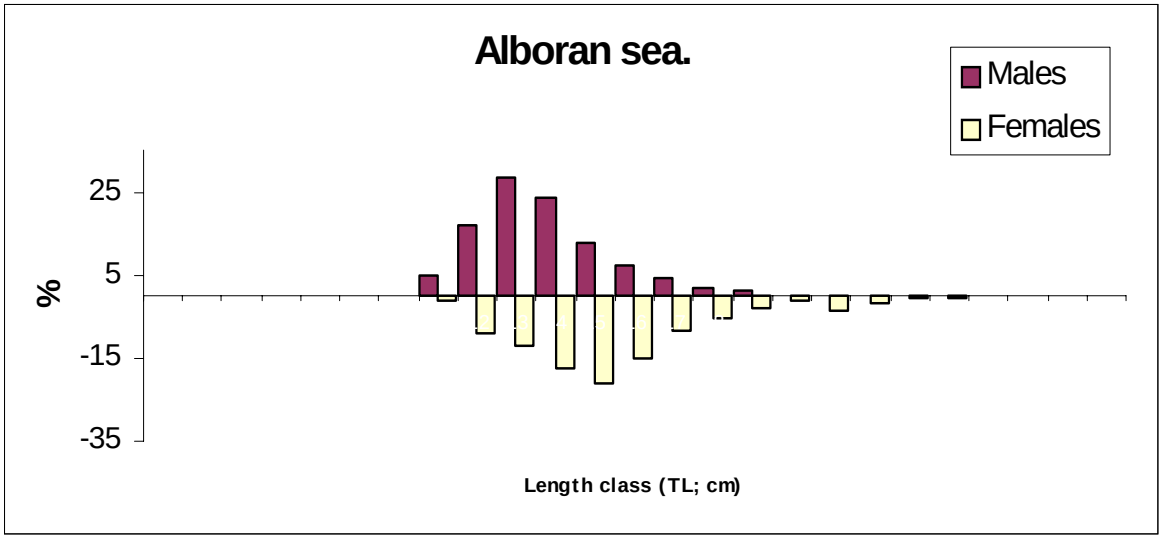




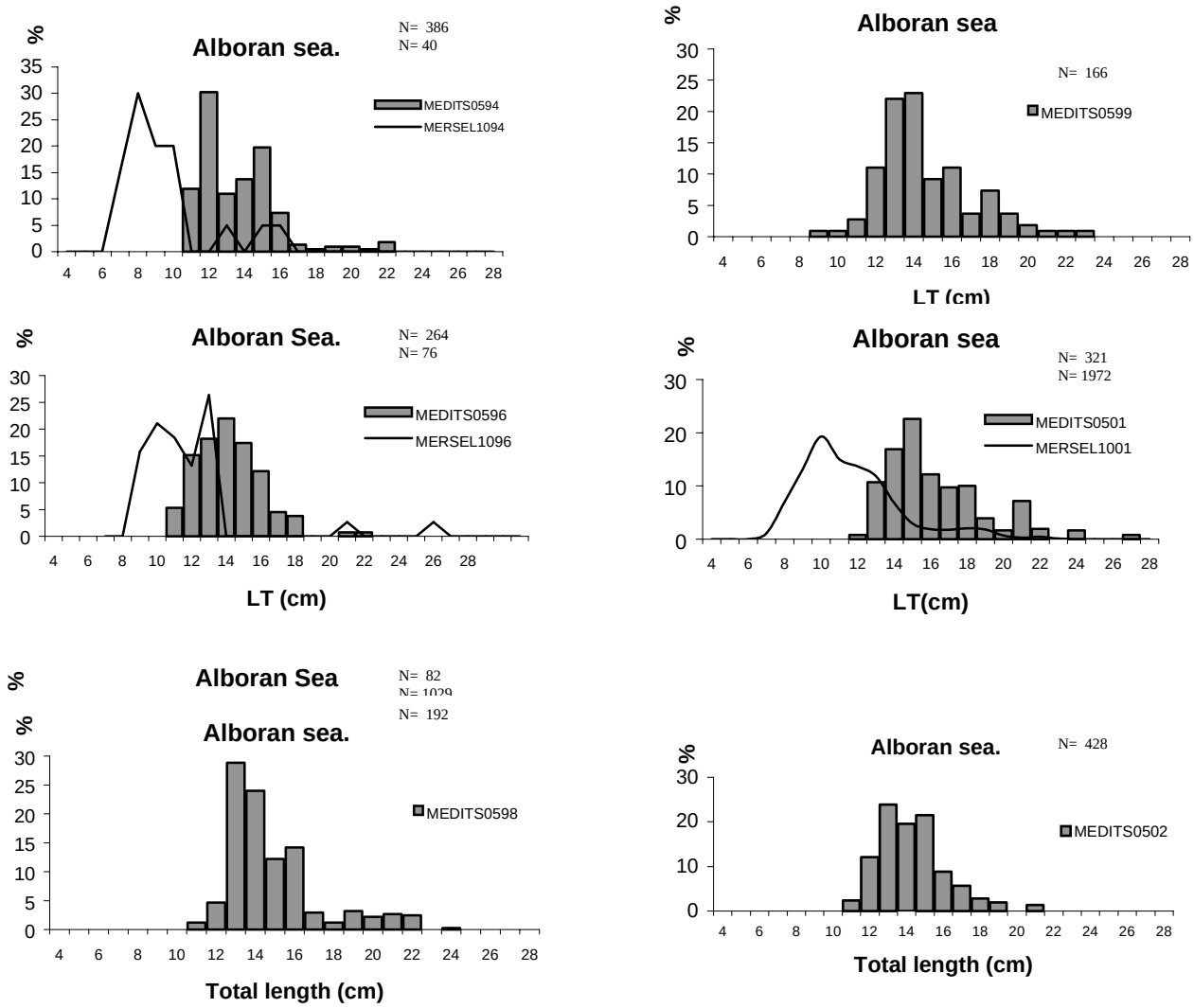


Landings of Mullus spp. in Adra, Estepona, Fuengirola, Málaga and Marbella ports in North Alboran Sea by months in 1998, 1999 and 2001. (*Source: From Project. I.E.O****). Landings increase between September and November. This interval coincides with the recruitment. In April and March of 2001 had an official fishing closure time.***

Spring experimental trawl surveys have been performed in the GSA 1 (MEDITS Program) from 1994 to 2002. Also, a number of autumn surveys (MERSEL series) were carried out from 1991 to 2001, being suspended between 1998 and 2000. Next figures show the available size distributions, by season (spring and autumn) from 1994 to 2000. A constant period of recruitment every autumn is observed. MEDLAND and DESCARTES data were obtained from the commercial fleet. Red mullet length frequencies distributions show that most of the catch consisted of individuals of 1 or 2 year, born 1 or 2 years before (at the end of spring and in summer). This means that red mullet trawl fishery is mainly based on the recruitment of the year.



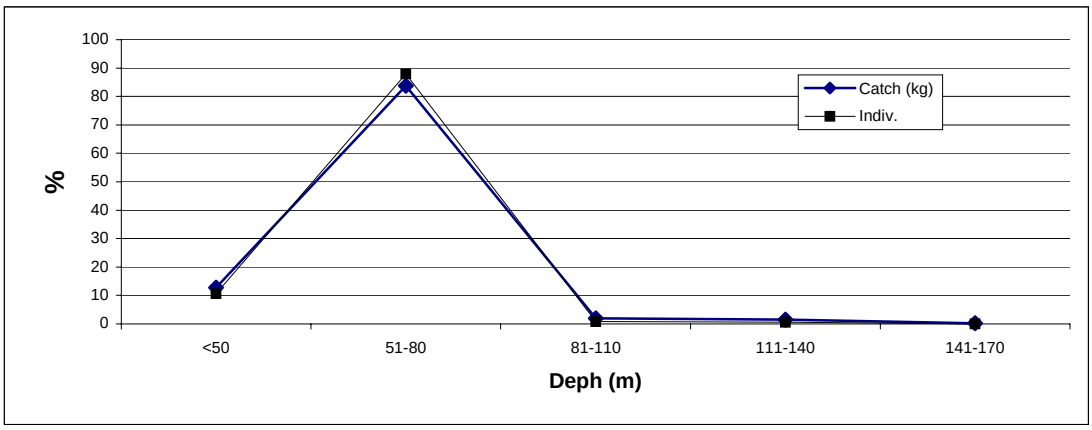
Size distributions of Mullus barbatus from MEDITS (Spring) trawl-surveys (1994-2002) in the north Alboran Sea.



Seasonal length frequency distributions for Mullus barbatus in spring and autumn trawl surveys carried out in the Alboran Sea from 1994 to 2001. (*Source MEDITS and MERSEL Series****)***

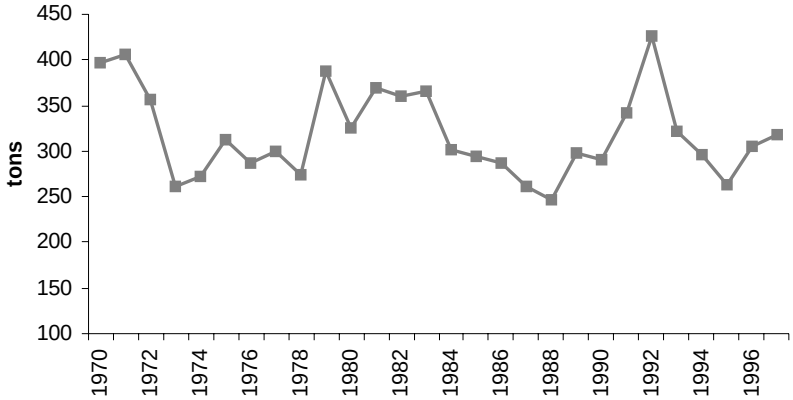
Geographic distribution

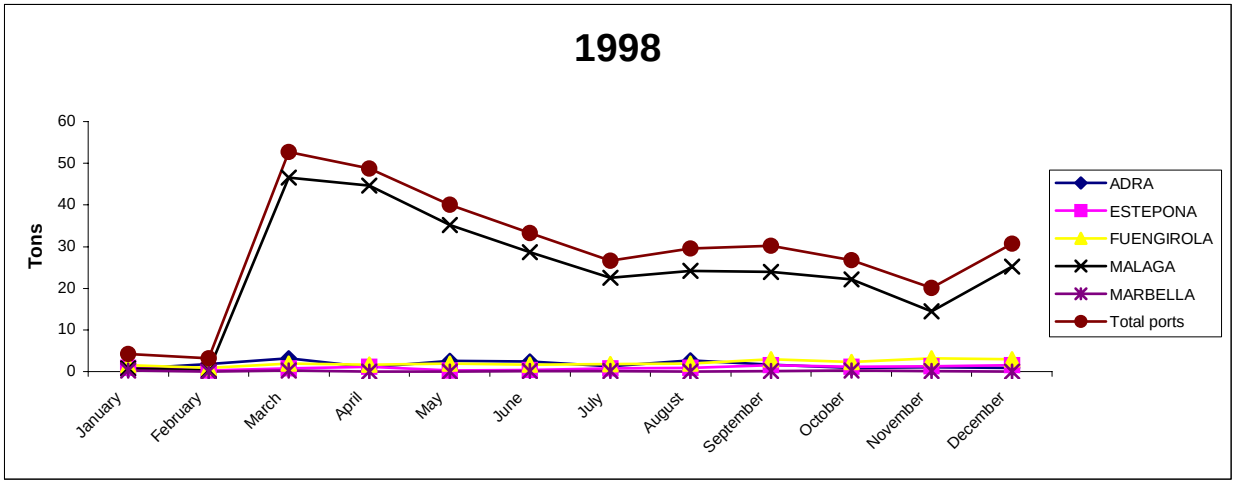
Red mullet is distributed within a wide bathymetric range between 0 and 180 m in GSA 1 along the whole continental shelf. Most of the catch is concentrated from 60 and 80 m.

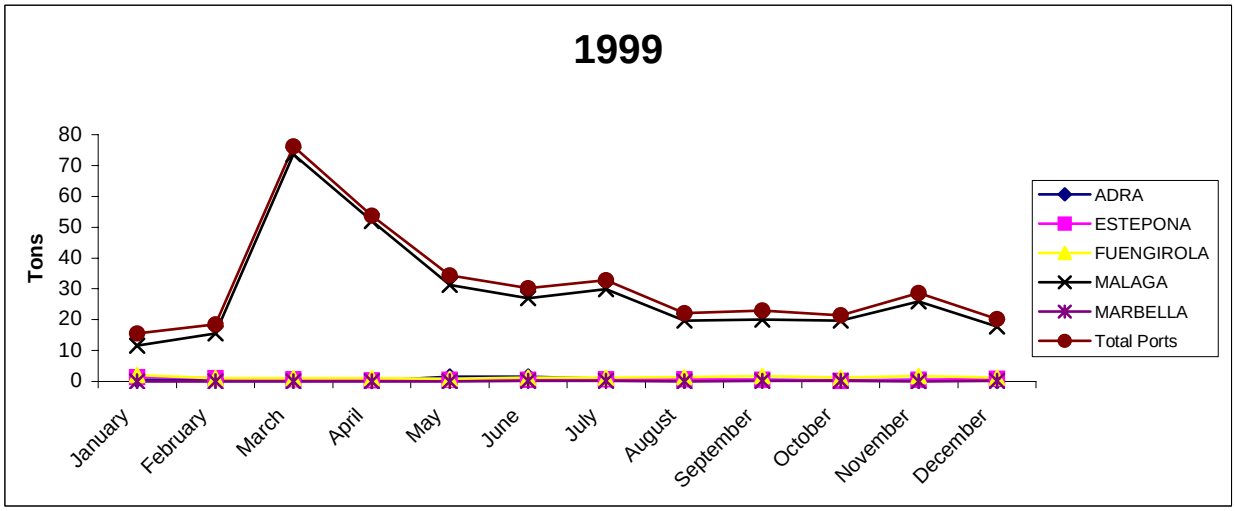


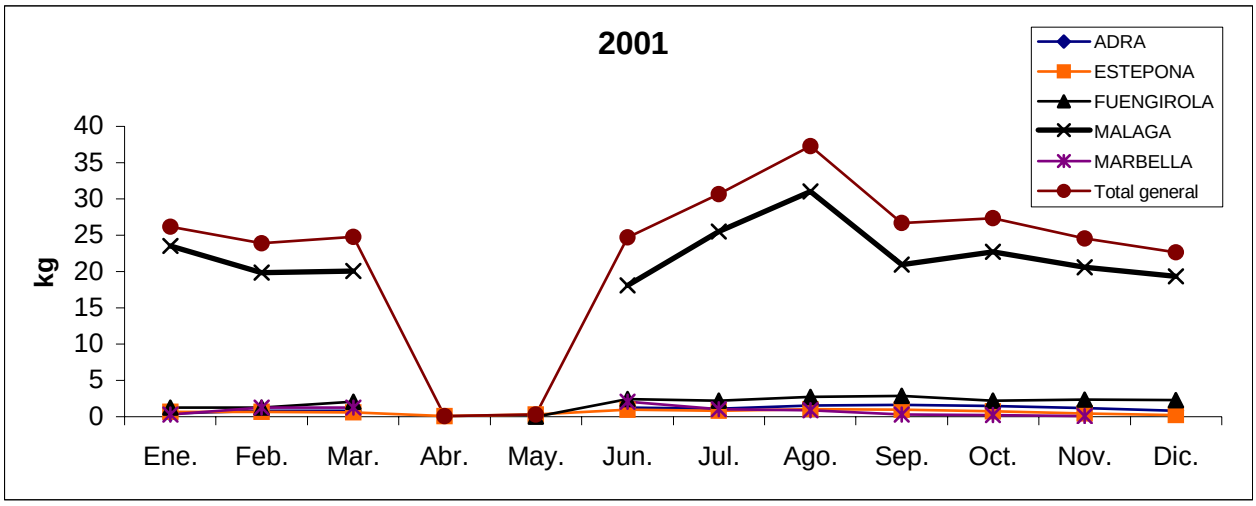
Red mullet by strata in GSA 1 during 2001 and 2002 seasonal surveys (*MEDITS and MERSEL Series****).*** Straight line:catch in weight and dotted line: catch in number of individuals. Practically 90% of biomass appears between 51 and 80 m of depth.

Hake is exploited almost exclusively by the trawl fleet, since only 11 long-line boats exploit the rocky bottoms and also they look for different target species. (*Source: MAPA, 2002*).Hake catches from 1970 to 1997 have fluctuated between 247 and 425 tons, in 1988 and 1992 respectively. Source: IEO





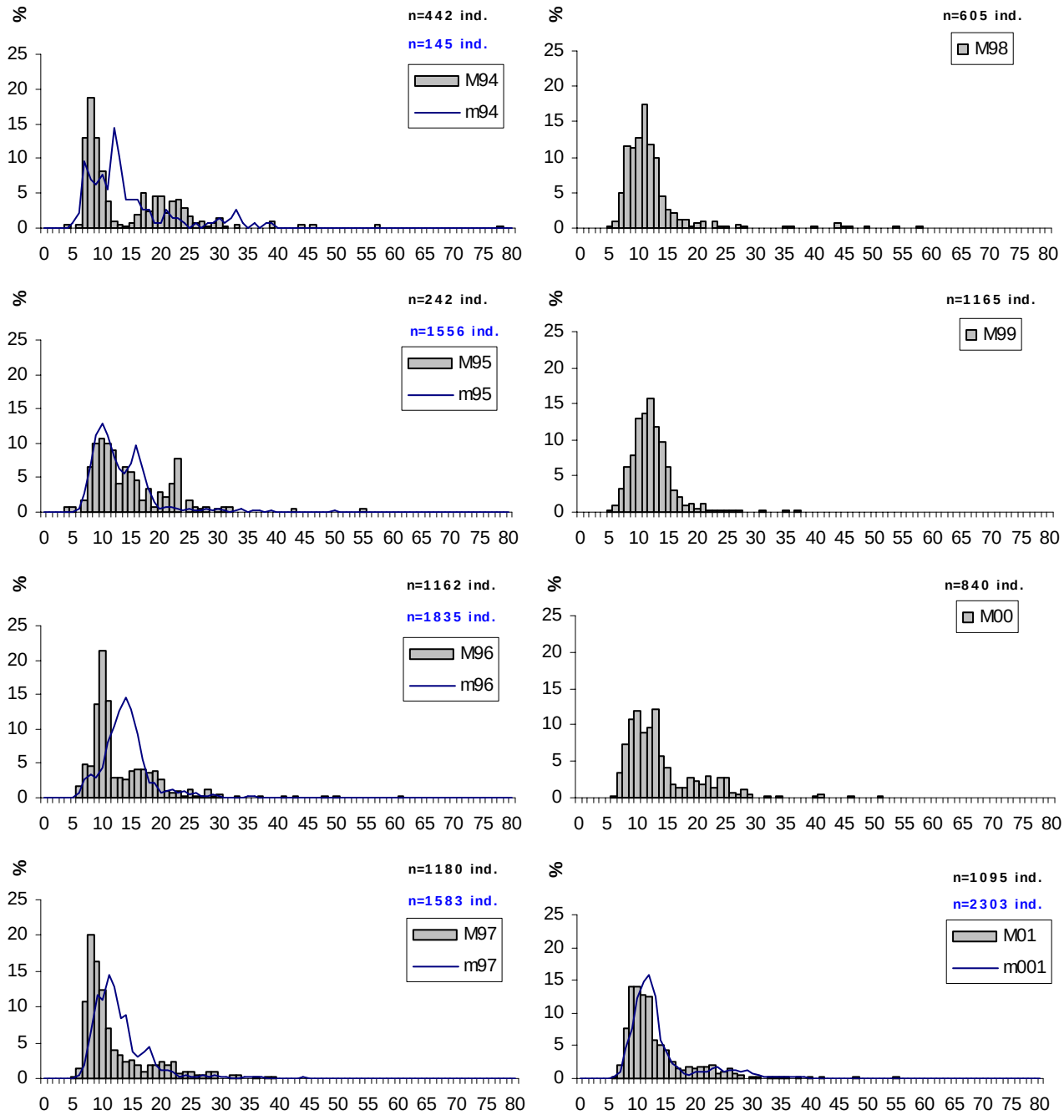




Landings of Merluccius merluccius in Adra, Estepona, Fuengirola, Málaga and Marbella ports in North Alboran Sea, by months, in 1998, 1999 and 2001 *(Source: From Project. I.E.O.*).

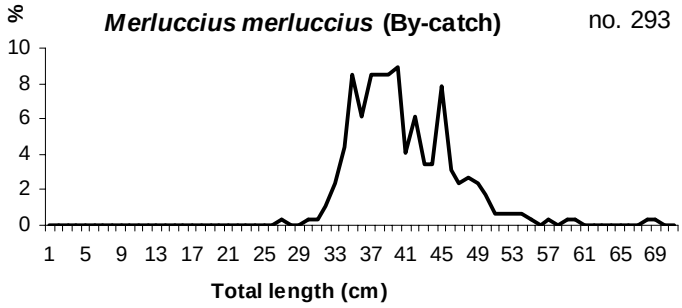
Next figures show size distributions by season (when available) from 1994 to 2001. Although some lack of information exists on summer and winter, a constant recruitment over the year is evident. The strength of the recruitment by season is highly variable, depending on changing oceanographic conditions.

Data of (MEDLAND, 1998/99) project have been based on commercial information, or from commercial trawl surveys (DISCARDS, 1995/96). In both cases hake length frequencies distributions show a higher presence of adult individuals. Other commercial surveys were performed in the Alboran Sea in 1997, studying the red shrimp (*Aristeus antenna*tus). Hake is the main by-catch species and is represented mostly by adults.



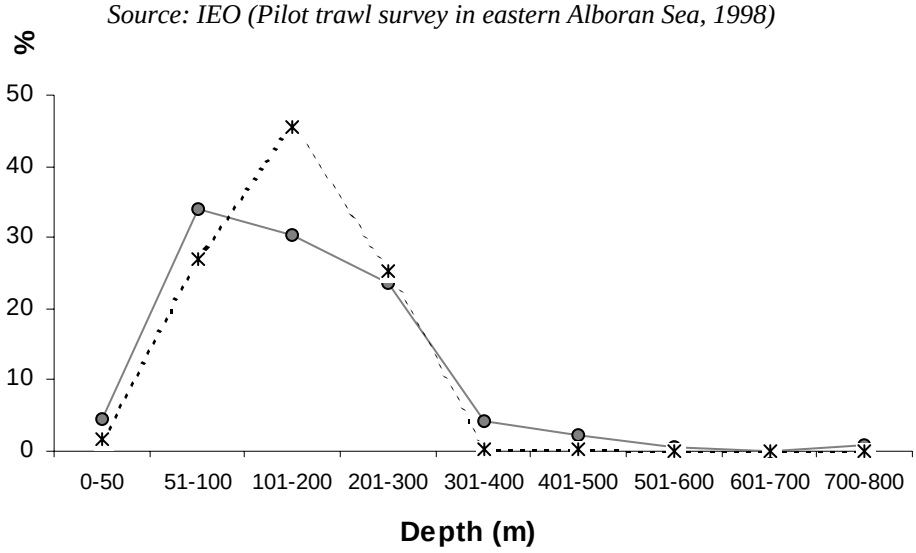
Length frequency distributions for *Merluccius merluccius* in Spring and Autumn trawl surveys carried out in the Alboran Sea from 1994 to 2001. Grey bars; Spring surveys. Line; Autumn surveys.

Source: IEO

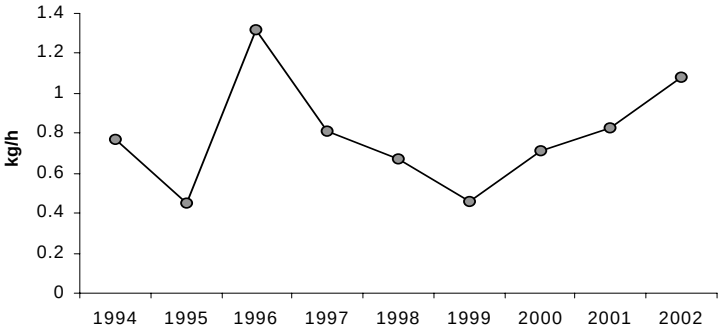


Hake length frequency distributions in Alboran Sea slope (500-800 m) as by-catch species in the red shrimp fishery.

Source: IEO (Pilot trawl survey in eastern Alboran Sea, 1998)



Hake catch by strata in the Alboran Sea during 2001 and 2002 seasonal surveys. *Straight line: catch in weight and dotted line: catch in number of individuals.Source: IEO (surveys)*



Hake biomass index calculated from MEDITS survey between 1994 and 2002

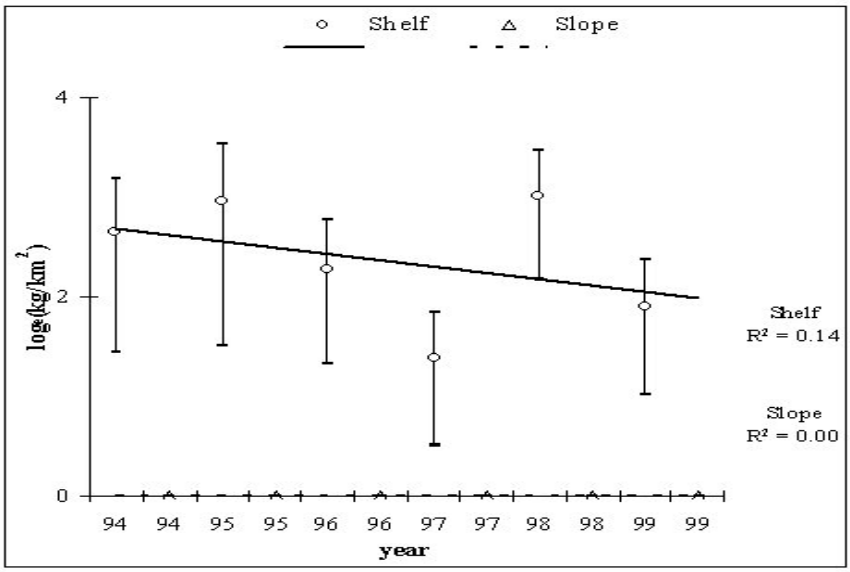
Hake is distributed within a wide bathymetric range between 30 and 800 m, along the whole continental shelf and upper slope. Most of the catch is concentrated from 50 and 300 m.
From 300 m to deeper bottoms explored adults hake usually occur isolately.
Alboran hake biomass index (and 95 % confidence interval) have been calculated from spring surveys (MEDITS series) since 1994. Values ranged from 0.45 to 1.32 kg/h. In general

Alboran biomass estimations are the lowest for the whole Iberian Mediterranean coast, in accordance with the narrow continental shelf.
Regarding trawl discards, a study was conducted in the GSA 1 in 1996 (European Project DESCARTES). Commercial surveys were performed covering three strata A;<150 m, B; 150-350 m and C; >350 m. Commercial and discarded fraction were analyzed.
In general, strong differences in the composition of the catch among the three considered strata were observed. The hourly yields decreased with depth, at the same time that the proportion of fish and cephalopods decreased and that of crustaceans increased.
In stratum A the species with more important catches corresponded to octopus, ***Octopus vulgaris***, with 23 % of the total catch. This stratum was characterized by the large quantity of fish species of high commercial value, although their yield did not tend to be very high. ***Pagellus acarne*** represented 4.39 % of the catch, smaller yields corresponded to ***Pagellus erythrinus, Mullus surmuletus, M. barbatus***, *Lithognatus mormyrus*, *Dentex dentex*, *Pagrus pagrus*, and sparids in general. In addition, this stratum had the greater discard proportion of the target species in the three strata, due mainly to *Boops boops*, that was completely discarded, and to *Trachurus trachurus*.

Technical interactions with other fisheries
There is a competition for the octopus (*Octopus vulgaris*) between this fleet and the artisanal fleet operating in the same area.

Special features
The segment of the fleet with small dimensions makes most of the catches of *Mullus barbatus*. Since this important resource is distributed in shallow waters, many times this fleet fish below the legal limit of 50 m depth despite the increase of the surveillance of the national authorities.

Relationship between fishing effort, fishing mortality and catch rates
The biomass index calculated by SAMED Project shows a decreasing trend, probably due to high the biomass index recorded in 1995, whose origin remains unknown. Nevertheless 3 years later it seems that the decreasing trend is stabilised (Relative biomass index calculated between 1994 and 2002 by MEDITS series with 95% confidence interval).
This values range from 0.08 to 0.47 kg/h. Ordinarily Alboran biomass estimations are the lowest for the whole Iberian Mediterranean coast. It coincides with the narrow continental shelf in the area.



General biomass index (log(Kg/km²)) in Spring (SAMED) in GSA 1

FISHERY 2 - SLOPE

Fleet

The fleet consists of 43 trawlers with a medium size of 17.5 m length and operates during the whole year except for a closed season of two months in the first half. The official medium power is 250 Hp, but probably is bigger than this value. The GT usually is bigger than 80. The distribution of the GT size is as follows: 25 (80<GT<100) and 18 (GT>100).

Fishing grounds

This fleet fish in the continental slope on grounds from 350 m to 500 m, but also usually fish in the continental shelf mainly to catch *Parapenaeus longirostris*.

Fishing time over a year.

The fleet operates during the whole year except for a closed season of two months in the first half of the year. The time in which the closed season is implemented can change among years. Spanish legislation in the Mediterranean limits the trawl activity for 12 hours during the day and only from Monday to Friday.

Fishing equipment

The characteristics of the otter trawl gear targeting Norway lobster are as follows (Sardá, 1998):

Mouth	Headline (m)	53
	Footrope (m)	66.5
Wings	Length (m)	**25**
	Width (nº of meshes)	180
	Stretched mesh (mm)	110
	Opening among wings (m)	22
Body funnel	Length (m)	**18**
	Initial width (nº meshes)	600
	Final width (nº meshes)	200
	Stretched mesh (mm, mean)	60
Codend	Length (m)	**11**
	Width (nº of meshes)	200
	Stretched mesh (mm)	40
	Total length (m)	**54**

The mouth spread of the gear is between 20-22 m and usually chains are deployed in the mouth. The bridle is 250 m length. The codend closure is sewed in all the cases. The trawl speed ranges between 2.8 and 3.5 knots.

The otter boards weigh from 450 kg to 650 kg. All of vessels use an echo sounder but only a few of them use some type of net sensors. In this case, the fishing efficiency is higher.

Deck layout and machinery involved
Most of the vessels have cover deck and are equipped with gantry, none of them with ramp. Usually there are on the working deck two net drums.

Electronic equipment
This fleet is well equipped with electronic devices helping the navigation and communications, such as GPS, electronic charts, video plotter.

Data on catch
There are two main target species, Norway lobster (*Nephrops norvegicus*) and red shrimp (*Aristeus antennatus*); the first species is mainly exploited by the western fleet and the red shrimp by the eastern fleet. Associated species to this fishery are forkbeard (*Phycis blennoides*), monkfish (*Lophius spp*.) and scabbardfish (*Lepidopus caudatus*), in the case of the Norway lobster catches, and forkbeard and some deep selacians for the red shrimp fishery. An seasonally important species is *Micromesisitius poutasou* which can be discarded in some occasions due to market reasons. When this fleet fish in shallower waters the white shrimp (*Parapenaeus longirostris*) is a very important part of the catch
Data on main species landed by port are showed in the following tables:

ARISTEUS ANTENNATUS

	2000	2001	2002	2003
Almería	153552	146848		
Garrucha	111983	97491		
Águilas	36417	28488	37872	61839
Cartagena				19342
TOTAL	301952	272827	37872	81181

NEPHROPS NORVEGICUS

	2000	2001	2002	2003
Estepona		1290	6210	6550
Marbella	3756	792	1032	
Fuengirola	600	320	180	
Málaga		9281	3829	16157
Almería	17248	12404		
Águilas	1136	877	2095	1124
Cartagena				938
TOTAL	22740	24964	13346	24769

PARAPENAEUS LONGIROSTRIS

	2000	2001	2002	2003
Estepona		9790	14330	13520
Marbella	10416	7284	2484	
Fuengirola	10410	6495	3860	
Málaga		32990	6166	21182
Almería	99180	66372		
Águilas	31170	26060	15725	6341
TOTAL	153176	150992	44567	43046

MICROMESISTIUS POUTASSOU

	2000	2001	2002	2003
Estepona		28368	30828	21144
Marbella	43392	24660	12684	
Fuengirola	13170	3515	870	
Málaga		126709	4415	219381
Almería	171234	120220		
Águilas	51448	34383	15895	8884
Cartagena				8803
TOTAL	279244	337855	64692	258212

LOPHIUS SPP

	2000	20001	2002	2003
Estepona		6276	9168	8520
Marbella	6528	4356	3204	
Fuengirola	7220	8915	6770	
Almería	29963	28742		
Águilas	8394	21399	17188	9884
Cartagena				32008
TOTAL	52105	69688	36330	50412

The discard is characterized by a very low proportion of target species. Most of the discarded commercial species were crustaceans: *Plesionika heterocarpus* (21.17 %), *Parapenaeus longirostris* (3.68%) and *Liocarcinus depurator* (3.5%). Smaller percentages were obtained from commercial highly important species, among wich were found some of the target species, such as *M. merluccius*, *M. poutassou*, *P. blennoides*, *Scyliorhinus canicula*, *Helicolenus dactylopterus*, and *L. budegassa*. The highest discard proportion within the three stata, were crustaceans such as *L. depurator* (13.09 % of the total discard) and *P. heterocarpus* (5.8 %).
In stratum C the biomass fraction discarded compared with the total catch was 40 %, the discard of target species being low or almost nil. The species with a highest percentage discard, among the target species, was *M. poutassou* with a 6.9 %. *Merluccius merluccius*, *Micromesistius poutassou* and *Phycis blennoides* represented half (50 %) of the commercial fraction. With respect to the commercial non target species, those contributing more to the commercialized catch were ***Nephrops norvegicus*** (4.95 %) and *Plesionika martia* (3.13 %).

In addition to the previous study, a sampling program was carried out by observers on board during normal fishing activity, from September 1997 to May 1998, in the GSA 1. The project's main goal was to study the faunistic list and yields in bottoms were the trawl fleets does not work regularly. Only one stratum was explored, from 500 to 800 m, according with rose shrimp ***Aristeus antennatus*** distribution, an important target species in eastern Alboran Sea.
Within the commercial fraction, *Galeus melastomus* was the species with highest mean weight, followed by *Trachyrhinchus trachyrhinchus*, *Phycis blennoides*, *A. Antennatus*, *M. poutassou* and *M. merluccius*. Among the discarded species pointed up the presence of *G. melastomus* and *Nezumia aequalis*, followed by *Etmopterus spinax* and *Hoplostetus mediterraneus*. *Geryon longipes* stands up within the discarded crustaceans group.

Another study carried out Between August 2000 and March 2001, analized catches from 33 hauls performed on board seven bottom trawlers, based in Motril. The study area is located in

the western area of GSA 1. Six different depth strata (between 50-650 m depth), coincident with the usual fishing grounds, were considered.
Hourly yields showed that 66.45% of the catch corresponded to commercial species and 33.55% was discarded. Highest discards were produced in the depth range between 150-275 m with 20 k/h. Between 350-460 m depth total yield is relatively low, 15 k/h, and of this 50% is discarded. Lowest discards are generated in the deepest strata (460-640 m).
By faunistical groups fish represents 55% of the total catch, crustaceans 22%, molluscs 11% and other invertebrates 12%. In number of species, 42% fish species, 79% of crustaceans, 16% of molluscs and 95% of other invertebrates are discarded.
Most of the discard practice is a consequence of the lack of commercial interest of the species concerned. However, in some cases specimens of species of high commercial interest are discarded. This discard by size is done in order to comply with the fishing regulations in force. This is the case of *M. merluccius* y *M. poutassou, P. longirostris, Plesionika martia* and *P. edwarsii*.

Technical interactions with other fisheries
There are not technical interactions with other fisheries in this area.

Special features
No special features occurs.

Relationship between fishing effort, fishing mortality and catch rates
Data not available.

GSA 2 –ALBORAN ISLANDS

FISHERY 1: SLOPE

Fleet
The fleet consists of 73 vessels, targeting red shrimp, with a medium size of 17.5 m length.

Fishing ground
The fishing ground is located in deep waters (600-800 m) about the island

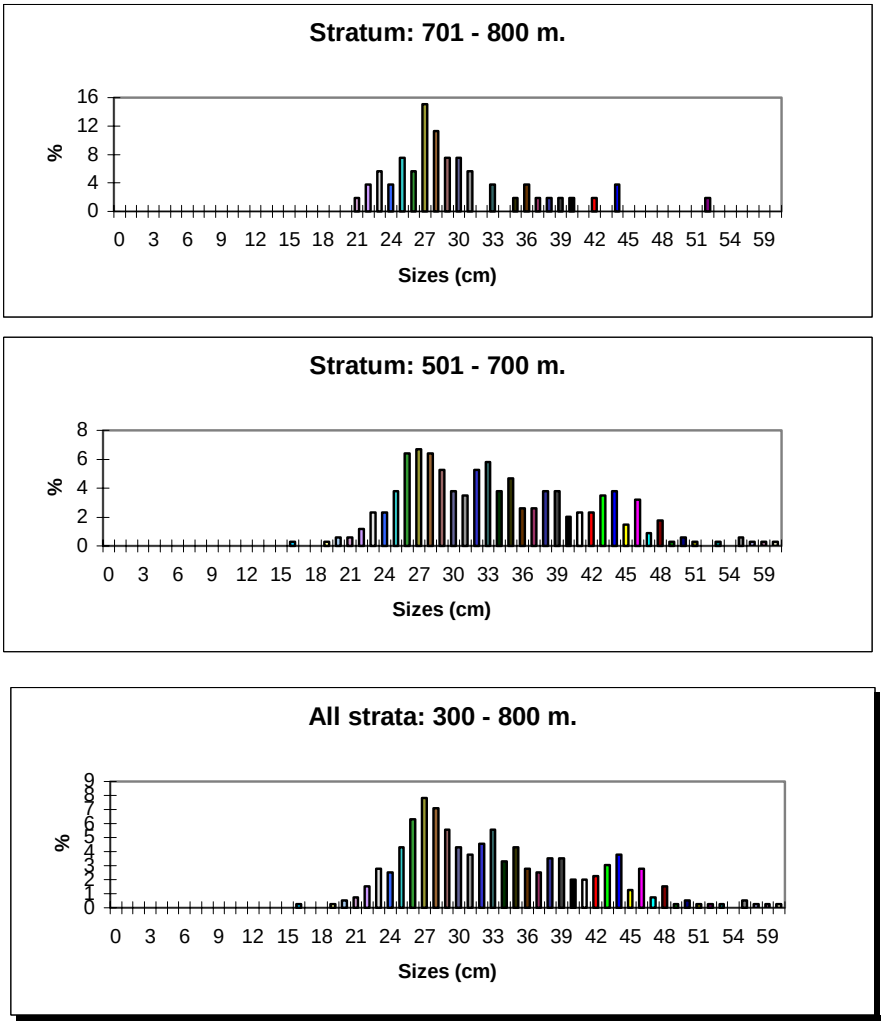
Fishing time over a year
The fleet operates during the whole year except for a close season of two months in the first half. Due to good weather conditions the number of fishing days increase in summer time.

Fishing equipment
As in the GSA1 slope fishery.

Deck layout and machinery involved
As in the GSA1 slope fishery.

Electronic equipments
As in the GSA1 slope fishery.

Data on catch
The red shrimp *Aristeus antennatus* is the target species of GSA 2 deep trawling.
Information from a survey carried out in February 1997 is presented. In total approximately 9 hauls were carried out according to a random methodology and an experimental net (with 20 mm stretched mesh) in studies on behalf of the IEO in the area. (IEO, Internal Report)
The length frequency distribution showed no clear modes by sexes.
The maximum size recorded was 60 mm of CL. The smallest sizes showed a wide range (16-30 mm of CL).



Sizes composition (cm) by stratum in GSA 2. Winter 1997.

Special features

The number of vessels is included in a restricted list under specific regulations.

GSA 5 – BALEARIC ISLANDS

FISHERY 1: CONTINENTAL SHELF AND SLOPE TRAWLING

Fishing ground

The fleet exploited both the continental shelf and slope in waters about the islands. Due to the nature of the bottom the trawlables grounds are limited in most of the areas.

Fleet concerned

The fleet consists of 31 vessels with a medium size of 18.5 m and operate over the whole year. These trawlers exploit both continental shelf and slope.

Number	31
Years old (mean)	27.8
Mean GRT	46.3
Mean GT	52.1
Mean Length (m)	18.5
Mean Power (kW)	202
Wooden (%)	79.7
Fiberglass (%)	15.6
No. fishermen	4-5

Fishing time over a year

The fleet operates during the whole year.

Fishing equipment

Three types of otter trawl are normally used: “huelvano”, “mallorquín” and “trawl”. The biggest vessels use net sensors.

Deck layout and machinery involved

Electronic equipments

All of the vessels have a GPS and additional electronic equipment for the navigation.

Data on catch

The fishery is multispecific. Main target species are: hake, striped red mullet (*Mullus surmuletus*), picarel (*Spicara smaris*) and *Octopus vulgaris*. The number of accessories species in the fishery is high, including red mullet (*Mullus barbatus*) and poor cod (*Trisopterus minutus*). In the slope the target species are decapods: red shrimp (*Aristeus antennatus*), Norway lobster and pink shrimp. Accessories species of this fishery are scabbardfish, forkbeard, blue whiting, anglerfish (*Lophius budegassa*) and blackmouth catshark (*Galeus melastomus*).

Technical interactions with other fisheries

Special features

The fishery is overexploiting most of the resources because of the oversized fleet, the high fishing capacity and an inadequate exploitation pattern, based in the youngest age classes.

Relationship between fishing effort, fishing mortality and catch rates

GSA 6 – NORTHERN SPAIN

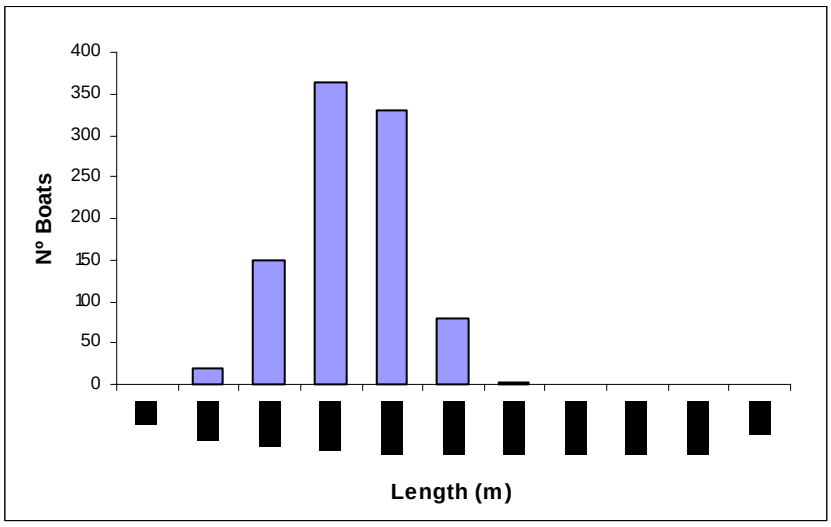
FISHERY 1: CONTINENTAL SHELF AND SLOPE

Fishing ground

Part of the fleet belonging to Spanish ports fish in GSA 7 for hake.

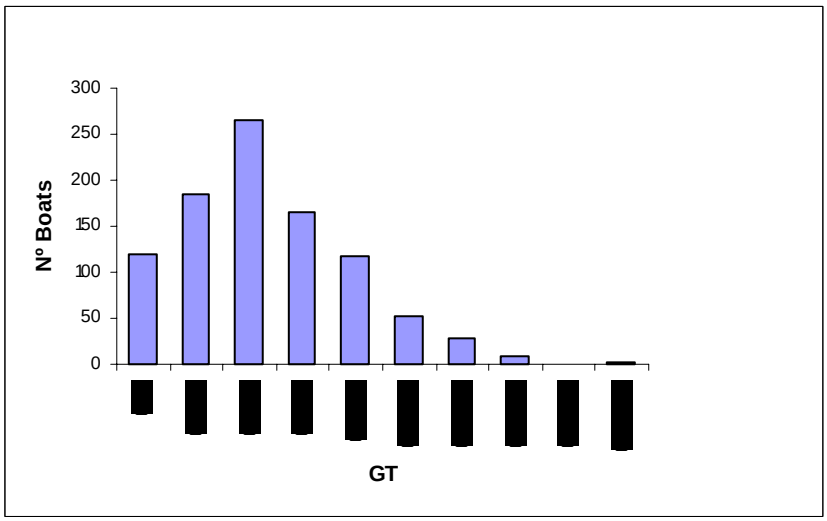
Fleet

The fleet is made up of 378 vessels, this number includes both Gulf of Lion fleet and trawlers fishing in deep water as well. The medium size is 17 m length. The distribution of the fleet by length range is given below.



Number of boats by ranges of length

Many different types of vessels are actually used in the subarea. The GT can vary from less than 20 to more than 150. There are also a different composition in the material in which the vessels are made, including wood, fibreglass and steel. The distribution of the fleet by GT range is given below.



Number of boats by ranges of GT

Fishing time over a year
The fleet operates during the whole year except for a close season of two months.

Fishing equipment
The gear is a typical otter trawl but local modifications are introduced. The size of the gears can vary a lot depending on the size of the vessels.
The characteristics of the trawl gear targeting Norway lobster in the GSA 6 are as follows (*Sardá, 1998, modified*):

Mouth	Headline (m)	47
	Footrope (m)	64
Wings	Length (m)	**25**
	Width (n° of meshes)	210
	Stretched mesh (mm)	150
	Opening among wings (m)	24
Body funnel	Length (m)	**47**
	Initial width (nº meshes)	468
	Final width (nº meshes)	170
	Stretched mesh (mm, mean)	65
Codend	Length (m)	**13**
	Width (nº of meshes)	170
	Stretched mesh (mm)	40
	Total length (m)	**85**

Deck layout and machinery involved

Electronic equipments
Most of the vessels have a GPS and additional electronic equipment for the navigation

Data on catch
The fishery is multispecific, one on the main target species being hake (*Merluccius merluccius*). Other important species are: *Mullus barbatus*, Octopus vulgaris, *Eledone cirrhosa, Lophius spp.* and blue whiting (*Micromesistius poutassou*).
Data on landings of the more representative ports are showed in the following tables (data in kilograms):

SANTA POLA			1999	2000	2001	2002	2003
Trawl fishery	Shelf	*Merluccius merluccius*	338068	602961	576791	291346	212593
		Lophius sp	29408	45522	64617	49421	35684
		Mullus surmuletus	47241	60544	44779	30422	22128
		Mullus barbatus	114603	135894	133229	125623	103913
		Pagellus erythrinus	1544	4272	10567	5744	4943
		Trachurus sp	97090	191763	213146	126931	119836
		Sardina pilchardus	21226	23032	35871	35527	31292
		Engraulis encrasicolus	14339	7515	25907	15172	6713
		Octopus vulgaris	326006	462001	363930	248090	198605
		Eledone cirrhosa	1340	416	1445	2416	12689
		Aristeus antennatus	463	3	57	7413	356
		Parapenaeus longirostris	78656	171758	112719	40138	17881
		Otras	1284429	1766294	1504669	1182433	927331
		Total	**2354413**	**3471975**	**3087727**	**2160676**	**1693964**
	Slope	*Merluccius merluccius*	17826	26909	37404	33622	18687
		Lophius sp	4501	3464	4987	5955	4064
		Mullus surmuletus	11	43	61	113	335
		Mullus barbatus	151	83	132	334	307
		Pagellus erythrinus	0	0	7	13	23
		Trachurus sp	234	74	223	717	1699
		Sardina pilchardus	0	84	145	138	1249
		Engraulis encrasicolus	13	0	22	293	258
		Octopus vulgaris	388	347	607	846	786
		Eledone cirrhosa	7	0	10	51	153
		Aristeus antennatus	58209	81315	70161	80011	63741
		Parapenaeus longirostris	232	179	3874	1941	835
		Otras	107712	94923	121020	161838	141648
		Total	**189284**	**207421**	**238653**	**285872**	**233785**

VILLAJOYOSA			1999	2000	2001	2002	2003
Trawl fishery	Shelf	*Merluccius merluccius*	316100	532130	547640	53741	228650
		Lophius sp	30262	52132	34527	3097	15617
		Mullus surmuletus	10634	9585	10991	1291	4510
		Mullus barbatus	26555	20940	41080	5172	40314
		Pagellus erythrinus	2858	6113	10080	263	6483
		Trachurus sp	37934	64510	153971	8147	77021
		Sardina pilchardus	16918	16055	29151	1749	25290
		Engraulis encrasicolus	13999	14387	55742	7335	16306
		Octopus vulgaris	68507	120089	146623	15124	86400
		Eledone cirrhosa	60822	62130	65836	10770	68290
		Aristeus antennatus	327	62	40	61	86
		Parapenaeus longirostris	59850	71736	79508	4243	4882
		Other	821443	867923	904693	79588	626601
		Total	**1466209**	**1837791**	**2079880**	**190581**	**1200451**
	Slope	*Merluccius merluccius*	6588	18863	15522	10771	9378
		Lophius sp	2630	5082	4071	4430	3838
		Mullus surmuletus	200	63	160	124	80
		Mullus barbatus	3	0	7	14	40
		Pagellus erythrinus	1	0	147	0	22
		Trachurus sp	138	256	460	47	218
		Sardina pilchardus	0	78	60	16	6
		Engraulis encrasicolus	14	41	29	135	2
		Octopus vulgaris	30	221	104	120	90
		Eledone cirrhosa	406	1266	468	665	563
		Aristeus antennatus	28089	41879	38525	31948	32227
		Parapenaeus longirostris	374	642	2339	1518	1193
		Other	69337	119221	101067	100240	91511
		Total	**107809**	**187612**	**162959**	**150028**	**139168**

AGUILAS		1999	2000	2001	2002	2003
trawl fishery	*Merluccius merluccius*	7189	33190	30606	18235	7871
	Lophius sp	3272	8394	21399	17186	9883
	Mullus sp	7159	24485	20285	17583	14835
	Pagellus erythrinus	507	2161	2369	1802	951
	Trachurus sp	2031	7554	4355	2631	2085
	Sardina pilchardus	23	55	307	430	64
	Engraulis encrasicolus	0	11	0	0	0
	Octopus vulgaris	10298	70686	67430	35115	17203
	Eledone cirrhosa	0	0	0	0	0
	Aristeus antennatus	7090	36417	28488	37871	61839
	Parapenaeus longirostris	5232	31170	26060	15725	6340
	Other	45635	156917	189600	136247	94865
	Total	**88436**	**371040**	**390899**	**282825**	**215936**

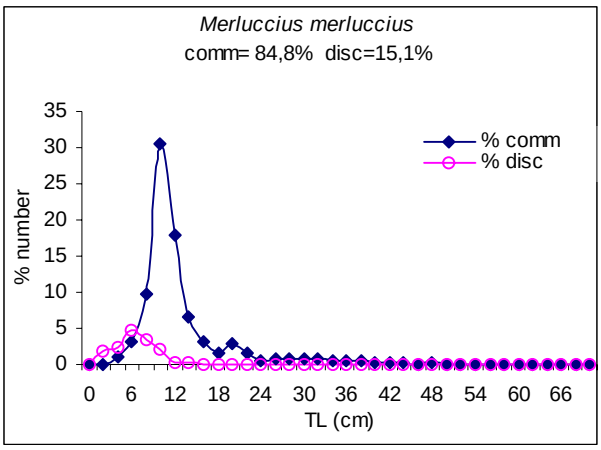
LLANÇÁ								
SPECIES	1996	1997	1998	1999	2000	2001	2002	2003
Merluccius merluccius	141894	184391	193344	193296	301835	194586	214697	156206
Micromesistius poutassou	72462	31839	40393	85536	136419	99729	63119	58582
Trachurus spp	59792	33780	25389	22032	84120	95677	32115	33547
Octopodidae	56688	91655	140001	85420	6037			
Scomber scombrus	49377	58724	83232	33580	54603	66355	35410	20805
Conger conger	45661	73301	54940	25791	61734	48993	47748	26225
Lepidopus caudatus	37725	57589	39905	17496	41217	33156	18140	20426
Sardina pilchardus	37203	37015	41676	27962	15216	19327	15744	11012
Lophius spp	37132	48564	34576	31049	59274	58550	44144	31080
Actinopterigios	35530	54557	47400	29211	34051	39082	34863	20569
Trisopterus minutus	29861	50564	30072	30530	75608	57252	71775	36775
Phycis blennoides	16359	19599	13491	10172	2233424	17858	22313	17274
Chelidonichthys gurnardus	16181	22103	16768	13702	18269	22268	18540	12838
Chelidonichthys lucerna	13679	12730	9630	9438	18417	19333	11140	7684
Pagellus acarne	13655	16666	6642	6723	22693	22538	15823	8737
Boops boops	11970	10399	17918	2874	9150	9447	3381	1627
Nephrops norvegicus	9588	5454	3552	3557	12166	11304	9016	11361
Mullus barbatus	8722	12706	13575	6987	22703	20489	11190	6192
Scomber japonicus	7323	11086	6871	6686	7806	7004	2145	3769
Loligo vulgaris	6709	12475	8603	2904	10683	10191	6482	2237
Cepola macrophthalma	6339	2197	1267	4395	4216	3257	4189	3541
Helicolenus dactylopterus	5885	9659	6019	3999	10560	3955	6430	6880
Diplodus sargus sargus	4980	2764	1938	322	2183	2617	1659	1159
Lepidorhombus boscii	4793	4918	4325	5325	6450	5148	5077	5098
Aristeus antennatus	4472	9704	8290	3685	9164	8456	16919	19931
Pagellus bogaraveo	4395	11684	9160	2884	11864	9434	7545	6330
Illex coindetii	3792	11254	9731	9985	9097	5310	15011	3490
Pagellus erythrinus	3604	4470	4218	1557	7819	5950	4436	3092
Eledone cirrhosa	3403	2226	2273	6371	132841	103683	98682	34267
Sparus auratus	1683	2663	966	281	2762	1829	1716	1558
Citharus linguatula	1656	1987	2075	1945	684	874	1388	623
Rajidae	1460	1838	951	995	532	760	599	974
Scyliorhinus canicula	1237	3479	2255	911	1772	1016	1124	908
Scorpaena porcus	1218	1955	1568	1338	819			
Sepia officinalis	1077	2337	6108	3339	460	110	68	19
Dicentrarchus labrax	953	1894	1023	709	1648	1750	879	653
Pagrus pagrus	914	1530	882	395	1174	732	527	704
Geryon longipes	899	1155	3243	3713				
Solea solea	685	960	1208	628	827	605	622	272
Platichthys flesus	682	583	1472	960				
Palinurus elephas	595	1207	938	772	884	304	815	568
Lithognathus mormyrus	507	293	292	135	284	57	94	42
Scophthalmus rhombus	273	322	377	309	347	336	409	206
Uranoscopus scaber	267	311	939	651	979	1044	1177	752
Trachinus draco	230	532	787	692	922	942	742	473
Zeus faber	201	768	363	491	790	1210	575	661
Serranus cabrilla	155	116	580	71	237	556	1001	534
Homarus gammarus	73	158	89	188	166	98	162	140

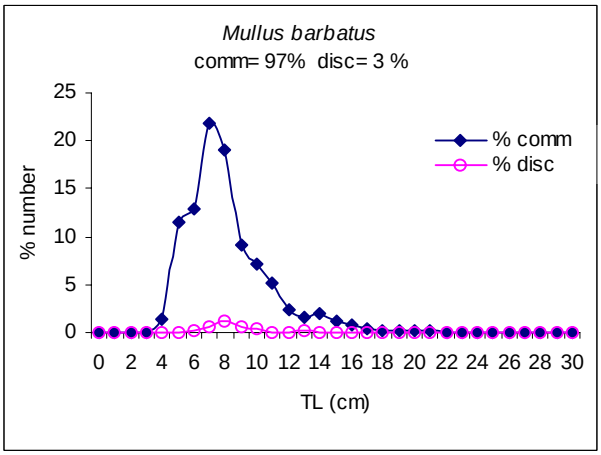
PORT DE LA SELVA				
SPECIES	**2000**	**2001**	**2002**	**2003**
Merluccius merluccius	108398	138023	154737	123367
Scomber scombrus	93137	111810	28960	22014
Trisopterus minutus	68926	46196	41357	26999
Micromesistius poutassou	63571	84815	35556	32668
Trachurus spp	62869	51828	20164	17327
Conger conger	18373	24317	27764	16497
Nephrops norvegicus	17750	16505	11674	16490
Trigla lyra	17217	24096	25419	23185
Octopus vulgaris	16211	31567	27039	15611
Actinopterigios	13886	12216	17818	9364
Lepidopus caudatus	11404	15808	11427	12750
Pagellus acarne	11060	7113	4794	4990
Aristeus antennatus	10566	15899	39966	32968
Sarda sarda	8826	3856	4603	5866
Loligo vulgaris	6814	8684	5274	3120
Todarodes sagittatus	6806	5398	9323	3492
Chelidonichthys lucerna	6354	6412	2973	3578
Citharus linguatula	5792	4953	5197	5002
Scomber japonicus	5326	5279	2941	7293
Geryon longipes	3891	488		
Boops boops	3707	5758	4514	3187
Scyliorhinus canicula	3493	6068	5629	6744
Dicentrarchus labrax	1726	1879	970	920
Raja clavata	1698	1077	1004	1099
Uranoscopus scaber	1047	1017	856	543
Oblada melanura	1032	133	11	1937
Argentina sphyraena	994	1270	721	1328
Pagellus erythrinus	924	1048	1159	1814
Diplodus sargus sargus	886	1451	1184	1469
Auxis rochei rochei	782	608	1132	1165
Lichia amia	712	1180	296	1791

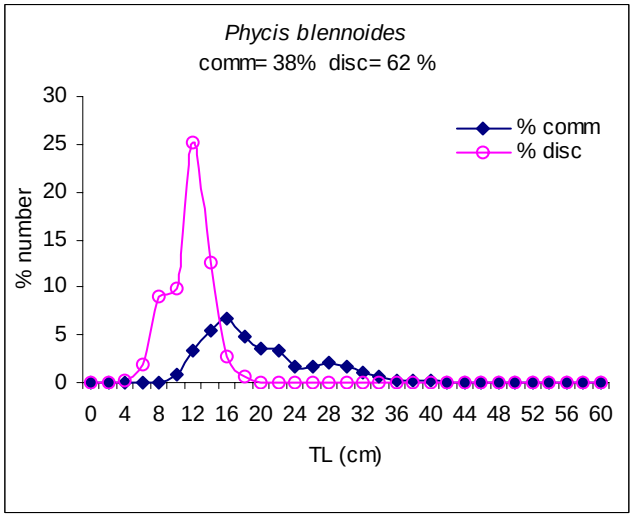
				ROSES				
SPECIES	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**
Micromesistius poutassou	392648	273817	445997	589681	544686	612616	276945	235723
Merluccius merluccius	314251	330959	364557	297456	174471	263320	319723	281735
Trachurus spp	216565	157238	135636	112169	143267	178638	74071	120482
Eledone spp	171837	195896	190026	229616	243114	167172		
Actinopterigios	164116	176033	172729	82368	135830	55975	10056	64432
Scomber scombrus	119670	120039	147425	83572	167097	179577	56572	46080
Lepidopus caudatus	86371	116318	72816	73158	24834	35863	28764	16072
Lophius spp	69138	119566	91727	65804	67348	99455	73168	77049
Trisopterus minutus	41585	68620	41687	80520	91774	56920	50043	33525
Mullus spp	41354	44232	56612	66254	54968	48931	37464	45111
Pagellus acarne	40104	46897	23896	32531				
Nephrops norvegicus	38177	45472	33071	38450	67408	67737	43603	48686
Aristeus antennatus	36535	44435	32473	19157	10338	16686	29089	20913
Phycis blennoides	30250	66010	51604	53351				
Conger conger	27586	36013	32612	22157	22311	25158	28230	30869
Citharus linguatula	26226	26312	31209	31350	22527	28213	25852	24161
Loligo vulgaris	25241	35593	34829	35573	29355	30232	30672	28414
Sepia officinalis	22222	33061	36570	27039	27367	19211	17391	14183
Penaeidae	21030	23375	22777	8416	5050	10227	24139	17114
Scomber japonicus	16806	15838	26508	13657	10827	13496	6847	6420
Pagellus erythrinus	12486	11986	12406	14882	18412	20261	19656	19828
Dicentrarchus labrax	12163	16212	12210	3011	3627	11933	29953	44818
Liocarcinus depurator	11722	16838	13039	25269	20186	6639	3940	4688
Scyliorhinus canicula	11564	20597	13464	10136				
Chelidonichthys lucerna	10889	11555	13623	18427	15305	14575	15494	17632
Diplodus sargus sargus	9402	6382	6400	4025	4628	5081	6020	6541
Boops boops	7086	4554	7504	4147	21741	6822	7007	2544
Todarodes sagittatus	6529	34599	34163	36578	24833	13744	33050	12010
Parapenaeus longirostris	4894	4740	7908	7289	4567	4214	6709	6951
Chamelea gallina	4589	1116	627	1954	3416	2035	63	177
Centrolophus niger	4553	4040	4204	748	4610	6967	3015	1878
Sarda sarda	4333	1937	4686	1684	3651	2030	2383	3979
Loligo spp	4090	4419	4656	2885	2339	4221	2273	1083
Argentina sphyraena	3676	13009	10698	12218	6148	9477	5093	6340
Raja asterias	3345	6103	4727	3322				
Scorpaena spp	3341	4258	3401	3425	3191	3100	2930	2681
Oblada melanura	3270	966	719	323	434	528	1053	8567
Mugilidae	3224	6088	3596	4671	3302	3272	1938	3256

Trawl discards can represent in the study area one third of the total captured biomass. In general, the incidence of discards in species with commercial interest is low (data were collected on board commercial trawlers, on a quarterly basis, from July 1995 to June 1996; sampling port: Vilanova i La Geltrú; research project MED 94/027). A total of 115 species were commercialised and 309 discarded. Discards showed a great variability, not only in terms of weight, but also in the number of species affected. Within the commercial fraction, 71 were fishes, 20 molluscs and 24 crustaceans. As for the discarded catch, it consisted of 135 species of fishes (73 always discarded), 60 crustaceans (40 always discarded), 44 molluscs (37 always discarded) and 70 other invertebrates (67 always discarded).

The amount of discarded catch generated by a given quantity of commercialised catch showed a great variability, depending on the depth at which the hauls were performed, the higher discards corresponding to the hauls performed in shallower waters (*Sánchez et al., submitted*). Although most of the catch of three of the main species consists of immature individuals, they show a different pattern regarding discards. *M. merluccius*: part of the smaller sizes are discarded. *M. barbatus:* discards practically nil. *Phycis blennoides*: clear example of discard by size, smallest sizes fully discarded.







Catalan coast, bottom trawling. Annual length frequency distributions of the commercial and discarded fractions, expressed as percentage of the total catch. (*Unpublished data, distributions elaborated from data in MED 94/027, July 1995- June 1996, sampling port: Vilanova i La Geltrú*).

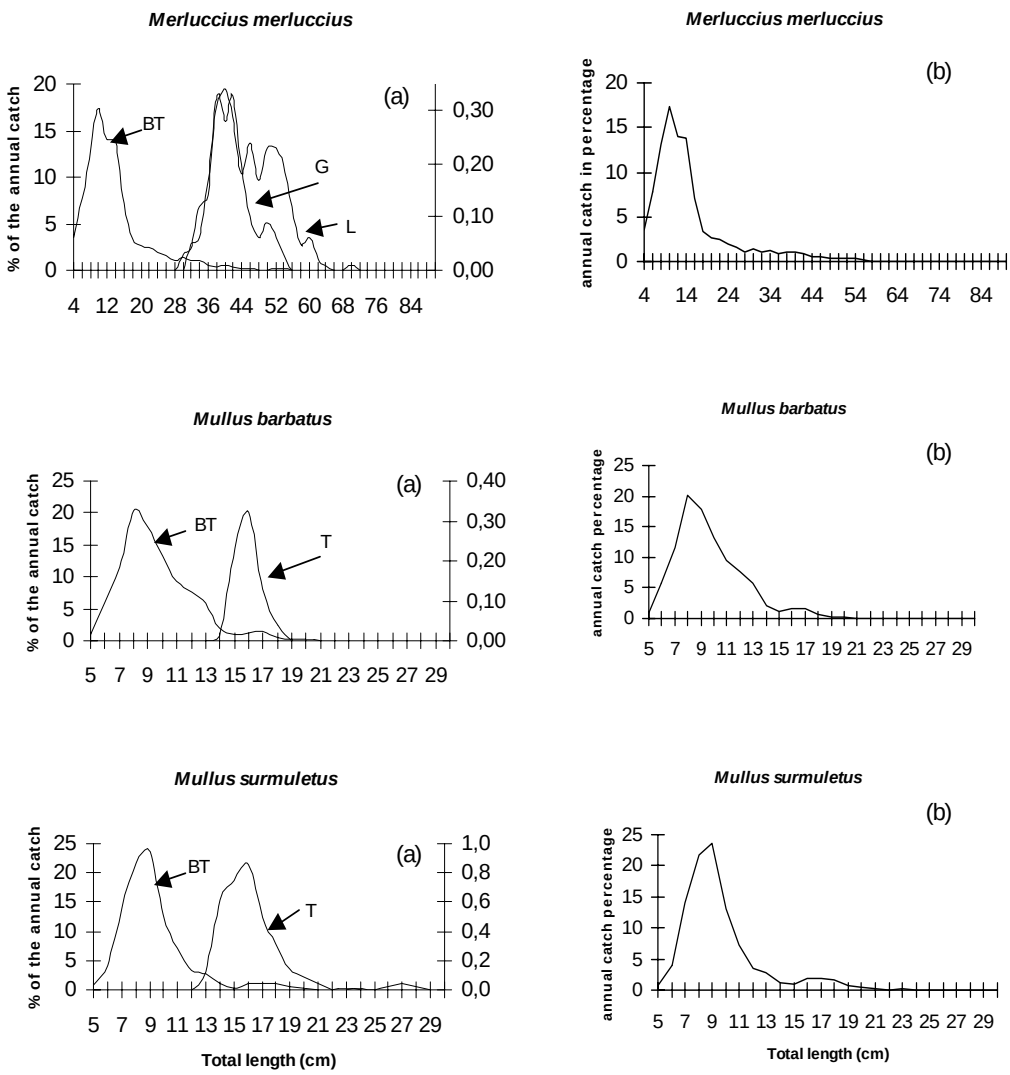
Technical interactions with other fisheries

European hake, red mullet and striped red mullet exploitation is multigear. These species are fished simultaneously or sequentially by bottom trawling and artisanal methods (long line and gillnet for M. merluccius, and trammel net for Mullus spp.). Bottom trawling is practised all year round, while the use of artisanal gear is seasonal. The fishing grounds of the different gear competing for the same target species do not overlap as artisanal gear are used in areas where trawling is not possible. This situation implies that a multigear approach is needed when assessing these stocks.

In all three cases, most of the bottom trawling catch consists of very small, immature specimens. Higher catches, in number, but also in weight, correspond to this fishing. The annual size frequencies distributions, all gear combined, are very similar to that of trawling (see (a) and (b) in the figure). Bottom trawl increase in the hake catches observed in the area in June- July takes place in coincidence with the time of the year when recruitment of this species to trawling is more intense. As for *Mullus* spp catches, the peak corresponds to the recruitment to trawling of the very small individuals in by the end of summer and early autumn.

Catalan coast. Sampling port: Vilanova i La Geltrú. Monthly landings, in tonnes
(*BT = bottom trawl; L = longline; G = gillnet; T = trammel net*).

	Merluccius merluccius			*Mullus* spp	
Month	BT	L	G	BT	T
Oct '93	8.9	1.0	0.0	16.5	0.00
Nov	10.7	3.6	3.4	16.4	0.00
Dec	12.1	1.7	0.0	8.3	0.00
Jan '94	9.7	1.4	0.0	5.0	0.00
Feb	8.3	0.0	0.0	3.1	0.00
Mar	8.6	0.3	0.0	1.7	0.00
Apr	5.6	0.6	2.3	1.9	0.52
May	6.7	4.6	1.9	3.2	0.56
Jun	10.1	3.2	3.3	2.4	1.04
Jul	12.7	4.1	3.7	1.3	0.66
Aug	10.7	1.6	3.6	8.8	0.59
Sep	4.6	1.0	0.8	16.8	0.00
Total	108.7	23.1	19.0	85.4	3.37



Annual landings length frequency distributions. Sampling port: Vilanova i la Geltrú, in the Catalan coast. (Data source: Martín et al., 1999). (a) Annual length frequency distributions, by species and gear. (BT= Bottom Trawl; G= Gillnet; L= Longline; T= Trammel net). BT frequency values according to the scale on the left Y-axis; right Y-axis scale for the other gears. (b) Annual length frequency distribution, by species, all gear combined

Relationships between fishing effort, fishing mortality, catch rates

No data available

GSA 1, 5, 6 - NORTHERN ALBORAN SEA, BALEARIC ISLANDS, CATALAN COAST

FISHERY 1: DEEP WATER FISHERY

Fleet

Information on red shrimp fishery is presented jointly for these areas since deep resources are considered shared stocks (*EC Report on Mediterranean Deep-Sea Fisheries*)

The analysis of the red shrimp trawl fishery in the Central Mediterranean Spanish coast was carried out by *Carbonell et al.(2002)* and presented to the WG-Demersals of the SCSA of the GFCM-SAC. This study is available at ftp://ftp.cmima.csic.es/pub/scsa/Demersals_2002 . Main results and conclusions are presented below.

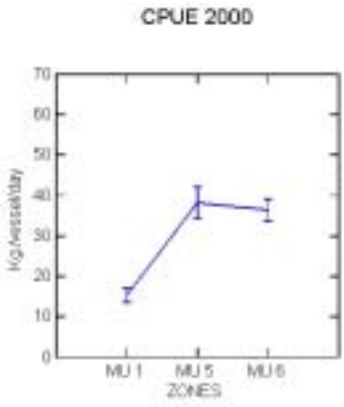
Management units considered are GSA 5, GSA 6 and GSA 1. In total, six sampling harbours were selected by the importance of the red shrimp fishery in them. There are two in each zone and together represent more than 75% of the catches obtained in each zone. For the Balearic zone, the harbours correspond to Palma, with 22 trawlers, and Soller, with 6 trawlers. In the western Spanish Mediterranean coast, the ports considered were Santa Pola with 80, but only about 30 of them have capacity to trawl in red shrimp fishing grounds, and Vila Joyosa, with 34 trawlers. For the Alborán zone, the harbours were Aguilas and Garrucha, with about 20 trawlers in each one of them. Sampling network in harbours obtain daily catches per vessel and monthly catches per fleet. Sampling on board vessels obtains size distribution and catch per unit effort (CPUE).

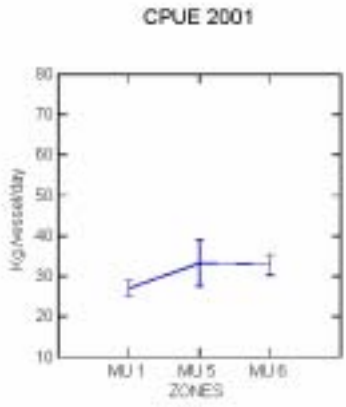
Monthly landings show seasonal fluctuation and some differences could be seen between zones. In general, larger catches were obtained in autumn and spring or early summer depending on the zone and year. Management regulations applied in the GSA 6 include a closure (one or two month) of the trawl fishery. Monthly landings fluctuate between 6 and 20 t. Total annual landings by zones vary from 109 (GSA 6, 2001) to 155 t (GSA 5, 2001). Considering the three areas, catches arise 423 t in 2000 decreasing to 388 t in 2001.

Red Shrimp landings, in kg, by Geographical Subarea. Minimum and maximum monthly landing. Mean monthly landing. Sum total annual landings. (*C. V. Coefficient of variation****)***

Year	GSA 5	GSA 6	GSA 1	Sum
2000				
Minimum	6209.40	5644.00	8508.00	24920.40
Maximum	18959.58	16700.00	16013.00	48817.58
Sum	145116.43	129485.00	148400.00	423001.43
Mean	12093.04	11771.36	12366.67	35250.12
C.V.	0.291	0.334	0.243	0.222
2001				
Minimum	8078.70	6541	2848	17976.20
Maximum	17976.20	14175.00	16080.00	45770.20
Sum	154907.92	108689.00	124580.00	388176.920
Mean	12908.99	9880.82	11325.46	32348.08
C.V.	0.232	0.267	0.378	0.264

The daily CPUE records were similar for the GSA 5 and GSA 6, but greatly differ in GSA 1 (Gulf of Vera) in the year 2000. In 2001 CPUEs differences among zones were not significant (0.05<P). The average CPUE ranged between 25 and 40 kg per vessel and day.

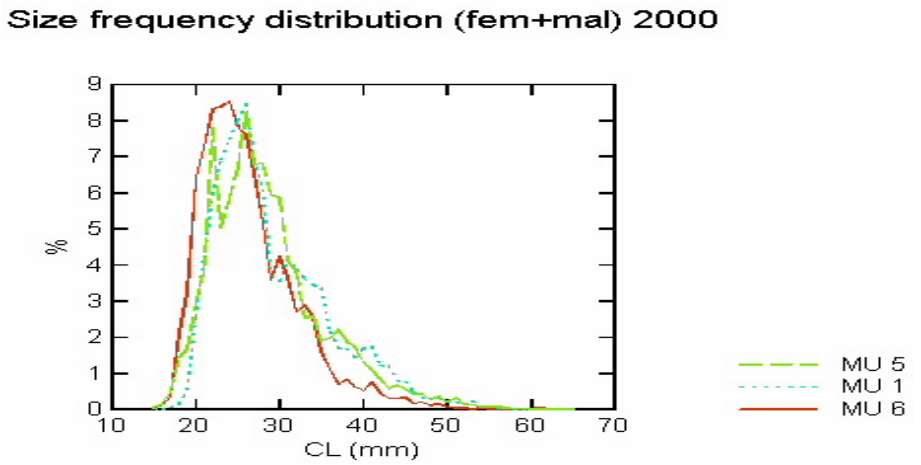


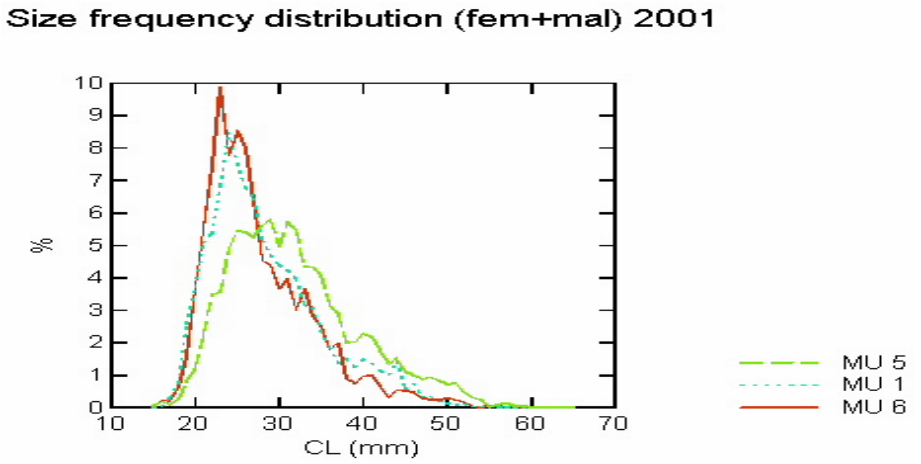


Red shrimp annual size distributions by Geographical Subareas are presented below. The most important metrics: the median, mean and the range of the distribution were not significantly different (0.05<P). Mean and median show different behaviour by sex, females mean was often over the median, whilst males mean was often below the median. The two years analysed remained fairly constant throughout the period studied in all the subareas.

Red shrimp fishery. Size distributions characteristics, by harbours

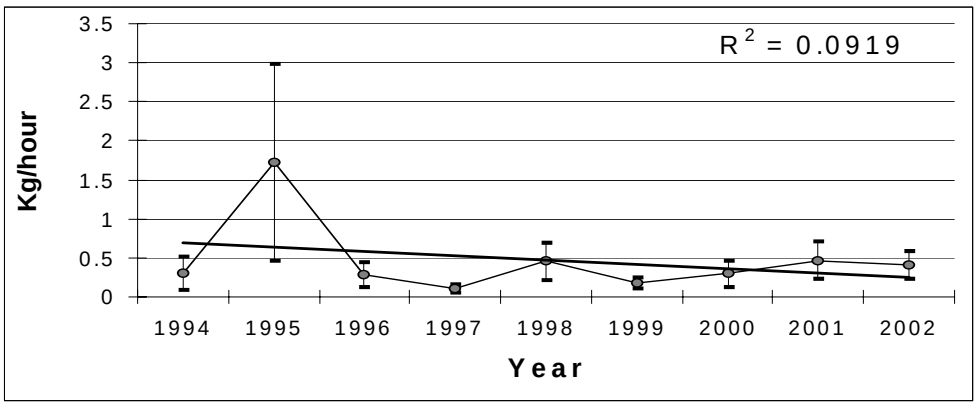
Year 2000	Santa Pola		Aguilas		Garrucha		Palma		Soller	
	Mal.	Fem.	Mal.	Fem.	Mal.	Fem.	Mal.	Fem.	Mal.	Fem.
Nº of cases	293	705	167	830	308	690	377	620	295	696
Minimum	16	17	19	18	17	15	17	18	15	16
Maximum	32	50	33	55	34	57	34	57	34	56
Median	22	27	25	27	25	32	25	31	23	28
Mean	23.36	27.92	24.80	28.52	24.97	32.76	24.48	32.13	23.61	29.60
95% CI Upper	22.67	28.35	25.27	28.96	25.33	33.30	24.76	32.61	24.00	30.14
95% CI Lower	22.05	27.49	24.33	28.09	24.62	32.22	24.20	31.64	23.22	29.06
Sex-ratio (%males)	29.44		16.73		30.89		32.54		29.59	
Year 2001										
Nº of cases	181	817	235	761	286	714	249	747	254	747
Mínimum	16	16	18	17	17	16	17	19	18	15
Máximum	30	56	31	49	33	55	34	57	34	59
Median	22	27	24	27	25	31	26	34	24	32
Mean	22.59	28.95	23.86	28.10	24.50	31.85	25.70	35.04	23.93	33.19
95% CI Upper	22.96	29.29	24.21	28.55	24.87	32.39	26.08	35.53	24.27	33.74
95% CI Lower	22.22	28.41	23.52	27.64	24.13	31.32	25.31	34.56	23.59	32.64
Sex-ratio (%males)	18.08		23.55		28.74		24.95		25.40	





Aristeus antennatus size distributions

Sex-ratio was variable, but in every case females were the major proportion of the catch between 60 and 80% of the total individuals caught.



Biomass index (kg/hour) in Spring (MEDITS_ES project) in GSA 1 (*Source I.E.O.*)

FRANCE

General

The French Mediterranean fishing fleet is composed of about 2000 artisanal units practising 3 main metiers: trawling, purse seining and small scale metiers. Among these techniques, static gear take the main important place. French Mediterranean towed gear is mainly trawling (otter trawl, beam trawl and dredge). Specific regulations (National, regional or local regulation) fix their utilisation and their mode of use.

French Mediterranean otter trawlers may indifferently practise bottom trawling and pelagic trawling targeting either pelagic fish or bottom and demersal fish according the need of the market. Some of them are more or less specialized on one métier the other practise indifferently the 2 techniques. Consequently, 2 main groups of trawl metiers can be identified thanks to the landings: bottom trawling and pelagic trawling obviously a variable number of vessels in each group.

Fleet

The French Mediterranean otter trawlers fleet is composed of 131 vessels working under trawling licence exclusively in the Gulf of Lions (GS7), 29 small fishing units ("ganguis à panneaux") included in the category of small scale métiers and working exclusively in the coastal waters of the Provence coast (GS7) and 10 bottom trawlers working in the coastal waters of Corsica (GS8).

Fishing equipment

The general characteristics of the vessels are roughly the same for the 2 categories; the choice of one of them needs the use of specific gear of which the main characteristics are fixed by UE and national regulation. Two types of otter trawls can be used for bottom trawling:

- Low vertical opening bottom trawl (LVO)
- High vertical bottom trawl (HVO)

Few of bottom trawls are made of 2 panels (for smaller trawlers) and most often now of 4 panels. Their vertical opening are between 2 and 10 meters, according the net type, the pulling traction, and the mesh size used (from 120 to 800 mm stretched mesh in the front part of the trawl). Cod-end mesh size used is 40 mm of mesh opening according to the legislation.

Two types of rigs are used :

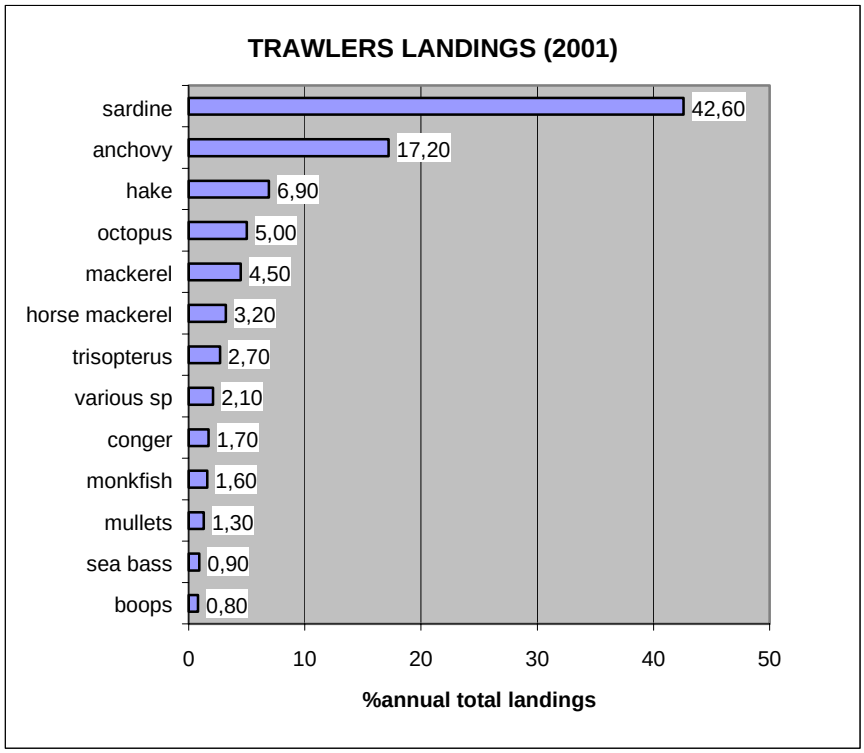
- bridle rig essentially for LVO trawl
- fork rig use for HVO trawl

Because these gear must be in contact with the bottom they are rigged with a mixed ground line with chain and sometime small rubber bobbin.

Generally the fisheries are mixed species but targeting seasonally particular species in specific area (ex: red mullet, sea bream, Norway lobster).

Data on catch

About 27000 t per year are landed by all the trawlers fleet. These landings are largely dominated by pelagic species.


TRAWLERS LANDINGS (2001)
sardine
anchovy
hake
octopus
mackerel
horse mackerel
trisopterus
various sp
conger
monkfish
mullets
sea bass
boops
42,60
17,20
6,90
5,00
4,50
3,20
2,70
2,10
1,70
1,60
1,30
0,90
0,80
0
10
20
30
40
50
%annual total landings

GSA 7 - GULF OF LIONS

FISHERY 1 - CONTINENTAL SHELF

Fishing grounds

Fishing areas for bottom trawling is mainly the smooth bottom of continental shelf to 150 m depth and more rarely the slope of Gulf of Lions (200 – 600 m).

Fleet

Most of trawlers are made in fibreglass, the oldest are wooden made and the most recent are in steel.
According the National registration of the French fishing fleet, the otter trawls of Gulf of Lions are in average 25 years old, 22,3 m long and powered with 306 kW.

	LOA	GT	P(kW)
min	14	21	147
max	26	175	316
mean	22,3	83	306

Fishing time over a year

The bottom trawlers work about 200 or 220 days/year, from 1200 to 2000 h of fishing time/year/boat. This activity is shared between trawling for different bottom species which are targeting according their seasonal occurrence and pelagic species according their market price.

Fishing equipment

Bottom trawls are mostly made to day of 4 faces which are joined together by selvedges with no lasting (lacing or lastridge) rope.

Net panels are made with PA braided twine from 600 m/kg for the front part to 110 m/kg for the cod-end. As for all bottom trawls the groundline is longer than headline and has a light protection of bobbins and chains. Some trawl have knotless cod-end. Only one net is used per haul.

Otter boards are mainly steel. Different types of otter boards are used but all are made in steel and used wide shoes for smooth bottom. Their weight is fitted to the effective power traction of each trawler and can reach 900 kg each.
During these last 40 years, the overall dimensions of the bottom trawl are increased for the same engine power. If the Horizontal opening is only 1.4 times higher than in the 60th , the Vertical opening is to day 4 times higher.

Deck layout and machinery

Exclusively stern-trawlers are equipped with stern gantry and few of them with ramp. Most of them are open deck and the most recent have a cover deck.
They normally have twin-winches with steel warps diameter from 11 mm to 18 mm, the maximum length of which is 1000 m.
Except for the smallest trawler, all are generally using 2 or 3 net drums. They are put on the working deck, the gantry onto the upper deck. Almost all the trawlers are using only one engine and nozzle propellers.
In 40 years, with an increase of the spread opening of 10 meters and a towed speed of 1 knot the area swept by one bottom trawl may be probably double of the past one.

Electronic equipment
In the last ten years, the main improvement concerning the electronic equipment is the development of GPS and the electronic chart and video plotter, the use of computer. To check the geometry and position of the trawl, sensors have been recently introduced.
No example of fishing grounds not exploited before these last 10 years. But according to better positioning system, some areas of the edge of gulf of Lions closed to hard bottoms are more efficiently exploited than in the past.

Data on catch
The annual production of bottom trawler is in average of 100 to 150 t, for daily landings from 500 to 600 kg. The trawlers may seasonally target either coastal (sparidae) or offshore species (monkfish, hake, triglidae, etc.).

Technical interactions with other fisheries
Main problem is regarding interaction between Spanish trawl and longline fleets and French trawl and gillnet fleet (Aldebert and al.,). For *sea bream*, interaction must be underlined between trawling, gillnetting and laguna fishing activity (Farrugio, Le Corre).

Special features
The French legislation define the characteristics of gear and trawler and the conditions of their use (*Arrêté du 19 décembre 1994 portant réglementation technique pour la pêche professionnelle en Méditerranée continentale; Art. 5*).
Bottom trawl is notably define as a trawl with a weight and protected foot-rope. The gear can tow by only one boat. The nominal power of the engine is limited to 588 kW (ISO 3046/l) and the cod-end mesh size is fixed to 45 mm. Furthermore, this regulation fix up also the accessory devices which are allowed for bottom trawl.
Trawling licence is only attributed to vessels of 18 to 25 m length (LOA).
Derogation for trawling can be allowed on one hand to some vessels under 18 m length and on other within the 3 nautical miles for a limited period of time by regional authority under particular conditions (bad weather,…).
Specific regulation stand by Fishermen organisations (Prudhomies) limit the trawl fishing activity to a period of maximum 17 hours during the day and to working days.

Relationships between fishing effort, fishing mortality, catch rates

The fishermen legislation limiting the time at sea (fishing days) limits consequently the fishing time but not the number of tows which may increase by the limitation of tow duration and vessel speed..

The relationship between fishing effort and catch is generally calculated from fishing capacity and number of fishing days. However this relationship don't take account of the increase of the fishing efficiency due to several technical evolution ((i.e. propulsion, bollard pull, trawl conception) which have affected trawling during 30 years. The nominal value of the engine power do not reflect consequently the reality of the fishing power of the French trawlers. There is consequently no data valuable on these relationships. Furthermore this evolution has lead to make ineffective the regulation by nominal capacity and fishing days limitation.

Bollard pull would be preferable to engine power or tonnage for expressing the fishing power of a trawler. On other hand twine surface of trawls or the filtering volume describe better the increase of fishing efficiency of trawl than other parameters.

FISHERY 2 – CONTINENTAL SHELF "GANGUI À PANNEAUX"

Fishing grounds

This fishery concerns essentially the area of the East Provençal coast. This coastal trawler fleet is working on *Posidonia* meadows which mainly present between 12 and 28 meters deep and outside of Posidonia meadows, on detritic bottom between 30 an 100 m.

Fleet

About 29 vessels, 40 years old, of max 12 m L_{OA} and 52 kW engine average power practise the fishing technique of "gangui à panneaux" in Provence with vessels.

	LOA	GRT	GT	P(kW)
min	4	2	0	11
max	12	8	9	97
mean	8	5	4	52

Fishing time over the year

Hard bottom: 123 days/year; smooth bottom: 83 days/year.

Fishing equipment

Small trawls are used of about 30 m long with large wings (10m) of 80 to 120 mm stretched mesh.

	Hard bottom	Smooth bottom
Spread opening	6 m	8 m
Height opening	1m	2m
Open Mesh size cod-end	24 to 28 mm	24 to 28 mm
Door weight	60 kg	100 kg
Towed speed	1,5 knots	2 to 3 knots

Deck layout

The boats are wooden made with mechanical winch and small gantry. They are caracterized by an open deck and a wheelhouse.

Electronic equipment

GPS, Echo-sounder and radio are used.

Data on catch

No official data are available for this fishery.
Total landing is estimated to 500 t/year for all the fleet. The catch is composed of juveniles.

	Hard bottom	Smooth bottom
Species number	29	19
soup	48 %	1 %
Poisson blancs	28 %	86 %
divers	24 %	13 %

Technical interactions

There are several interactions with static gear fishery particularly, concerning scorpanidae trammel and gillnet for sparidae. Problem of impact on fishing nurseries does exist.

Special features

This activity of small scale fisheries is regulated by specific national legislation on size and power of vessel and gear characteristic (door weight, cod-end mesh size, …). Practices are

also regulated by specific professional legislation, which may be different between fishing areas.
This regulation puts the lower limit of the codend mesh size opening to 20 mm and the weight of the doors of 90 kg each.
A specific regime of licence limits the practice to vessels of less of 12 m length and to less of 85 kW.

Relationships between fishing effort, fishing mortality, catch rates
No data available

GSA 8 - CORSICA

The trawling is operating on bottom from 50 m to 650 m along the Eastern coast of Corsica, in the Tyrrhenian Sea. Trawling métier is multispecies targeting. About 11 trawlers are working exclusively along the East coast in Tirrenian sea and practise essentially bottom trawling without any specific target.
Generally the fisheries are mixed species but targeting seasonally high value species (red mullet, bream, norway lobster,) with LVO trawl and demersal fish, small pelagic fish and shrimp (*Parapenaeus longirostris, Aristeomorpha foliacea, Aristeus antennatus*).

FISHERY 1 – CONTINENTAL SHELF, SLOPE and DEEP TRAWLING

Fleet
The fleet consists of 11 trawlers ranging from 12 to 25 m L_{OA} with an average of 203 kW and 31 GT.
Their age is about of 30 years. Their hull is mainly wood made while 3 of them are of fiberglass.

Fishing time over a year
The trawlers work essentially during day-time and approximately 12 hours per day for 200 fishing days per year (2000 to 2400 hours of fishing time). There is no restriction for holidays and week end.

Fishing equipment
The main gear type used is a low vertical opening bottom trawl (LVO), “Italian” type. However the largest vessels can use also high vertical bottom trawl (HVO).
The LVO trawl is mainly made of 2 panels.
Their vertical openings are about 2 meters, according to the net type, the pulling traction, and the mesh size used (from 120 to 800 mm stretched mesh in the front part of the trawl).
According to the legislation, the cod-end mesh size used is 40 mm. They have mixed groundline and use mainly bridle rig. This gear is fitted to work from 50 to 650 m with warps of 14 mm diameter.
The HVO is 4 panels made with 10 m of vertical opening. They are used with fork rig and warps of 18 mm diameter max. No lasting (lacing) rope is adopted.
The panels are only joined together by selvedges. The hanging ratio is not documented. Only one net per haul is used. Otter boards are mainly wooden made and have a maximum weight of 150 kg. The largest vessel use steel otter boards of 600 kg.

Deck- layout and machinery
They are exclusively stern-trawlers with stern gantry. Most of them are open deck. Twin winches with steel warps of diameter from 11 mm to 18 mm and 2000 m length in maximum.
The smallest trawlers have no net drums.
On the contrary, the biggest ones use 2 or 3 net drums. They are fixed on the working deck, the gantry or onto the upper deck.
Almost all of them are using only one engine and nozzle propellers.

Electronic equipment
In the last ten years, the main improvement concerning the electronic equipment is the development of GPS and the electronic chart and video plotter, together with the use of a computer.

No examples there are of fishing grounds not exploited before last 10 years but, according to better positioning system, some areas of the slope are certainly better exploited than in the past.

Data on catch
Catch composition for the deep bottom trawl per vessel is as follows:

Species	Yield (kg/h)	Catch evaluated/year
Hake	8 – 10	6000 kg
Red mullet	4-5	3000 kg
Pink shrimp	2 – 10	3000kg
Norway lobster	10	6000kg
Red shrimp	No data	No data
Anchovy	20	2500kg
Sardine	30	2500kg

Technical interactions with other fisheries
Only one interaction is observed in the Northern Corsica with the crawfish gillnets which are catch also by trawlers.

Special features
Special derogation is allowed to trawlers of less 147 kW to tow inside 3 nautical miles and the isobath upper of 50 m.

Relationships between fishing effort, fishing mortality, catch rates
No available data

ITALY

General

The Italian bottom trawlers possess a trawling licence, in some cases for only one fishing metier and in other cases, for more fishing metiers and then, for a number of months (or years), they may use a different fishing gear. Currently, there are no regulations forcing fishermen to declare the type of fishing practised, with the exception of the fishing logbook which, at any rate, is to be filled out by recording species quantities exceeding 50 kg. Most of the Italian multi-purpose fleet is made up of small-sized fishing boats catching dozens of different species for trips lasting 8-12 hours where quantities of 50 kg per individual species are seldom caught.

From an UNIMAR survey making use of data as of 31-12-1996, 72% of fishing boats in Italy possess more than one fishing licence, and 28% only possess a licence for a single fishing system. However, an UNIMAR survey dating back to 1999 shows that in actual fact 67% of the fleet use one fishing system only the whole year round, while 23% use two fishing systems, 7% three fishing systems by turns throughout the year, and 3% use 4 or more types of gear. This underscores the difference existing between data on fishing licences and what happens in reality.

With reference to bottom trawling, the UNIMAR survey highlighted that 4,245 fishing boats fish by bottom trawling, 679 possessing multiple licences, and therefore using also other gear.

Depending on their vertical opening, bottom trawls may be classified into:

a) Fixed opening trawls, such as “rapido” or beam trawl, with openings of some thirty centimetres,
b) Low-opening trawls, not exceeding one metre in height, such as the traditional Italian panel trawl,
c) High-opening trawls, exceeding two metres.

Traditional or Mediterranean bottom trawl, also known in Italy as *tartana*, *coccia*, *rizza*, depending on the area, is the most widely used trawl in Italy for fishing high-quality bottom species. However, some of its technical features may vary from area to area even considerably, its main features however remaining the same, such as asymmetry between the top panel and the bottom lower panel (*tassello*), or the greater lower panel length compared to top panel. These two portions of the net are then sewn together based on a specific ratio between their respective lengths, length difference being called slack (*in bando*). In addition, the ground rope is longer than the float rope so as to prevent that when the first dislodges fish from the sea bed, the former may swim upwards. The float rope is made of a rather thin textile line (12-16 mm in diameter) interspersed with several floats, while the ground rope has a larger diameter (30-40 mm), and is made of a combined rope, or a steel sheathed cable. The Italian bottom trawl has two wings almost as long as the rest of the net body, without the cod end. Both top and lower panel are made up of various netting pieces with mesh size decreasing from the ropes to the cod end. This portion of the body of the net is the most important one, as it traps fish, and is therefore responsible for net selectivity. In addition, the cod end is usually fitted with round chafer wrapping it up completely, protecting it from abrasion caused by chafing against the sea bed, and may be further strengthened by means of a chafer made of rubber or other material, depending on type of sea bed (muddy or sandy). The lower panel, the underside part of the net, must be able to withstand chafing on the seabed, and is therefore made up of cheap thick-yarn netting, sometimes with knot, while the upper section of the net, i.e. the top panel, where the greatest towing tension is exerted, is made of knotless netting, as in the case of the wings. The latter end with two wooden or steel danlenos, 40-60 cm in length. The use of knotless nets is commonly found in the production of Italian bottom trawls. It should be added that traditional Italian bottom trawls, marked by

rather small vertical and horizontal openings, do not need great power. This gear however possesses very long bridles, making it possible to explore a large area. This way good catch is obtained with small fuel consumption, compared to other trawls.
However, if large and fast fishes are to be caught, also Italian bottom trawls need to be towed at great speed, thus requiring a greater towing power.
It should be recalled that in order to catch fast and large fishes, increasing cod end and net mesh size may prove useful, in order to ease fish entry into the net, and reducing water load resulting from small filtering capacity.
However, studies on bottom trawls show that an increase in cod end mesh size increases catch capacity significantly as far as the larger fish are concerned.
There are different kinds of otter boards: rectangular, oval and polyvalent. They are responsible for the horizontal opening of the trawl.
According to Presidential Decree no. 651 of 22/09/1978 all bottom trawls, with the exception of special fishing, mesh size may not be less than 40 mm for every netting of the bottom trawl. According to Presidential Decree no. 1639/68, fishing activity cannot be performed within three miles off the coast, where seabed is less than 50 m in depth. In the GSA 17, the circumference of the lengthening piece is frequently lesser than the circumference of the cod end.
High-opening trawl is also known as “volantina”, although there are other bottom trawls whose opening may be even larger, is a bottom trawl with four wings and four danlenos and it is similar to the traditional Mediterranean bottom trawl.
High-opening trawls are always of the knotted-type, and feature shorter bridles (some 50 m) compared to traditional bottom trawls, without *libani* (chains attached to the danlenos), which are replaced by a double bridle.
There are also other types of high-opening trawls. The most widely used in Italy is a four-panel trawl deriving from the Larsen trawl providing extremely high openings, while touching the seabed. A twin trawl is used since some time by about 20 fishing vessels.
In general, all the trawl nets make use of round chafer to protect the cod end from the marine mammals, from the wear and to help the cod end when a large catch occurs. More over also the bottom side chafer does exist. By law, the round chafer circumference must be larger than the circumference of the cod end.

GSA 9 - LIGURIAN AND NORTHERN AND CENTRAL TYRRHENIAN SEA

FISHERY 1 - CONTINENTAL SHELF, TRADITIONAL TRAWL

Fleet

Vessels belonging to this fishery represent an important portion of the trawl fleet with local differences depending on fishermen traditions and geo-morphological characteristics of the grounds exploited by each port. Most of them are small-medium sized (<20 m length) and low-medium powered (<260 hp). The total number of trawlers exerting the activity on the continental shelf is high especially in some ports. For example, in Viareggio, this fishery involves the majority of the trawlers fleet (about 75 of 82 vessels), which operate on very coastal fishing grounds. The Livorno, Piombino and Castiglione della Pescaia trawlers are specialised in this kind of strategy and the major part of these fleets (about 25 vessels in Livorno, 10 in Piombino and 19 in Castiglione della Pescaia) exploit all the grounds positioned on the continental shelf.

The trawl net fishery utilises two different types of net: tartana and volantina. A decreasing trend in the number of vessels operating on this area was observed in the last years following the general reduction of the fleet that has occurred in the GSA 9.

Fishing time over a year

This fishery is carried out all round the year. The number of vessels fishing on coastal resources may increase during the winter season, when the weather conditions do not allow the operations far from the ports. Normally, vessels perform daily trips, amounting for a total of 150-160 fishing days. The total number of fishing days varies according to the different ports.

During summer-autumn time, the total number of boats and the fishing effort on the continental shelf may notably concentrate on fishing grounds about 80-100m depth, where young specimens of *Eledone cirrhosa* with high economic value are abundant. In some cases, exploitation of these "continental grounds" constitute an alternative activity when the excessive availability of some "coastal" resources during the recruitment period produces a drastic reduction of their commercial prices.

Fishing equipment

The trawl nets generally used by the fishery are the tartana (traditional) and the volantina (slightly higher vertical opening). The cod-end mesh size of the nets utilised in this fishery is in general 40 mm. No structural modifications of fishing gear have been observed in the last ten years.

In July – August some boats may utilise a superimposed cod-end in order to catch small specimens of *Eledone cirrhosa*.

Deck layout and machinery involved

The small vessels operating on shallow waters do not require particular devices as net drum. The larger boats may utilise net drum. No changes neither in the gear characteristics nor in the time spent to fishing were observed in the last years.

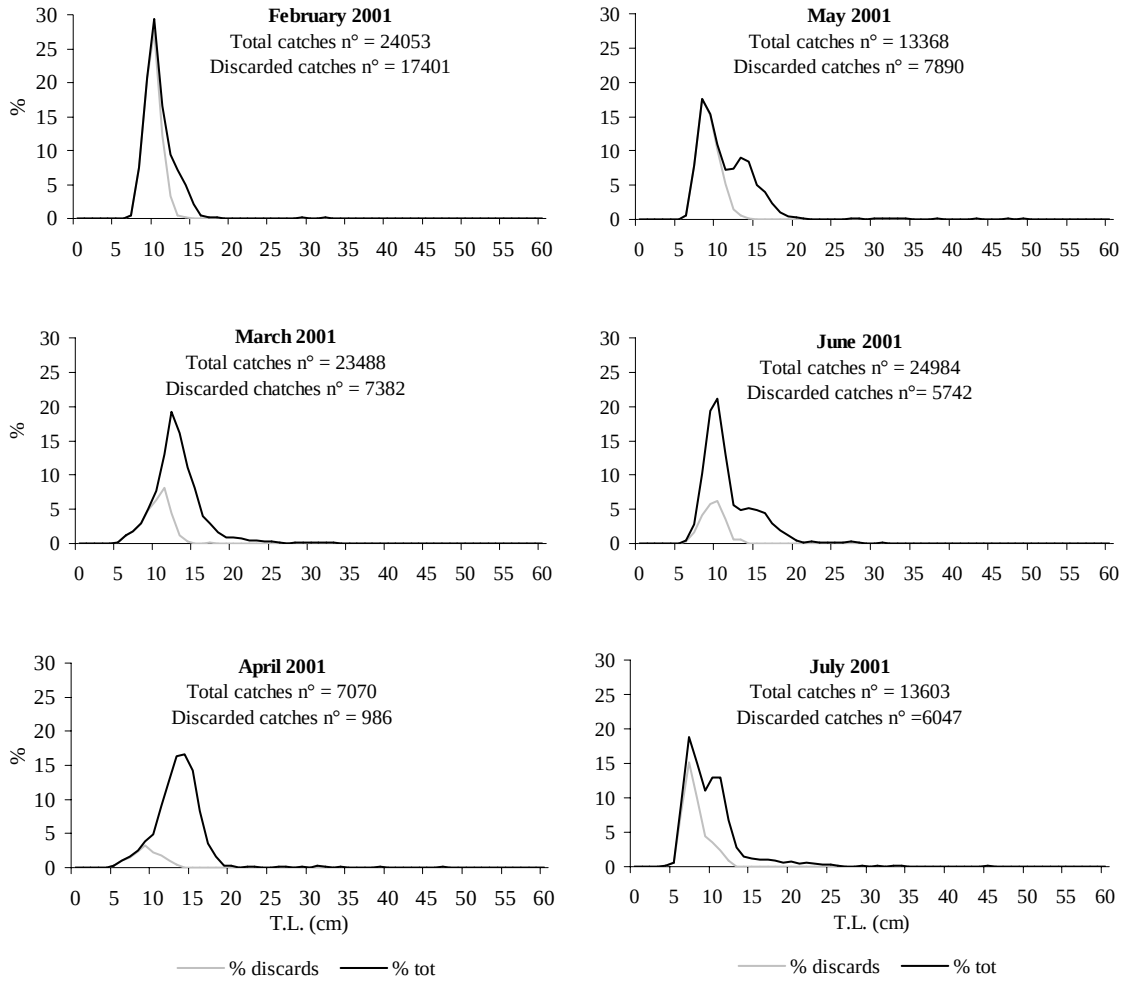
Electronic equipment

Almost all the vessels utilise GPS but this fact does not imply the exploitation of new fishing grounds. On the other hand, electronic assistance for navigation has reduced the time spent for searching trawlable grounds. It is likely that this fact may increase effective time fishing.

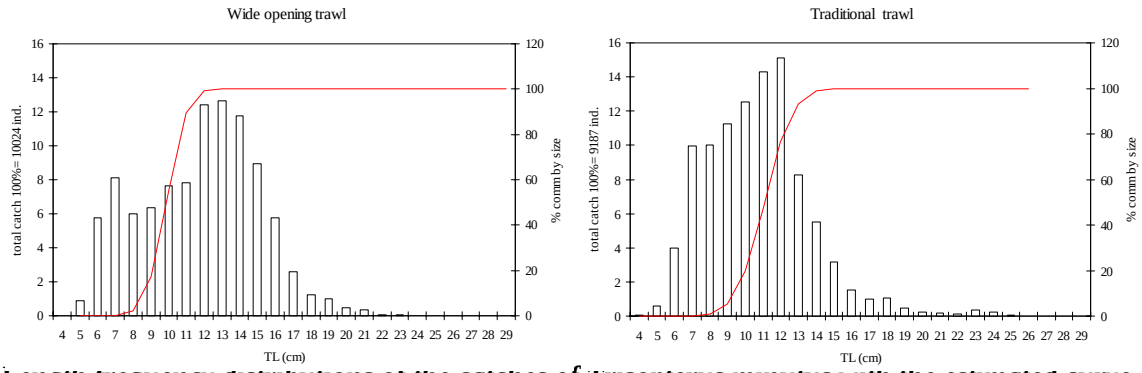
Data on catch

The target is characterised by a mix of species. The most important are *Mullus barbatus*,

Sepia officinalis, *Squilla mantis*, *Octopus vulgaris*, *Merluccius merluccius* on the more coastal fishing grounds (depth <50m), and *Merluccius merluccius*, *Eledone cirrhosa*, *Raja spp.*, *Scyliorhinus canicula*, *Trisopterus minutus* in deeper waters of the continental shelf. The species composition is variable along the year, depending on the availability and recruitment schedules of the coastal resources. The percentage of discard in this fishery is in general lower in the more coastal hauls, where it is mainly composed by damaged specimens. Going to deeper bottoms, the percentage of discard significantly increases reaching about 30% of the total catch; it is mainly composed by *Trachurus trachurus*, *Sardina pilchardus*, some species of the Triglidae family, small specimens of *Trisopterus minutus* and *Merluccius merluccius*.
For this last species, a study carried out in this GSA showed a very high percentage of discards between 8 and 15 cm TL.

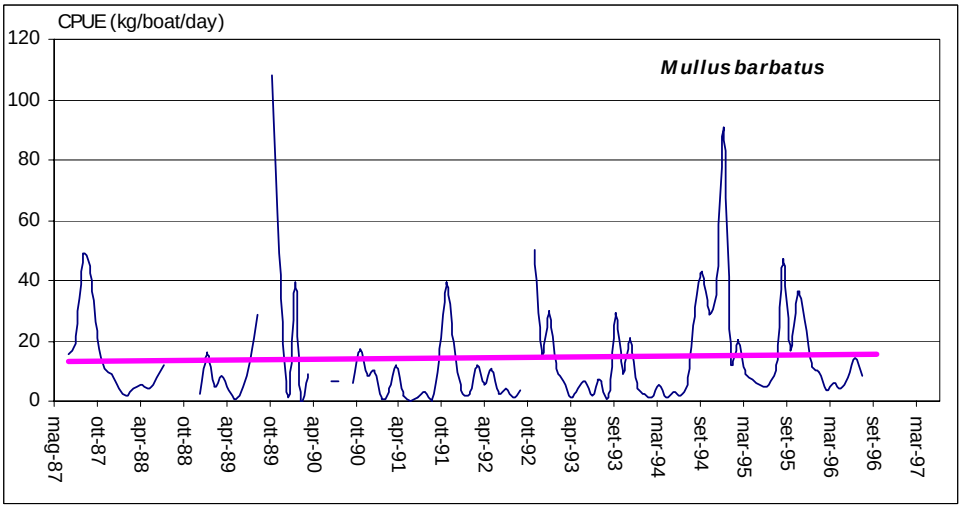


Hake. Monthly length frequency distribution in number of specimens per 100 hours of commercial trawling of the total catches and of the discarded fraction

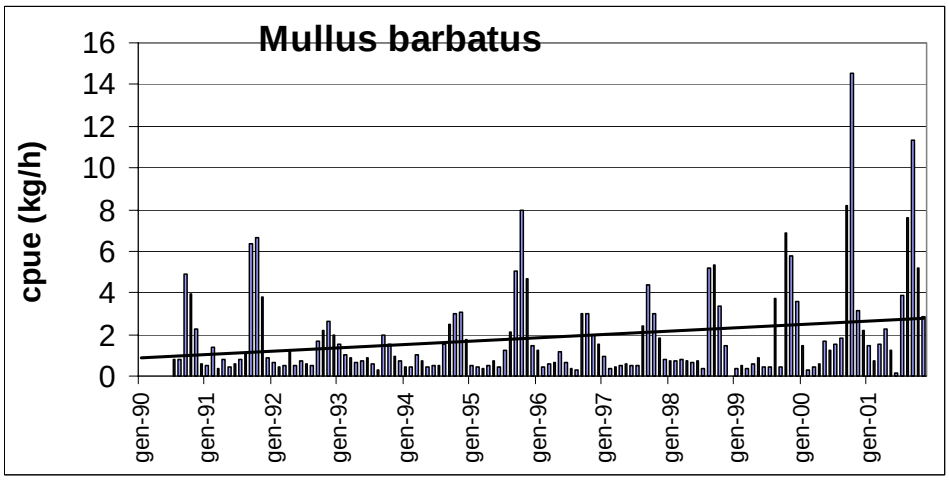


Length frequency distributions of the catches of Trisopterus minutus with the estimated curve of discard (*Porto Santo Stefano****).***

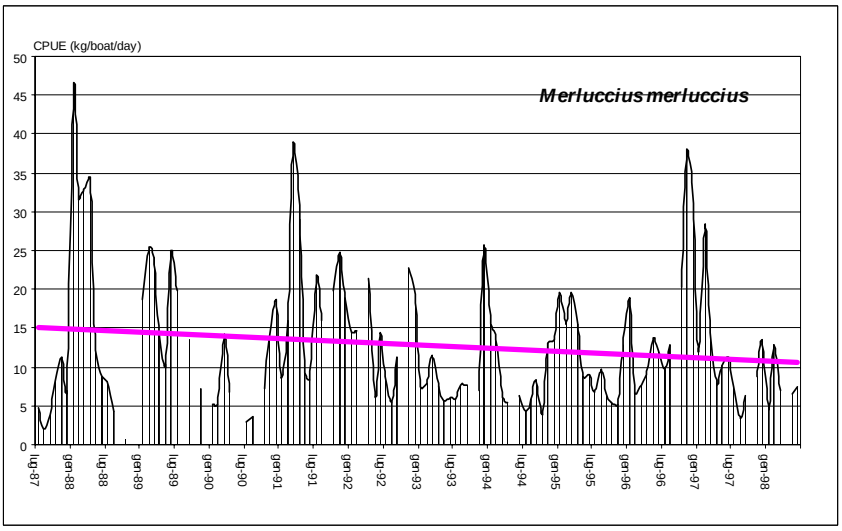
As regards the catches per unit of effort of hake, one the most important species of this fishery, they show decreasing trends or stable situations in the most important landing ports of the GSA 9. On the contrary, in *M. barbatus* the CPUEs show a tendency to increase in the last years.



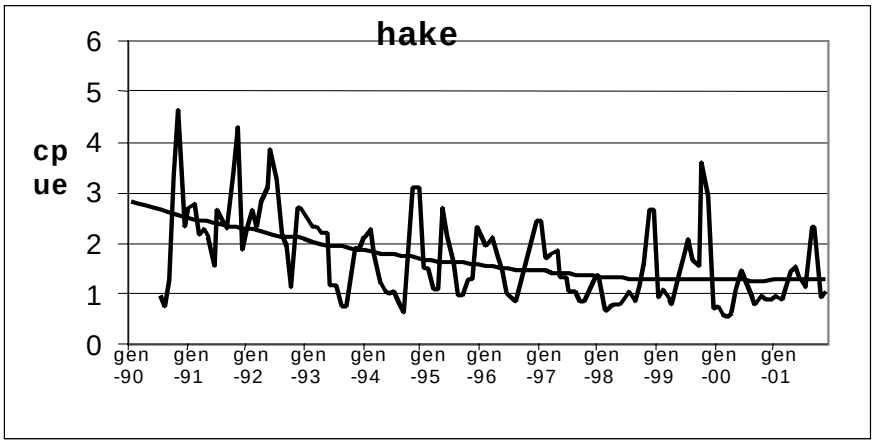
Catch per unit of effort (kg/boat/day) of Mullus barbatus (S. Margherita Ligure)



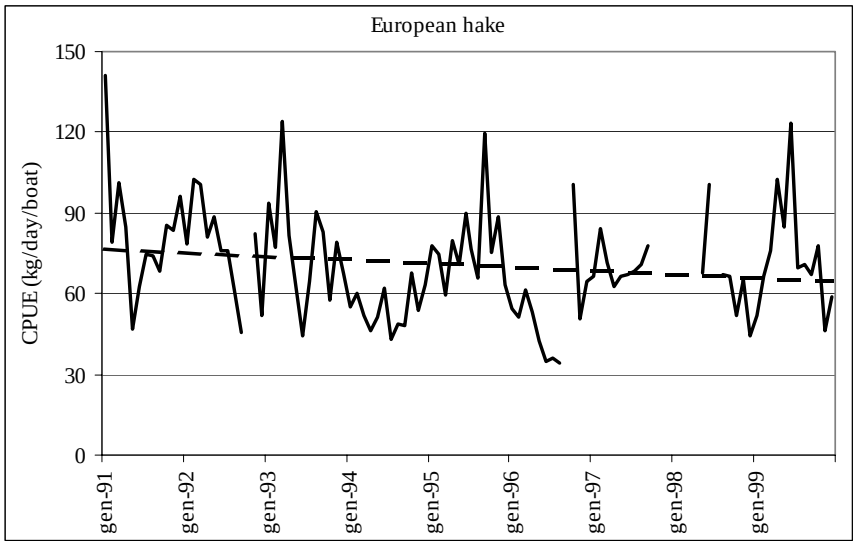
Catch per unit of effort (kg/hour) of Mullus barbatus (*Fleet of Viareggio****)***



Catch per unit of effort (kg/boat/day) of Merluccius merluccius. Fleet of Santa Margherita Ligure

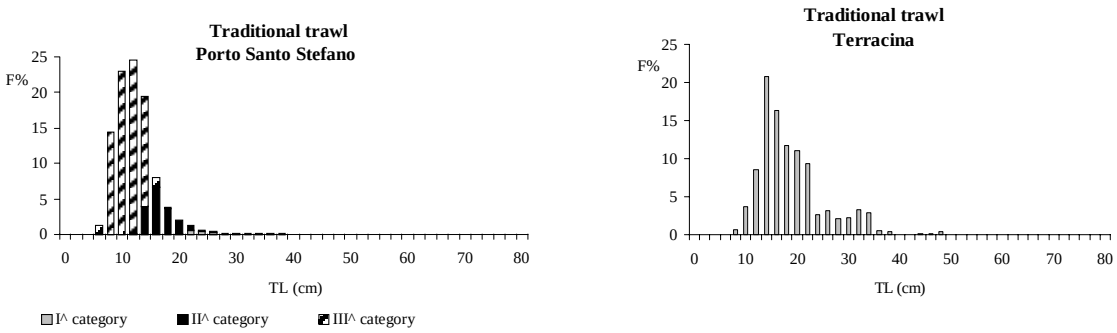


Catch per unit of effort (kg/hour) of Merluccius merluccius. Fleet of Viareggio



Catch per unit of effort (kg/day/boat of Merluccius merluccius. Fleet of Porto Santo Stefano

Size composition of the landings of hake does not show noticeable differences among seasons. Individuals of small size, belonging to age class 1 or 2 in general represent them. No evident changes in mean size of the catch that can be linked with increasing fishing pressure has been observed in data series of commercial catch length frequency.



Size frequency distribution of hake in Porto Santo Stefano and Terracina – Traditional trawl

Interaction with other fisheries

In the more coastal fishing grounds there is a spatial overlapping between this fishery and the artisanal fleet using set nets and the rapido (beam trawl) fishery. The interaction is characterised by a competition for the same resources and by partial overlapping of fishing areas. Having trawl net and rapido quite different catch efficiency as regards to each single species, their catch compositions may show noticeable differences in particular related to flat fishes and rays.

A wider overlapping could be observed considering the trawl fleet operating with wide opening trawling. This interaction occurs both for the fishing grounds and for the resources.

There is certain spatial overlapping with the artisanal fleet using set nets targeting hake, but showing quite different exploitation patterns, being the trawling fishing pressure mostly exerted on smaller individuals than those exploited with fixed gear.

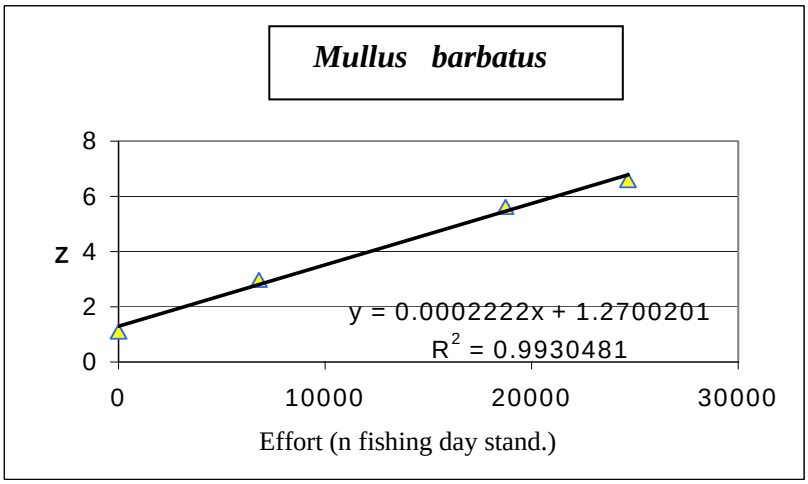
Special features

There is not derogation to the current general rules. In order to reduce the fishing effort, in the last years the Italian Ministry (MIPAF) proposed a facultative ban for trawling in September-October, but the fleet of the GSA9 chosen to not interrupt the activity. In alternative, trawl fishery has been forbidden in delimited areas where high abundance of small hake was observed. In spite of this, catches and landings of small hakes (<20 cm TL) resulted still high in many ports of the GSA. In addition, the illegal fishery on shallow waters inside the three miles (or 50m depth) from the coastline represents an evident problem, producing landings of under-sized specimens of important species like *M. barbatus*, *Pagellus* spp. etc.

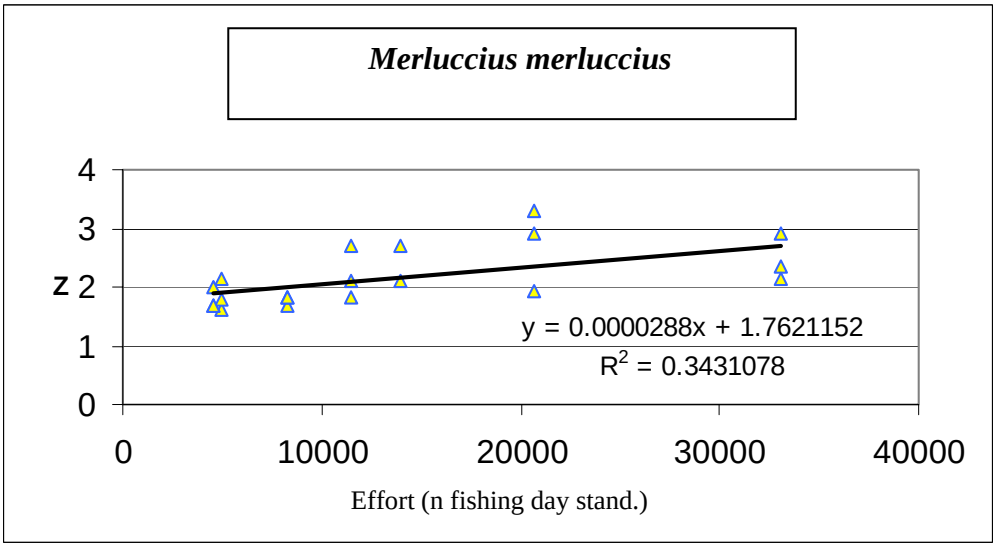
Relationships between fishing effort, fishing mortality and catch rates

Some information regarding the relationship between an index of fishing effort (fishing days) and the estimates of total mortality in red mullet allowed to obtain a rough estimate of the coefficient of catchability (q), and an independent value of natural mortality rate (M).

For hake the relationship between an index of fishing effort (fishing days) and the estimates of juvenile total mortality is not very evident due to imprecise estimates of Z and a lacking of sufficient contrast among exploitation rates. Anyhow, they furnish a rough estimate of the coefficient of catchability (q), and an independent value of juvenile natural mortality rate (M) in hake fisheries of the Sub-Area.



Relationship between fishing effort (*total fishing days****) and total mortality rates for red mullet***



Relationship between fishing effort (total fishing days) and total mortality rates for hake

FISHERY 2 –CONTINENTAL SHELF, WIDE OPENING TRAWL

Fleet

Vessels belonging to this fishery represent an important portion of the fleets of the ports of southern Tuscany and Latium. Most of the vessels are medium-large sized (>20 m length) and medium-large powered (>260 hp). A decreasing trend in the number of vessels operating on this area was observed in the last years following the general reduction of the fleet that has occurred in the GSA 9.

Fishing time over a year

This fishery is carried out all round the year. The number of vessels fishing on coastal resources may increase during the winter season, when the weather conditions do not allow the operations far from the ports. Vessels can perform daily trips, or, in the case of larger one, two-three days trips. During the year, each vessel performs about 180 fishing days. However, the total number of fishing days varies according to the different ports. For example in Porto Santo Stefano WOT trawlers perform about 200 fishing days per boat during the year.

Fishing equipment

The trawl nets generally used by that fishery is the wide opening trawl net (WOT). The cod-end mesh size of the nets utilised in this fishery is in general 40 mm. No structural modifications of fishing gear have been observed in the last ten years.

Deck layout and machinery involved

The smaller vessels operating on shallow waters do not require particular devices as net drum. The larger boats frequently utilise net drum. No changes neither in the gear characteristics nor in the time spent to fishing were observed in the last years.

Electronic equipment

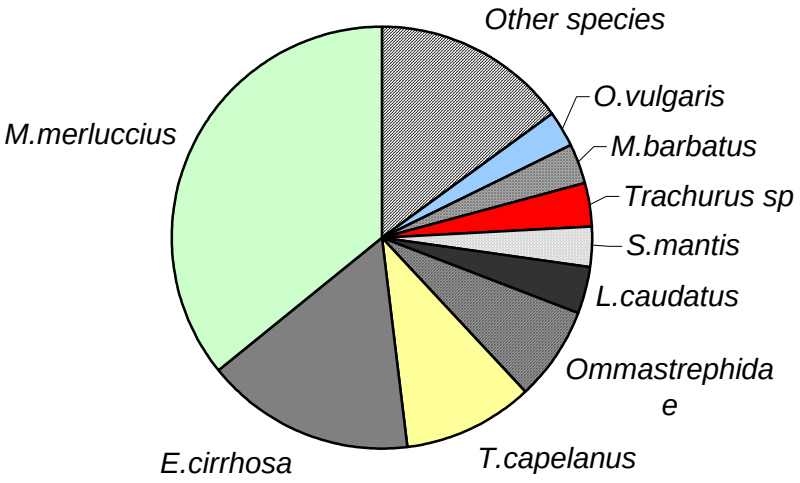
Almost all the vessels utilise GPS but this does not imply the exploitation of new fishing grounds.

On the other hand, electronic assistance for navigation has reduced the time spent for searching trawlable grounds. It is likely that this fact may increase effective time fishing.

Data on catch

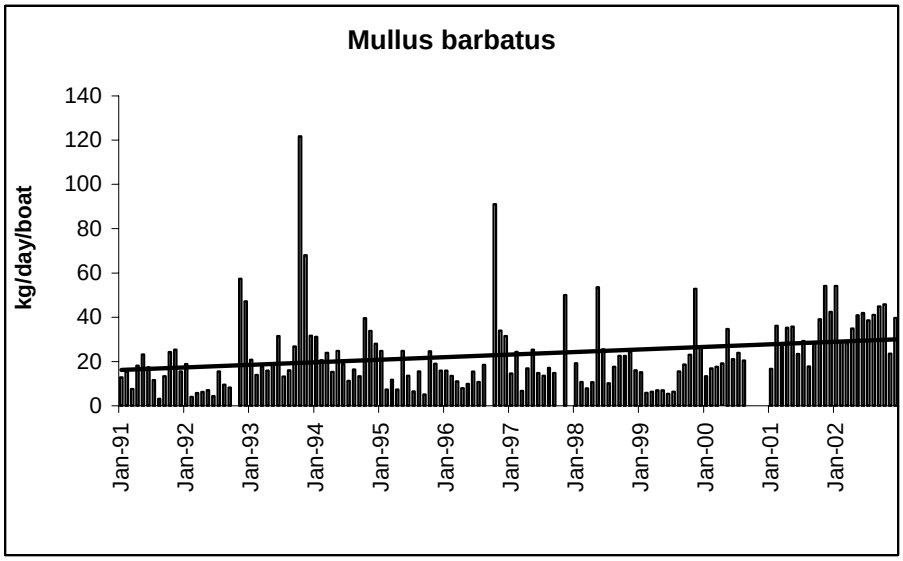
The target is characterised by a mix of species; the most important components are medium sized specimens of *Merluccius merluccius, Mullus barbatus, Sepia officinalis, Squilla mantis, Octopus vulgaris*, on the more coastal fishing grounds (depth <50m), and *Merluccius merluccius, Eledone cirrhosa, Raja spp., Scyliorhinus canicula, Trisopterus minutus, Octopus vulgaris* in deeper waters of the continental shelf. The percentage of discard in this fishery is in general quite high. The majority of the biomass rejected at sea is represented by algae, invertebrates and small specimens of many coastal species (*Spicara* sp., *Trachurus mediterraneus, Sardina pilchardus*, some species of the Triglidae family etc.). The percentage of the biomass discarded in the fishery can reach about 20% of the total catch.

Average CPUE = 165.1 (+/-1.7) kg / boat / day



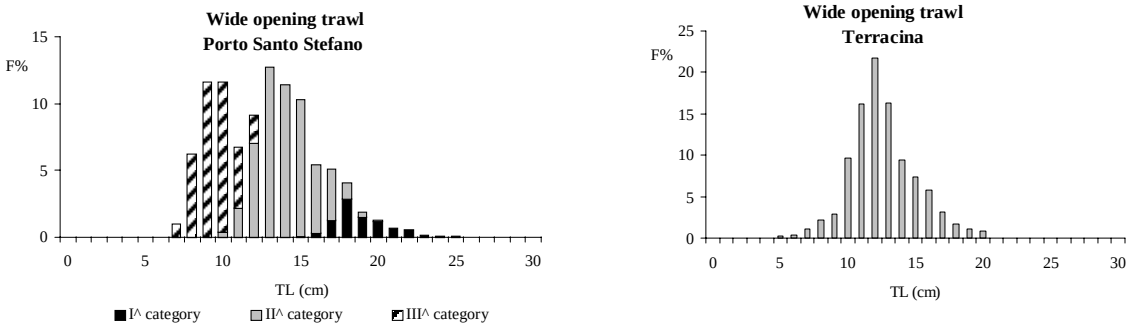
Porto Santo Stefano: example of landing composition of the continental shelf fishery with wide opening trawl

As regards the catches per unit of effort of hake, one the most important species of this fishery, they show decreasing trends or stable situations in the most important landing ports of the GSA 9. For red mullet CPUE shows a slightly increasing trend over years.



Catch per unit of effort (kg/day/boat) of Mullus barbatus. Wide opening trawl *(Porto Santo Stefano)*

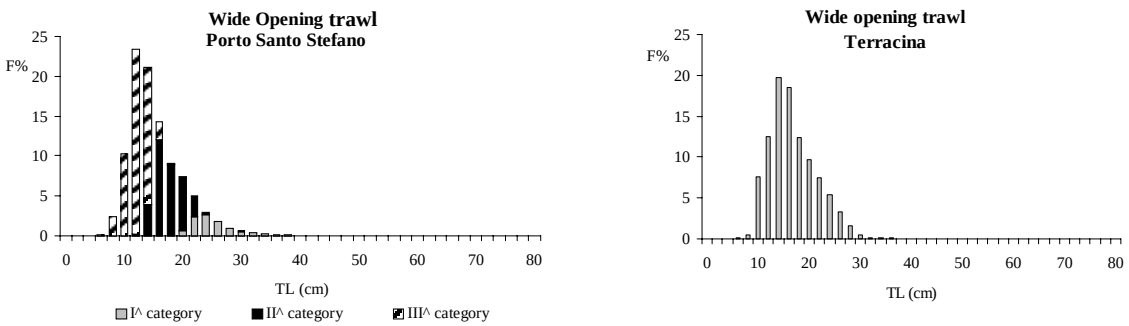
The demographic composition of the landing of *M. barbatus* collected in Porto Santo Stefano is characterised by small-medium sized specimens. Particularly in October, in correspondence of the recruitment period of the species, a high number of under-size individuals were present in the landing. In Terracina the annual demographic structure of the landings of M. barbatus is characterised by a very low percentage of specimens under the minimum legal size of commercialisation.



Monthly frequency distribution of red mullet landing in Porto Santo Stefano and Terracina – Wide Opening trawl

I^ category: specimens with mean size from 18.5 to 20.0 cm TL.
II^ category: mean size from 14.0 to 15.5 cm TL. III^ category: mean size from 9.0 to 12.0 cm TL.

Size composition of the landings of hake proceeding from this fishery does not show noticeable differences among seasons. Individuals of small-medium size (14-22 cm TL) in general represent them. In comparison with the demographic structure of the landings with traditional trawl, it appears evident a higher contribution of medium sized specimens. The percentage of specimens No evident changes in mean size of the catch that can be linked with increasing fishing pressure has been observed in data series of commercial catch length frequency.



Size frequency distribution of hake landing in Porto Santo Stefano and Terracina – Wide Opening trawl

Interaction with other fisheries

In the more coastal fishing grounds there is a spatial overlapping between this fishery and the artisanal fleet using set nets and the rapido (beam trawl) fishery. The interaction is characterised by a competition for the same resources and by partial overlapping of fishing areas. Having trawl net and rapido quite different catch efficiency as regards to each single species, their catch compositions may show noticeable differences in particular related to flat fishes and rays.

A wider overlapping could be observed considering the trawl fleet operating with traditional trawling. This interaction occurs both for the fishing grounds and for the resources.

Special features

See what reported in FISHERY 1

Relationships between fishing effort, fishing mortality and catch rates

No data available

FISHERY 3 – SLOPE

Fleet

The fishery is directed to catch Norway lobster (*Nephrops Norvegicus)*, and to deep-water rose shrimp (*Parapenaus longirostris*) on the fishing grounds to the south of Elba Island. The fleet carrying out this type of fishery is localised in the ports of Liguria, Tuscany and along the Latium coast. The total number of vessels involved in this activity is quite different for each port and represents about 15-20% of the total trawl fleet of the GSA9. The fleet characteristics are very variable and conditioned by the geo-morphological characteristics of the exploited areas. As a matter of fact, in Liguria, the boats are of small size and lower engine power, with the fishing grounds localised quite close to the ports. In the other ports, the distance to the fishing grounds limits this activity to the larger and powerful vessels. Along the Latium coast the vessels performing this fishery are characterised by medium-large size.

Characteristics of the vessels targeting N. Norvegicus in Porto Santo Stefano

Boat length (m)		Engine power (kW)		GRT	
Mean	s.e.	Mean	s.e.	Mean	s.e.
20.8	0.1	294.0	4.1	48.5	0.8

Also in this fishery, a decreasing trend in the number of vessels was observed in the last years following the general reduction of the fleet.

Fishing time over a year

The activity of this fishery is all over the year, but mostly concentrated from the spring to the autumn, as a consequence of more favourable weather conditions. The shifts that occur along the year in the targets for most of the fleets make difficult to quantify the effective number of vessels and fishing time spent on these fishing grounds. The long distance of the fishing grounds may produce in some ports fishing trips of 2-3 days.

Fishing equipment

The trawl nets generally used by the fishery are the tartana and the volantina. The cod-end mesh size of the nets utilised in this fishery is in general 40 mm. Along the Latium coast a modified wide opening trawl is also utilised to fish on these deep bottoms.

Deck layout and machinery involved

The small dimensions of the vessels of Liguria do not allow the use of specific devices and that implies longer time spent in the hauling operations. In the other ports, the greater dimensions of the boats allow the use of net drums and more powerful trawl winches. No changes neither in the fishing gear characteristics nor in the time spent to fishing were observed in the last years.

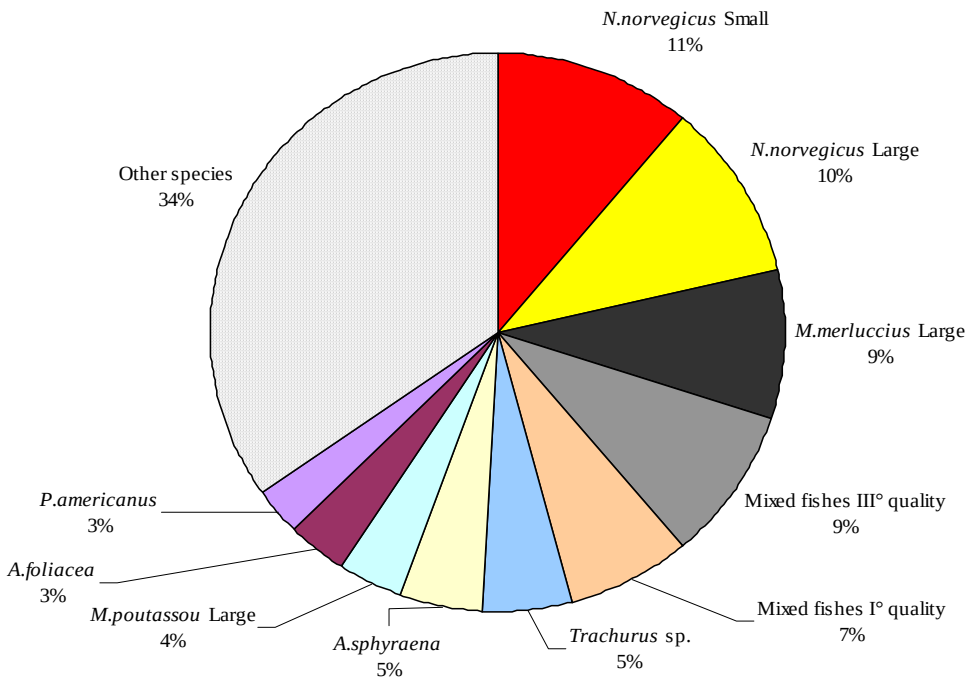
Electronic equipment

All vessels utilise GPS, color Echosounder and plotter and most of them computerised geographic charts.

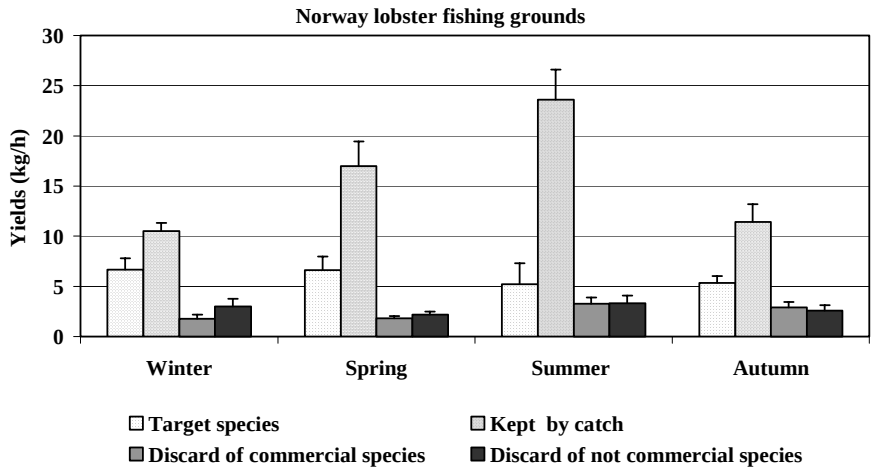
Data on catches

The target is represented mostly by the Norway lobster, but on the fishing grounds of south Tuscany and Latium also deep-water rose shrimp could be an important economic component of the landing. By-catch is mainly represented by *Phycis blennoides*, *Todaropsis eblane*, *Eledone cirrhosa*, *Merluccius merluccius*, *Pagellus bogaraveo*, *Galeus melastomus* and *Micromesistius poutassou.* Depending on the ports, the blue whiting *M. potassou* is landed or

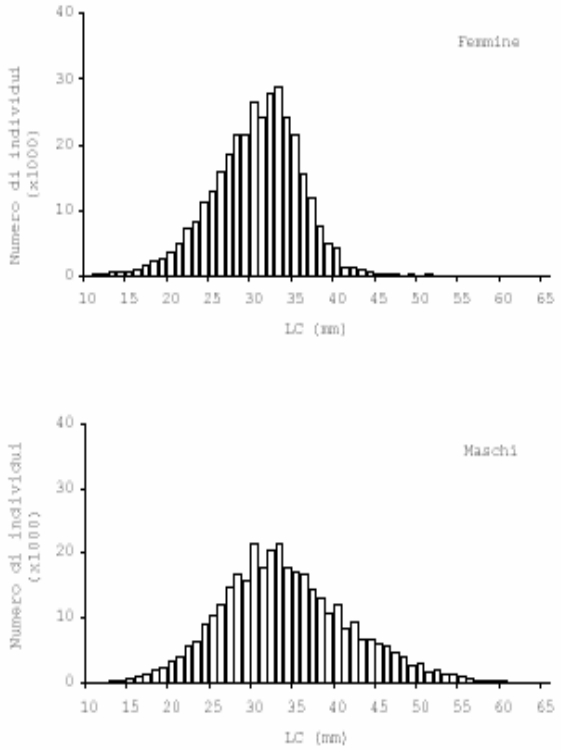
partially or totally discarded.



Composition of the catch in the upper continental slope fishery of Porto Santo Stefano



Seasonal mean yields per hour (kg/h) of each fraction of the catch obtained in the upper continental slope fishery. Target species is represented by Norway lobster



Demographic structure of the catches of Norway lobster in Porto Santo Stefano

In this fishery, discard constitutes a considerable fraction of the total catch, ranging from about 15 to 30%. Discard of commercial species is mostly due to specimens of fishes and cephalopods under commercial size. Although this fraction is constituted by a large number of species, its biomass is mostly due to *Galeus melastomus*, accounting for about 30%.
Discard of non commercial species is mostly constituted by species without commercial interest, in particular finfish and crustaceans. Most of the species are of small size; the silvery pout, *Gadiculus argenteus*, accounts for about 60% of the non-commercial catch. Norway lobster individuals are almost absents in the discard.

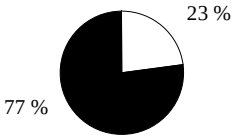
□ Commercial
■ Discard

Discard length (TL) = SL50 or
discard mean length

HAKE
Merluccius merluccius

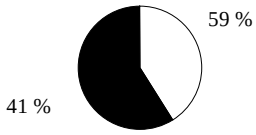
LIGURIAN SEA

Discard length (TL) = 10 cm



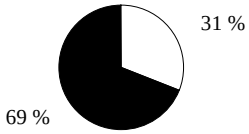
NORTH TUSCANY

Discard length (TL) = 11,6 cm



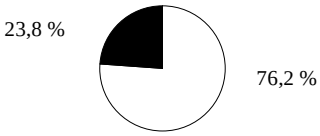
SOUTH TUSCANY

Discard length (TL) = 14,9 cm



LAZIO

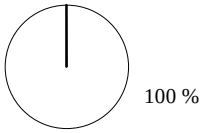
Discard length (TL) = 11,7 cm



RED MULLET
Mullus barbatus

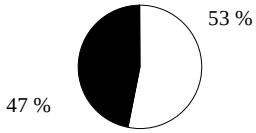
LIGURIAN SEA

Discard length (TL) = 9 cm



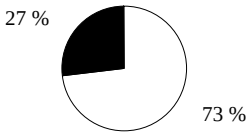
NORTH TUSCANY

Discard length (TL) = 10,5 cm



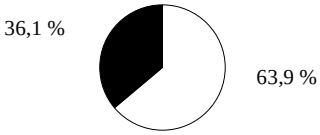
SOUTH TUSCANY

Discard length (TL) = 11,5 cm



LAZIO

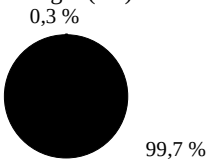
Discard length (TL) = 11,7 cm



HORSE MACKEREL
Trachurus trachurus

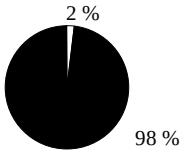
LIGURIAN SEA

Discard length (TL) = 8 cm



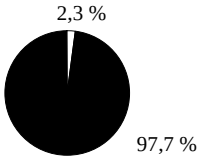
NORTH TUSCANY

Discard length (TL) = 24,8 cm



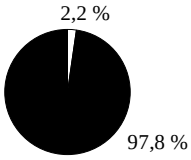
SOUTH TUSCANY

Discard length (TL) = 21 cm



LAZIO

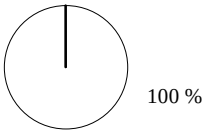
Discard length (TL) = 21,5 cm



BLUE WHITING
Micromesistius poutassou

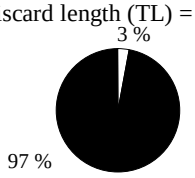
LIGURIAN SEA

No discard



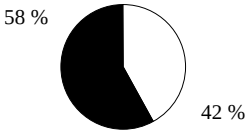
NORTH TUSCANY

Discard length (TL) = 20 cm



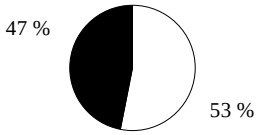
SOUTH TUSCANY

Discard length (TL) = 20 cm



LAZIO

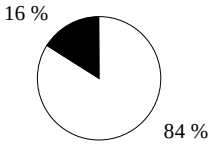
Discard length (TL) = 22 cm



RED PANDORA
Pagellus erythrinus

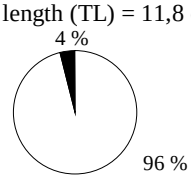
LIGURIAN SEA

Discard length (TL) undeterminable



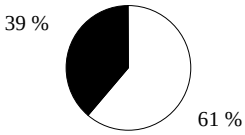
NORTH TUSCANY

Discard length (TL) = 11,8 cm



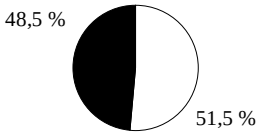
SOUTH TUSCANY

Discard length (TL) undeterminable



LAZIO

Discard length (TL) = 16,3 cm



RED SHRIMP
Aristeomorpha foliacea

LIGURIAN SEA

Discard length (CL) undeterminable

No catch

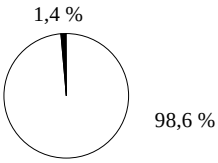
NORTH TUSCANY

Discard length (CL) = 20 mm

No catch

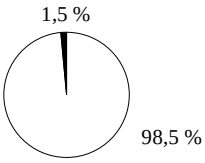
SOUTH TUSCANY

Discard length (CL) = 18 mm



LAZIO

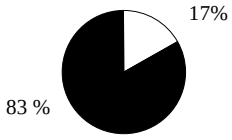
Discard length (CL) undeterminable



PINK SHRIMP
Parapenaeus longirostris

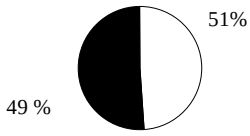
LIGURIAN SEA

Discard length (CL) undeterminable



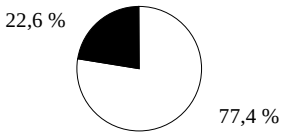
NORTH TUSCANY

Discard length (CL) = 14 mm



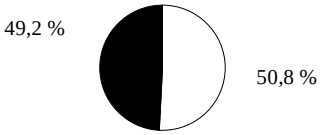
SOUTH TUSCANY

Discard length (CL) = 14 mm



LAZIO

Discard length (CL) = 18,4 mm



NORWAY LOBSTER
Nephrops norvegicus

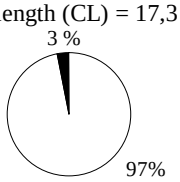
LIGURIAN SEA

Discard length (CL) undeterminable

No catch

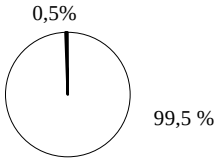
NORTH TUSCANY

Discard length (CL) = 17,3 mm



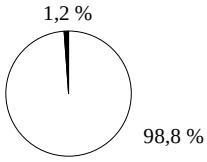
SOUTH TUSCANY

Discard length (CL) = 22 mm

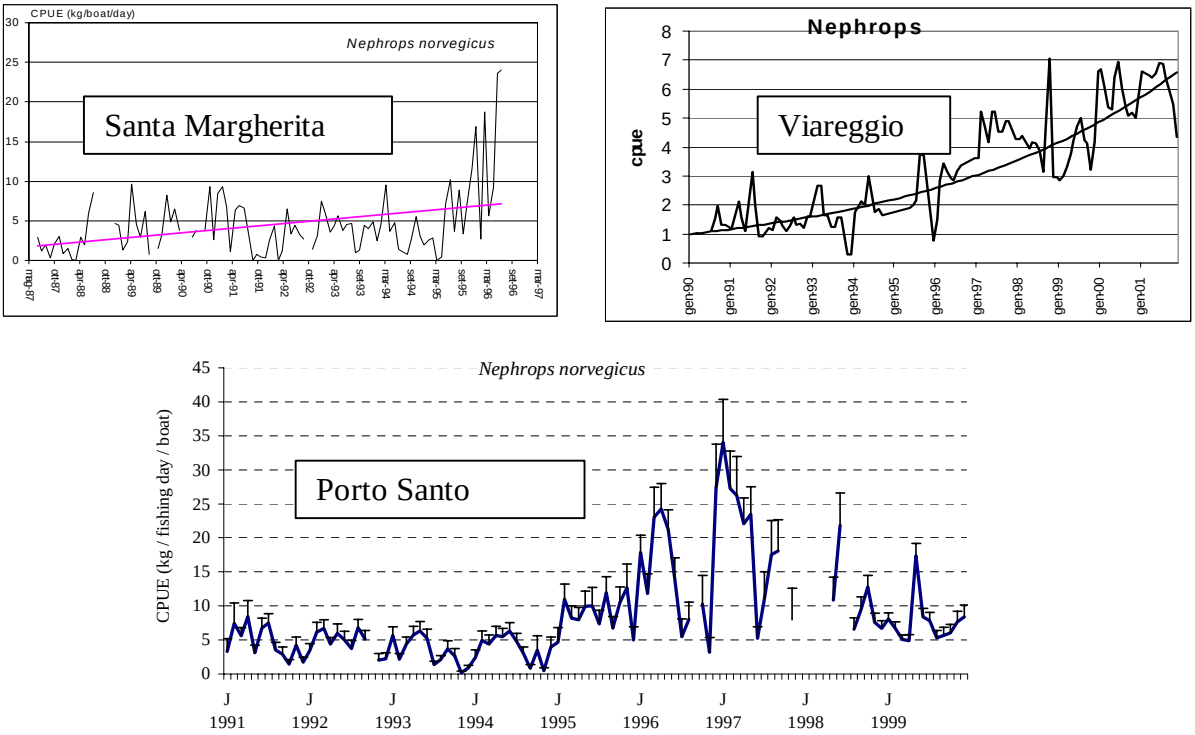


LAZIO

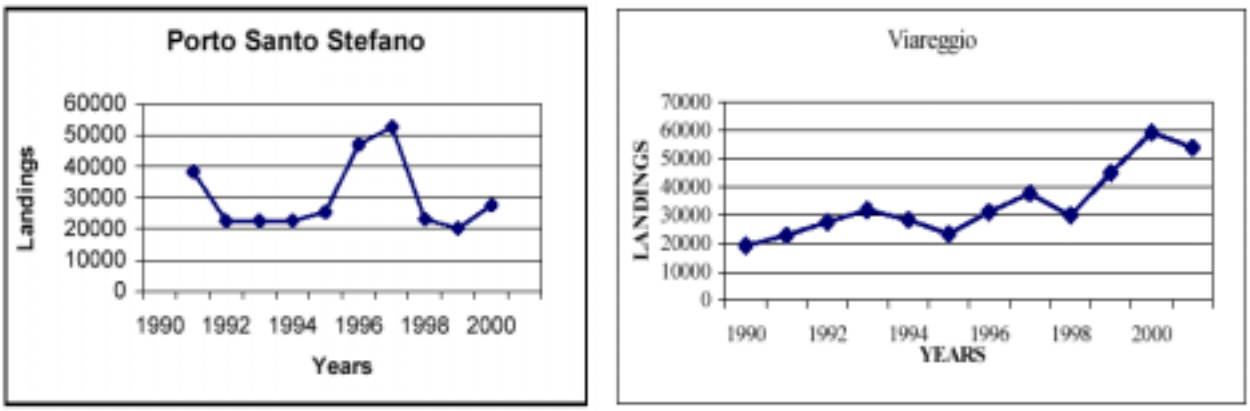
Discard length (CL) undeterminable



During the last years, it was observed an almost generalised increase in abundance of Norway lobster at sea that was reflected in the catch rates. Consequently, in some fisheries, the number of fishing vessels targeting *Nephrops* increased. However, the increasing trend in abundance seems to be interrupted in some ports like Porto Santo Stefano.



Catch per unit of effort (kg/day/boat) of Norway lobster in 3 of the main ports (GSA 9)



Trends of commercial landing (kg) of N. norvegicus for the period 1990-2001 in two ports of GSA 9

Interaction with other fisheries

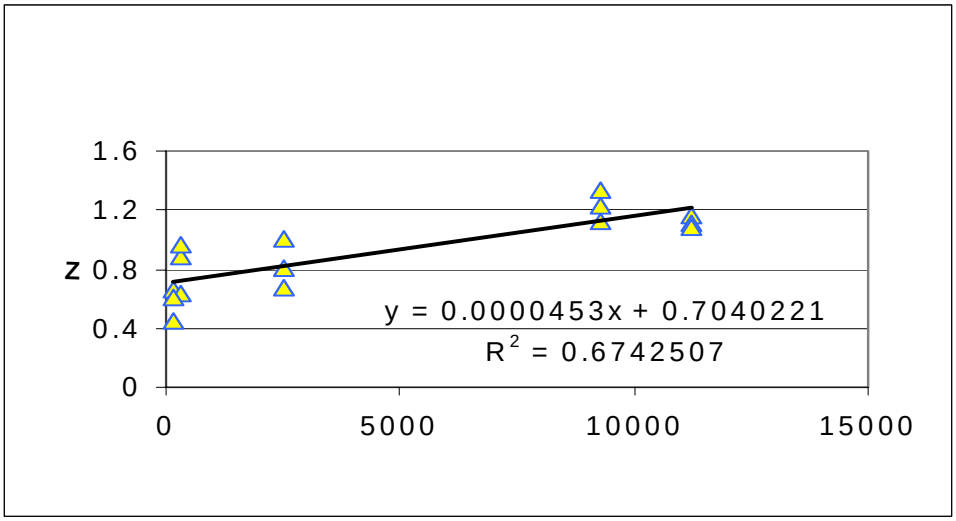
The offshore location of the fishing grounds limits the interaction with other types of fishery. A spatial interaction, exclusively in the summer season, may occur with the pelagic long-lines targeting swordfish and competition for the resource with the hand line fishery targeting *Pagellus bogaraveo*, that is among the more valuable components of the Norway lobster fishery by-catch.

Special features

There isn't derogation to the current general rules. In order to reduce the fishing effort, in the last years the Italian Ministry (MIPAF) proposed a facultative ban for trawling in September-October, but the fleet of the GSA9 chosen to not interrupt the activity.

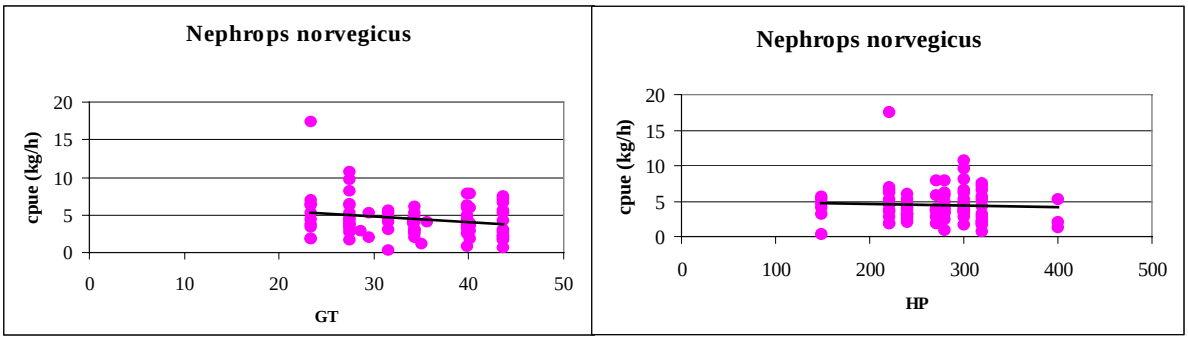
Relationships between fishing effort, fishing mortality and catch rates

A fairly good correlation was obtained between effort directed to fish Norway lobster, expressed as standardised effort as number of fishing trips targeting this species per unit area and estimates of total mortality rates.



Relationship between effort (number of fishing trips standardised by the size of fishing grounds) and total mortality rate Z . Estimates of total mortality rates Z are derived from the size structure present in the different fishing grounds put inside GSA 9 which are exploited with different rates by the fleets proceeding from different ports.

Within the considered vessels size range, it seems that similar CPUEs are obtained with vessels of quite different size.



Relationship between Gross Tonnage and HP with CPUE (kg/h) for vessels operating in the same area and during the same period of time, with the same gear (tartana)

FISHERY 4 – DEEP WATER

Fleet.
The deep-water fishery is targeting red shrimps (*Aristaeomorpha foliacea* and *Aristeus antennatus*). In the GSA 9 the fleet carrying out this type of fishery is localised in the ports of Liguria and along the Latium coast. In Tuscany, boats performing this fishery are present only at Porto Santo Stefano and Porto Ercole. The total number of vessels involved in this activity is quite low in respect to the total trawl fleet of the GSA. Their characteristics are very variable in accordance with the geo-morphological features of the exploited areas. As a matter of fact, in Liguria the boats show small length and low engine power, the fishing ground being localised close to the ports. In Porto Santo Stefano and Porto Ercole the distance of the fishing grounds needs limits this activity to the larger and powerful vessels. Along the Latium coast the vessels performing the deep-water fishery are characterised by medium-large size.

Characteristics of the vessels targeting red shrimps in Porto Santo Stefano

Boat length (m)		Engine power (kW)		GRT	
Mean	**s.e.**	**Mean**	**s.e.**	**Mean**	**s.e.**
21.8	**0.2**	**313.4**	**9.8**	**56.8**	**1.7**

s.e. = standard error

In this fishery, a decreasing trend in the number of vessels was observed in the last years, following the general reduction of the fleet.

Fishing time over a year
The fishing activity in this fishery is mostly carried out from spring to autumn in consequence of more favourable weather conditions. The alternation during the year with other fishing activities doesn't allow quantify the effective fishing time spent on these fishing grounds.

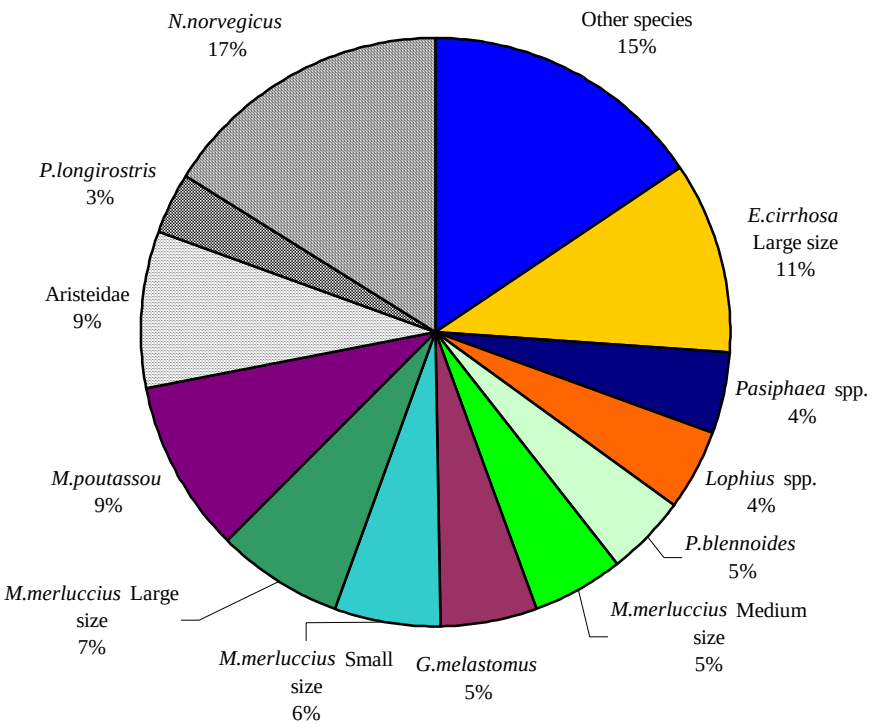
Fishing equipment
The trawl nets generally used by the fishery are the tartana and the volantina. The cod-end mesh size of the nets utilised in this fishery is in general 40 mm. Along the Latium coast a modified wide opening trawl is used to fish on these deep bottoms.

Deck layout and machinery involved
The small dimensions of the Ligurian vessels do not permit particular devices and very long time in hauling net is spent by these boats. In the other ports, the greater dimensions of the boats allow the use of net drums and more powerful trawl winches. No changes neither in the gear characteristics nor in the time spent to fishing were observed in the last years.

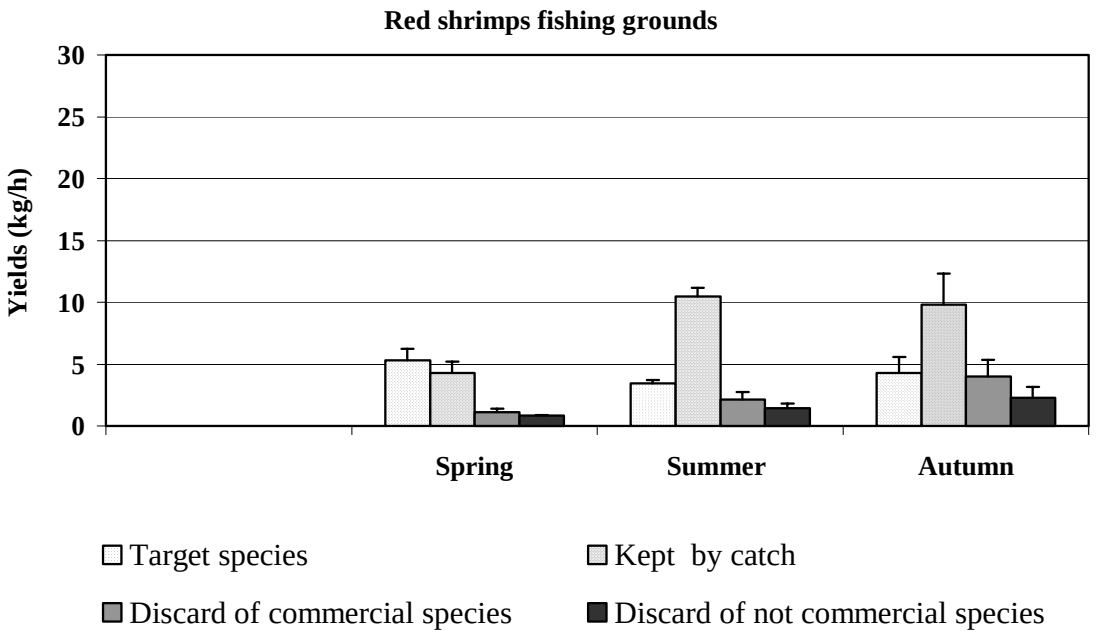
Electronic equipment
All vessels utilise GPS, Echo sounder, plotter and computerised geographic charts.

Data on catch
The target is represented by red shrimps, *Aristeus antennatus* and *Aristaemorpha foliacea*, and Norway lobster. However, also in this fishery the composition of the catches is characterised by a high level of multispecificity. Other important species are large specimens of horned octopus, hake and blue whiting.

Deep water fishery

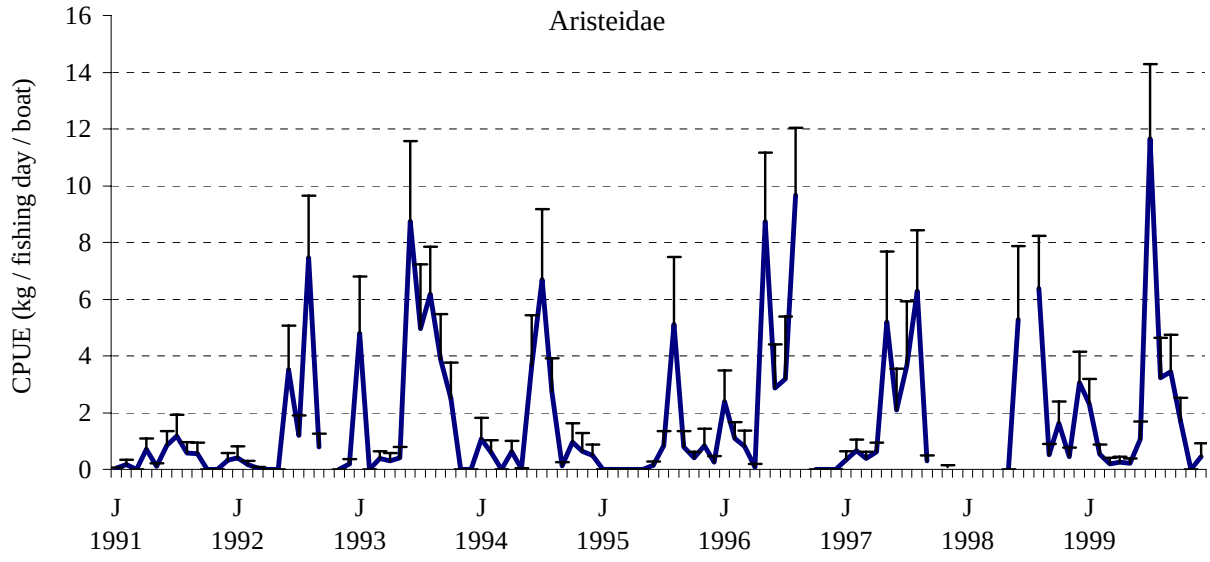


Catch composition in the deep water fishery. Traditional trawl of Porto Santo Stefano



In the deep fishery, discard constitutes a considerable fraction of the total catch, ranging from about 15 to 30%. Discard of commercial species is mostly due to specimens of fishes and cephalopods under commercial size. Although this fraction is constituted by a large number of

species, its biomass was mostly due to *G. melastomus*, accounting for about 60%.
Discard of non commercial species is mostly constituted by species without commercial interest, in particular belonging to fishes and crustaceans. Most of the species are of small size, lower than 10 grams of individual weight. Discard of target species is negligible.
CPUE values for red shrimps shows marked seasonality. A peak is usually reached each year in summer, followed by a secondary peak in winter. Maximum monthly values ranges between 5.1- 11.7kg/fishing day/boat for the Porto Santo Stefano fleet. Among years, the highest values were obtained in the period 1996-1999; from 1991 to 1995 values fluctuated, a peak being observed in 1993.



Catch per unit of effort (kg/day/boat) of red shrimps (Porto Santo Stefano).

Technical interaction with other fisheries
The distance of the fishing grounds limits the interaction with other types of fishery. A spatial interaction, exclusively in the summer season, may occurs with the pelagic long-lines targeting swordfish.

Special features
Same as other fisheries in GSA 9

Relationships between fishing effort, fishing mortality and catch rates
The highest catch rates observed in summer could be related to important biological phenomena including reproduction and recruitment, which occur mainly in this period and could increase availability to the gear, thus fishing mortality.

GSA 11 - SARDINIA

General

The fleet operating in Sardinia consists of about 1327 vessels (11537 GRT) which are based in 18 ports. Main ports are listed below.

Coast side			
East	**North**	**West**	**South**
Arbatax	Castelsardo	Alghero	Cagliari
Cala Gonone	La Maddalena	Bosa	
Golfo Aranci	Porto Cervo	Carloforte	
Olbia	Porto Conte	Oristano	
Siniscola	Porto Scuso	S.Antioco	
	Porto Torres		
	Santa Teresa di Gallura		

The Italian maritime departments in the GSA 11 are Cagliari, Olbia and Porto Torres.
Fishing vessels structural characteristics and gear utilisation may be very different depending on the ports, available resources, geo-morphology of the grounds, dominant weather conditions, etc.
Several fishing gear such as bottom trawl nets, trammel nets, gillnets, pots and long lines are utilised by island fishery. Information on Sardinian fishing fleet composition, which is being collected from official sources, seems to indicate that trawlers constitute (in number) about 14% of the whole Island fleet.
Moreover, an important share of the fleet composition, about 70% of the total, is made up by polyvalent vessels (i.e. authorised to employ different fishing gear) which mostly practice bottom trawling. Even if trawlers only represent the 14,4% of the fleet, economically speaking they are the most important fishery.
The bottom surface potentially exploited by trawlers is about 27,000 km^2 (shelf 17124 km^2 and slope 9880 km^2) but the extension of trawlable grounds is very different side by side (62 % on the western and southern side, 28% on the eastern, and 10 % on the northern side). Although fishing grounds are particularly spacious in the western and southern side (a very wide shelf and slope exist), as a general rule boats belongs to these areas are smaller and less powered.
The main ports regarding bottom trawling operations in the GSA 11 are Cagliari with 55 vessels, Sant'Antioco (38), Oristano (25) and Alghero (7). They are located in the South and Western Coast and as a general rule are larger and more powered than others.

Total trawlers number N	Total tonnage GRT	Mean tonnage GRT/N	Mean engine power HP/N
191	**6842**	**35,8**	**186,7**

The composition of the trawling fleet in terms of horsepower showed a wide degree of variation, both between ports and in the same port. However, in all ports, trawlers are mostly constituted of small-medium size vessels, with a mean horsepower of 187 hp and 35,8 GRT; the larger and more powerful trawlers are concentrated at Cagliari (more than 650 hp).
As a general rule, small trawlers (less than 30 GRT, total number 177) usually operate on shallow waters.

Trawlers (GRT<30)			
total trawlers number N	**Total tonnage GRT**	**Mean tonnage GRT /N**	**Mean engine power HP/N**
117	**1420**	**12,1**	**112,8**

Large trawlers (about 70 mean GRT, total number 74) usually employed on long fishing trips (2-5 days) within national and international waters of the Sardinian seas and Sardinia Channel. Large trawlers operate both on the continental shelf and on deep bottoms (50 m down to 700 - 800 m depth).

Trawlers (GRT≥30)			
total trawlers number N	**Total tonnage GRT**	**Mean tonnage GRT/N**	**Mean engine power HP/N**
74	**5422**	**73,3**	**303,6**

In the last ten years it was evidenced an increasing of the consistency of the large trawler fleet GRT>30, especially in relation to the number of vessels. This tendency, is particularly evident from 1991 till now, and it has been favoured by subventions from regional, national and from European Community Government with the aim of reducing the fishing effort in shallower waters. The reduction mostly interested the oldest, smaller and less equipped vessels that are usually converted in bigger boats suitable for operate on deeper fishing grounds.

Gross Tonnage	1991	1994	2001
30 ÷ 70	43	47	39
70 ÷ 100	6	7	14
> 100	10	12	17
Total	59	66	70

List of various fisheries

Depending on their target, trawlers mainly operate on the relatively wide continental shelf and on the slope. Each fleet in general exploits the grounds more close to their respective ports, especially on Eastern and Northern coast. However some fishermen use to fish in those areas that seems to be more economically productive even if they are very far from the base port.

Net used in shallow waters (called "terra" net) are more light and less long than those employed in deeper ones ("fondale" net). Sardinian bottom trawls are made mostly of knotless polyamide with other materials, such as knotted polyester, sometimes used for wings or belly sections.

The vessels using the traditional trawl generally worked in a wide depth range, comprised from 50 to 750 m.

The target of the fisheries using the above fishing gear is constituted by a species assemblage, in which there is no a clear predominance of any species.

The main fish market of the Island is Cagliari. Here all the catches landed in the main ports (Cagliari, Porto Torres, Alghero, Arbatax, La Caletta, S. Antioco, Oristano) come daily. However, catches from artisanal fishery and from trawlers landed in the Northern ports are sold on local markets. Trawling represents the most important fishery activity in the Island. Generally, trawl fishery is targeted to a species pool of which red mullets (*Mullus barbatus* and *M. surmuletus*), gadidae (*Merluccius merluccius, Phycis blennoides*), shrimps (*Parapenaeus longirostris, Aristeus antennatus, Aristaeomorpha foliacea, Plesionika sp.),*

lobsters (*Palinurus elephas, P. mauritanicus, N. norvegicus*) and some cephalopods (*Octopus vulgaris, Eledone* spp.) correspond to the most important species economically speaking.
Catch composition may present differences along the year depending on species availability or on commercial constraints. Moreover, differences may exist among the catches that can be obtained in the different fishing grounds that each fleet exploit. Bottom trawlers exploit most of the accessible bottoms in the GSA 11 mostly up to 800 m depth.
In the GSA11 two main trawl fisheries can be identified:

1. Continental shelf fishery (from 10 to 150 m depth). Activity carried out by small trawlers using tartana ("terra" net). The target is a mix of species, the most important are red mullet, cuttlefish and common octopus.
2. Deep water fishery (from 300 to 700 m depth). Activity carried out with tartana ("fondale" net). Target species are red shrimps, mainly *Aristaeomorpha foliacea* and *Aristeus antennatus.* (from 500-550 to 700 m of depth), Norway lobster (from 400 to 520 m depth), *Merluccius merluccius* (from 350 to 450 m of depth) *Parapenaeus longirostris* (from 300 to 500 m depth).

FISHERY 1 - CONTINENTAL SHELF

The bottom area potentially exploited by trawlers is 17,000 km^2. The extension of the trawlable although is very different considering the cost side (50% on the western side, 29% on the eastern side, about 10% on Southern and Northern side). In the Eastern shelf bottoms are very narrow (50 m within 3 miles boundary).

Fleet

The trawlers of this fishery represent an important portion of the trawl fleet with local differences depending on fishermen traditions and geo-morphological constrains. Most of them are characterised by small and medium dimensions (mean GRT =12.) and low engine power (mean power =110 hp). It is quite difficult to quantify the total number of trawlers that exert their fishing pressure on the continental shelf, because that grounds are exploited by bigger trawlers also, especially during the night.
A decreasing trend in the number of vessels was observed in the last years following the general reduction of the fleet that had occurred.

Fishing time over a year

This fishery is carried out all round the year. The number of vessels may increase during the winter season, when the weather conditions not allow the operations further from the coast. Vessels perform daily trips, amounting for a total of 150-160 fishing days/year.

Fishing equipment

The trawl nets generally used by the fishery are the tartana ("terra" net). The cod-end mesh size of the nets utilised in this fishery is in general 40 mm. No gear modification has been observed in the last ten years.

Deck layout and machinery involved

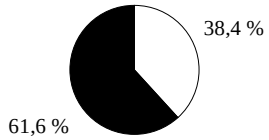
The small dimension of the vessels and the operations on shallow waters do not require particular devices. However an increasing use of steel made doors occurs. The net drums are utilised by most of the fleets present in the Sub-Area.
No changes neither in the gear characteristics nor in the time spent to fishing were observed in the last years.

Electronic equipment
All vessels utilise GPS and Echo-sounder but it does not imply the exploitation of new fishing grounds since 10 years. On the other hand, electronic assistance for navigation has reduced the time spent for searching trawlable grounds. It is likely that this fact may have increased the effective time fishing.

Data on catch
The target is a mix of species, the most important are common octopus, horned octopus, red mullet, cuttlefish, Raja spp., *Scyliorhinus canicula*, poor cod. The species composition is variable on percentage along the year due to the availability and recruitment schedules of the coastal resources.
The percentages of discards are given below.

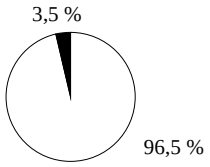
Merluccius merluccius
SARDINIA

Discard length (TL) = 16 cm



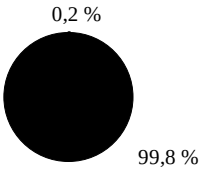
Mullus barbatus
SARDINIA

Discard length (TL) undeterminable



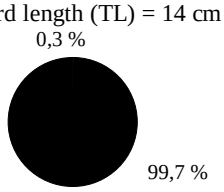
Trachurus trachurus
SARDINIA

Discard length (TL) = 10 cm



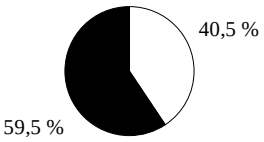
Micromesistius poutassou
SARDINIA

Discard length (TL) = 14 cm



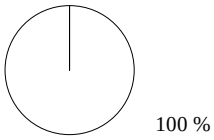
Pagellus erythrinus
SARDINIA

Discard length (TL) = 10,1 cm



Nephrops norvegicus
Aristeomorpha foliacea
Parapenaeus longirostris
SARDINIA

No discard



Data on landings and catch per unit of effort for each single species are not available.
Trawl fishery commercial catches in the GSA 11 are characterised by a large number of species but the more significant species in terms of economic values are 17 species.

Interaction with other fisheries
There is a spatial overlapping between this fishery and the artisanal fleet using set nets and pots. In some case the interaction is characterised also by a competition for the same

resources. The technical interaction of trawl fishery in the GSA 11 is related to the use of long-lines, and mostly bottom long-lines targeting hake. In fact, some fishing ground are exploited by both the trawl nets and the bottom long-lines although targeting different fractions of population (hake large individuals for long-lines).

Special features.
No derogation to the current general rules.

Relationships between fishing effort, fishing mortality and catch rates
Catch rates may change depending on the level of aggregation and abundance of each species at different depths. As a general consideration on western coasts catch rates and total catches are higher if compared to those obtained by other fleets inside the Sub-Area.
Trawl fishery in the GSA 11 could affect mortality rates of long-lived species (hake) mostly on first age cohorts.

FISHERY 2 – SLOPE-DEEP WATER

General
Economically speaking, this fishery is the most important fishery in the island. Even if its main target species are red shimps (*Aristaeomorpha foliacea* and *Aristeus antennatus*), it also direct to exploite meso-bathial resources such as *Nephrops norvegicus* and epi-meso bathyal resources such as *Parapenaeus longirostris* and *Merluccius merluccius.*
The bottom surface potentially exploited by trawlers is 10,000 km^2. The extension of the trawlable although is very different considering the cost side (42 % on the western side, 23-29% on southern and northern side, less than 10% on the eastern side). As a matter of fact the eastern shelf bottoms are very narrow (700 m within 5 miles boundary).

Fleet
In the GSA 11 the total number of vessels involved in this activity is quite low (39%) in comparison to all the trawlers of the sub-area.

total number	Total tonnage (GRT)	Mean GRT	Mean engine power (HP)
74	5422	73,3	303,6

Their characteristics are very variable according to the geo-morphological characteristics of the exploited areas. Along the Northern and Eastern coasts, boats show smaller length and lower engine power, due to the fishing ground being localised close to the ports.
In the Western and Southern Sardinia, where the shelf is wider, the distance of the fishing grounds, limits this activity to the larger and powerful vessels.
In this fishery, an increasing trend in the number of vessels was observed, as previously described.

Fishing time over a year
This fishery is carried out all round the year, although is mostly concentrated in spring to autumn in consequence of more favourable sea-weather conditions. Due target species change during a single fishing-day it is not easy to quantify the effective time spent on these fishing grounds. The distance of the fishing grounds may produce fishing trips of 2-3 consecutive days, when the vessels also fish during the night (in shallower waters). During hauls target on shrimps, Nephrops and epi-benthic fish assemblages fishing operation duration is about 3-4 hours (towing and hauling not considered). On shallower waters (<250 m) the duration of fishing operation is about 1-2 hours. Fishing days over a year are about 150-160.

Fishing equipment
The trawl net generally used by the fishery is the tartana ("fondale" net, "mezzo fondale" net) The cod-end mesh size of the nets utilised in this fishery is in general 35-40 mm.

Deck layout and machinery involved
The dimensions of the boats allow the use of net drums and more powerful trawl winch. No changes neither in the gear characteristics nor in the time spent to fishing were observed in the last years.

Electronic equipment
All vessels utilise GPS, color Echosounder, plotter and computerised geographic charts.

Data on catch
During the day the target is represented by red shrimps, *Aristeus antennatus* and *Aristaemorpha foliacea* fished at level of 550-700 m. In these deep strata catch compositions are represented by percentages of about 60 %, 15-20 % and 20-25 % for fishes, cephalopods and crustaceans respectively. At this depth the highest either in biomass or densities of animals are found. The by catch is mainly composed of selachians (*Galeus melastomus*, *Etmopterus spinax* and *Scyliorhynus canicula*), teleosts (*Phycis blennoides*, *L. piscatorius*, Macruridae, Merluccius merluccius and *Helicolenus dactylopterus*) and another crustacean appreciated on fish markets, *Plesionika martia.* Most of the fully discarded species are selachians (most of *Galeus melastomus* specimens, *Etmopterus spinax*, etc.) or crustaceans (*Liocarcinus depurator*, *Macropipus tuberculatus*, *Munida* spp.) and some fishes such as *Hoplostetus mediterraneus*, Macruridae and grenadiers. Small animals of *Scyliorhynus canicula* are also discarded.
At depth of 300-450 m (target species Norway lobster) the composition of the catches of this fishery is characterised by a high level of multispecificity. By-catch is mainly represented by *Phycis blennoides*, *Todaropsis eblane*, horned octopus, hake, and blue whiting. The fully discarded species are *Galeus melastomus*, *Etmopterus spinax*, *G. argenteus*, *Macroramphosus scolopax*, *Capros aper*, *Hoplostetus mediterraneus*. Commercial species such as *C. Agassizi* and *G. leioglossus* are sorted by length and smaller specimens are discarded at the sea in high numbers.

Interaction with other fisheries
The distance of the fishing grounds limits the interaction with other types of fishery. A spatial interaction, exclusively in the summer season, may occurs with the pelagic long lines targeting swordfish.

Special features

Relationships between fishing effort, fishing mortality and catch rates
The highest catch rates observed for red shrimps in summer could be related to important biological phenomena including reproduction and recruitment which occur mainly in this period. Moreover the different availability on the fishing grounds should is related to the season with higher abundance from winter to spring on deeper bottoms. During summer-autumn periods this species moves on shallower depths (about 500m) (Cau et al., 1998).
Because in Sardinia red shrimps fishing grounds are located 10-20 miles offshore, catches related to this activity are strongly influenced by weather conditions, especially on western, southern and northern areas.

GSA 16 - STRAIT OF SICILY

General

The fleet operating in the Strait of Sicily consists of about 350 only monolicensed vessels vs multipurpose trawlers, with an overall GRT amounting to 27100 and a total power of 94496 kW, based in Sicilian harbours (*IREPA source*).

The Sicilian trawlers, operating mainly on a short-distance trawl fishery, are based in seven main port (Mazara del Vallo, Sciacca, Porto Empedocle, Licata, Gela, Scoglitti, Pozzallo) along the southern Sicilian coasts. Excluding the Mazara fleet, trawlers usually perform daily trips, starting in early morning and coming back in the afternoon. Normally they carry out two 4-5 hour hauls per day. Mazara del Vallo represents the main commercial fleet of trawlers of the area and one of the most important of the Mediterranean, with 147 trawlers, having an overall GRT amounting to 20211 and a total power of 59970 kW (*IREPA source*). Differently from the other Sicilian fleets, about the 80% of the Mazara trawlers, the largest ones, usually are employed on long fishing trips (15 – 25 days) mainly in international waters of the Strait of Sicily, operate both on the continental shelf and on deep bottoms (down to 700 – 800 m depth). The remainder of the Mazara fleet is comprised of small trawlers that are used on short fishing trips (4 – 5 days) mainly on the continental shelf (*Anon., 2000*).

Main fisheries in the Strait of Sicily

Considering the Sicilian fleet, two main types of trawling fisheries could be identified:

- the inshore trawling, operating closely to Sicilian coast, including the whole fleet of Sciacca, Porto Empedocle, Licata, Gela , Scoglitti e Pozzallo and about the 25% of the Mazara del Vallo trawlers. This fishery is a typical mixed species Mediterranean;
- the distant trawling which is formed by the most of Mazara del Vallo fleet, operating in a wider area. This fishery is targeted, according to areas and season, to three key species (*P. longirostris, A. foliacea* and *Mullus* sp.)

The gear typology and the main target species are reported in the following table.

a) Gear typology and main target species in trawling fisheries in the Strait of Sicily

Fisheries	Gear type	Main target	Secondary target
Inshore trawling	Traditional Banco net	*Mullus sp., Merluccius merluccius, Pagellus* sp., *Uranoscopus scaber, Trachinus sp., Octopus vulgaris, Sepia officinalis, Eledone* sp., *Lophius* sp., *Parapenaeus longirostris, Nephrops norvegicus, Illex coindetii, Todaropsis eblanae,., Zeus faber, Raja* sp.	
Distant trawling		*Mullus sp. (mainly M. surmuletus)*	*Merluccius merluccius, Pagellus* sp., *Uranoscopus scaber, Raja* sp., *Trachinus sp., Octopus vulgaris, Sepia officinalis, Eledone* sp., *Lophius* sp.,.
	Traditional Fondale net	*Parapenaeus longirostris*	*Nephrops norvegicus, Merluccius merluccius, Eledone* sp., *Illex coindetii, Todaropsis eblanae, Lophius* sp., *Mullus* sp., *Pagellus* sp., *Zeus faber, Raja* sp.
		Aristaeomorpha foliacea	*Nephrops norvegicus, Merluccius merluccius, Todarodes sagittatus, Lophius* sp., *Helicolenus dactylopterus, Phicys blennoides, Raja* sp.

FISHERY 1 -INSHORE FISHERY

Fishing grounds
The fishing areas of the inshore trawling are placed inside GSA 16.

Fleet characteristics
The main indicators of trawling fleet capacity of inshore fishery (2002) are reported in the following table (*IREPA source*). This amount must be added by about 34 small trawlers, based in Mazara del Vallo harbour, whose mean characteristics are similar to those of the other port. Hence the overall capacity of inshore trawling could be estimated in about 240 boats, having a total GRT of 7850 and 40200 kW.

The main indicators of trawling fleet capacity of inshore fishery by harbor (*IREPA source*).

Harbor	Number	GRT	kW	MEAN GRT	MEAN kW
Sciacca	77	3296	13540	43	176
P.Empedocle	38	1467	6915	39	182
Licata	59	1259	8536	21	145
Gela	1	20	162	20	162
Scoglitti	25	794	4964	32	199
Pozzallo	3	54	409	18	136

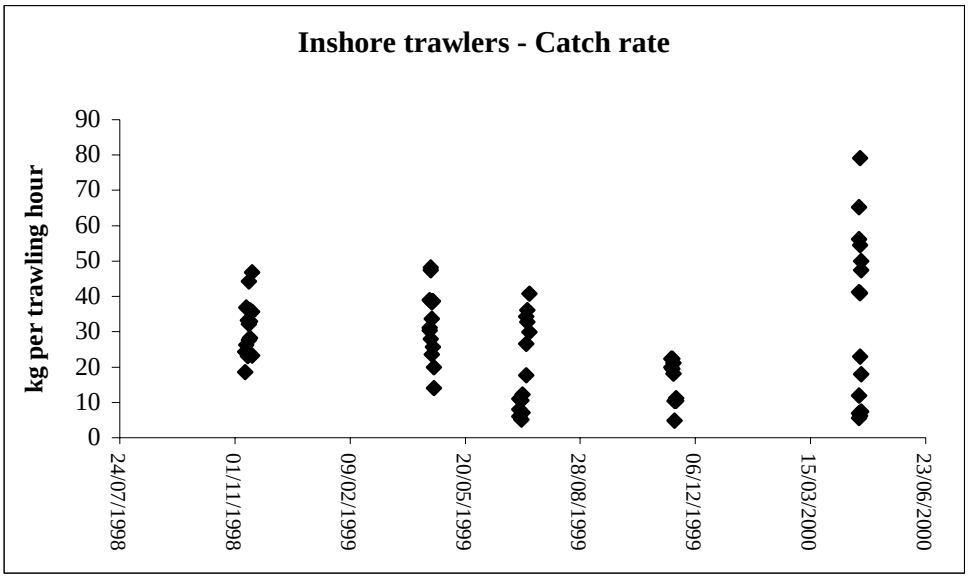
Fishing time over a year
The time spent fishing in a year is generally 180 days**.**

Fishing equipment
The traditional Italian trawl net, characterized by low vertical opening and having about 30 – 40 mm mesh size opening in the cod end, is mostly used in the inshore trawling.

Deck layout
Deck layout consists of a trawl winch put in the stern area. A net drum is generally also installed.

electronic equipment
The boats are equipped with the most common apparatus for fishing activity.

Data on catch
No recent information on catch rate of commercial trawling of main harbour in the Strait of Sicily are available. However this information could be derived from Porto Palo trawlers, which partially exploits the eastern sector of GSA 16 (Anon., 2000).



Catch rate of inshore trawling derived from Porto Palo trawlers.

According to Anon. (2000), the average discarded fraction ranged between 15 and 24 %, being 18% as yearly average.
A knowledge on mean size of the discarded fraction and landings of target species in typical inshore fisheries could be derived from the following table.

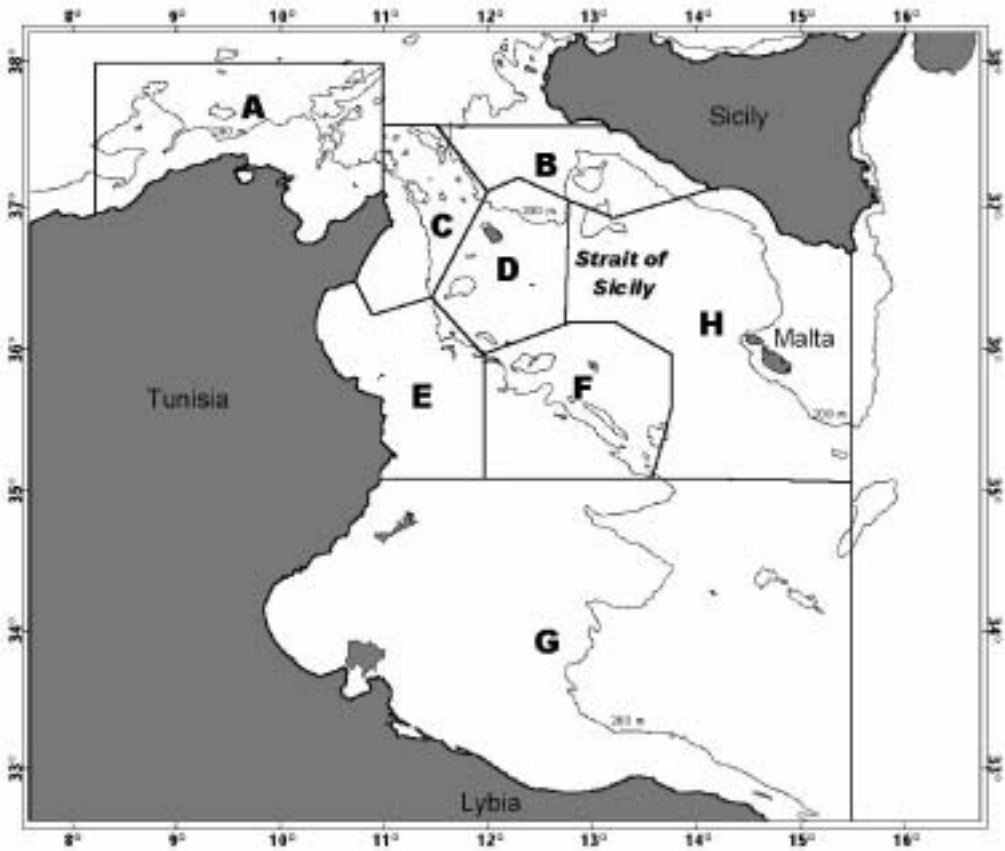
Yearly modal length (fish in cm TL; crustaceans in mm CL) of discarded fraction and landings of typical inshore (Porto Palo-South Eastern Sicily) *(from Anon., 2000).*

Species	Inshore fisheries	
	Modal length of discard	Modal length of landing
M. merluccius	9	20
M.barbatus	12	18-19
M. surmuletus	9	18
P. erythrinus	8 and 12	15-17
P. longirostris	12	16 and 19

FISHERY 3 - DISTANT WATER FISHERY

Fishing grounds.

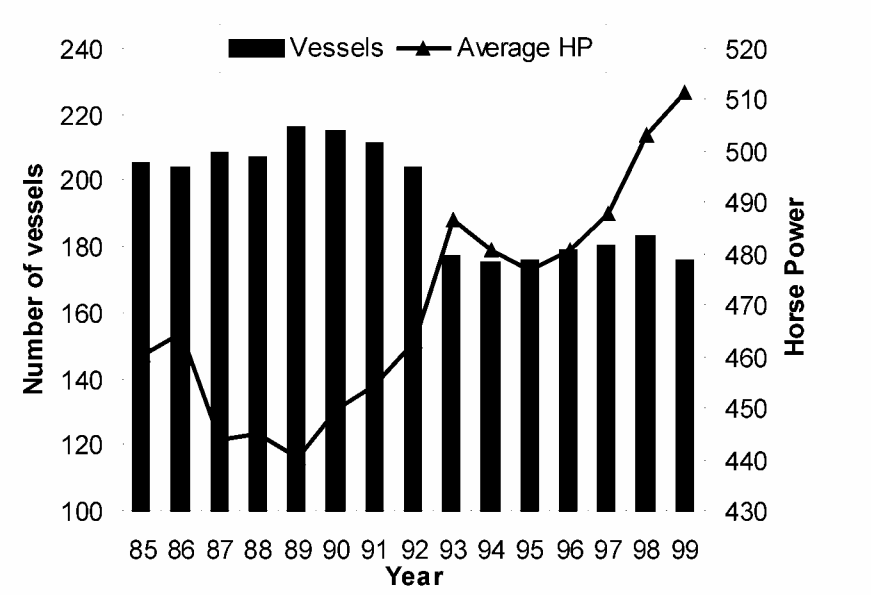
The fishing areas exploited by the distant fishery, include portion of all the GSA, in which the Strait of Sicily is divided (GSA 12, 13, 14, 15, 16 and 21).



Main fishing areas of Mazara del Vallo distant trawlers in the Strait of Sicily

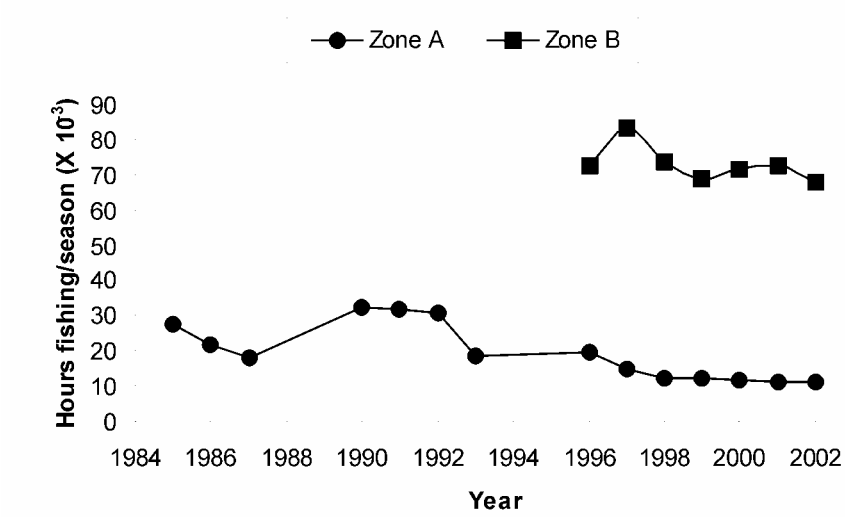
Fleet

Although an overall reduction of fishing capacity of the Mazara del Vallo fleet in terms of number of trawlers was occurring since late eighties-early nineties, a constant increase in the mean engine power and GRT is reported. At present, the distant fisheries fleet exploiting the Strait of Sicily bottoms amounts to about 115 trawlers, being about 140 GRT and equipped with engine of a mean power of 410 kW



Capacity parameters of Mazara del Vallo trawlers (*from Garofalo et al., in press*).

The Mazara del Vallo fleet has developed towards large vessels that can operate in the distant waters where the demersal resources are still economically advantageous. An example of the different level of fishing effort of the distant fleet in two selected areas of the Strait is given below.



Time series of fishing effort per season in two selected areas of the Strait of Sicily. Zone A (Adventure Bank) close to the Sicilian coast and zone B, near the African coast (Area G – Fondaletto-Curva) (*from Garofalo et al., in press*).

Fishing time

Main information and fishery features by fishing-grounds of distant trawlers in the Strait of Sicily are reported below.

Main fishing-grounds and fishery features of distant trawlers in the Strait of Sicily

Areas	Target species	Seasons	Gear	Depth range	Haul Length	hauls per day
A +C (Ponente)	*P. longirostris, A. foliacea, N. norvegicus, M. merluccius*	All about the year	"fondale " trawl net	250-750 m	250-500: 3-4 h (day) and 5-6 h night; 500-750: 4 h	250-500: 4-5(day)+ 1 (night) ; 500-750: up to 5 during 24 h
C+D+E (Kelibia)	*P. longirostris, M. merluccius, N. norvegicus*	All about the year, with a peak in spring	"fondale " trawl net	200-500 m	250-500: 3-4 h (day) and 5-6 h night	250-500: 4-5(day)+ 1 (night) ;
D (Pantelleria)	*A. foliacea, N. norvegicus*	Mainly in Winter-Spring	"fondale " trawl net	400-750 m	4-5 h	up to 4 during 24 h
E+G (shelf)	*M. surmuletus; P. erythrinus*	Mainly in Autumn	"banco" trawl net	< 100 m	About 1 h	12-15 hauls
F (Greco Linosa)	*A. foliacea, N. norvegicus*	Mainly in Winter-Spring	"fondale " trawl net	400-750 m	4-5 h	up to 4 during 24 h
G (Fondaletto-Curva)	*P. longirostris, M. merluccius, Mullus sp.*	All about the year	"fondale " trawl net	200-500 m	3-4 h (day) and 5-6 h (nigth)	up to 4 during 24 h
G (Deserto)	*A. foliacea, N. norvegicus*	Mainly in Winter-Spring	"fondale " trawl net	400-750 m	4-5 h	up to 4 during 24 h

Although a reduction in fishing capacity of Sicilian trawl is occurring since the eighties, the technological creep in nautical and fishing equipment is expected increasing the trawling efficiency. A description of main technical improvement and corresponding effects on stocks dynamics are reported below.

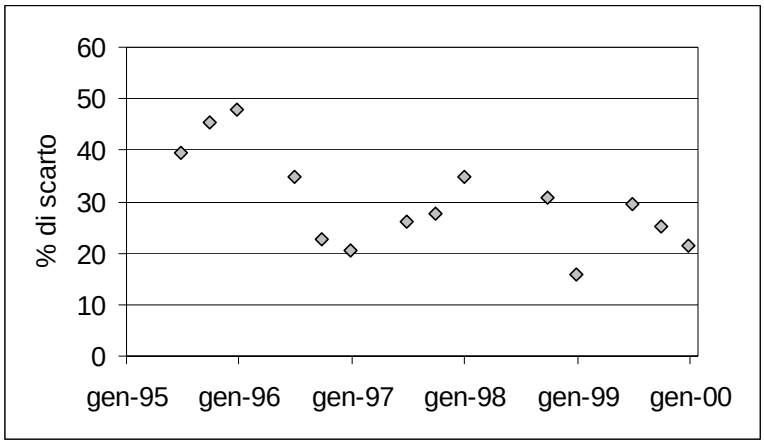
Main technological creep in the Mazara del Vallo fleet and expected effects on stocks

Creep	Year	Expected technological consequence	Expected Effect on stock
Polyvalent otter board	Late eighties – early nineties	Highest trawling speed	Increased catchability
Automatic pilot	Late eighties – early nineties	More efficient navigation	No evident effect
Bridle drum	Late eighties – early nineties	More hauls per day	Increased fishing mortality
Engine	Late eighties	More powerful engines	Increased catchability
GPS	Middle nineties	More precise positioning	Increased fishing mortality
Computerised nautical chart	Middle nineties	More precise positioning	Increased fishing mortality
Larger trawl net	Late eighties – early nineties	Increase of swept area	Increased fishing mortality

Data on catch

The total catch can vary over a wide range throughout the seasons investigated, probably due to the competence of the captains, to the fishing area and to the characteristics of the boat

employed for sampling. The average of the total catch per season does not show apparent variations, ranging between 37.3 Kg/h during the summer 1999 and 40.5 Kg/h during winter 2000. According to Ragonese et al. (2001), the mean catch rate of the red shrimp fishery was about 23 kg/h in spring-summer 1993. The catch is composed by *A. foliacea* (35%), bony fish (35%, being *P.blennoides* and *M.merluccius* the most abundant,) cartilaginous fish (20%, showing *Galeus melastomus* and *Etmopterus spinax* the highest presence), other crustaceans (8%, the most of fraction formed by *A.antennatus* and *N.norvegicus*) and cephalopods (2%, being *Todarodes sagittatus* the most abundant).
The percentage of the discarded catch, combining both "banco" and "fondale" distant trawling, presented great variability, ranging between a minimum of 6% during summer 1999 and a maximum of 72% during winter 2000. The development of mean value of discarded fraction, showed an evident decrease over time.



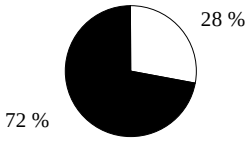
Time series of percentage of discarded fraction of catch in distant trawling *(unpublished data).*

Information on the mean size of the discarded fraction and landings of species of commercial value of Mazara del Vallo distant trawling fisheries is given below.

Merluccius merluccius

SICILY STRAIT

Discard length (TL) = 14,7 cm



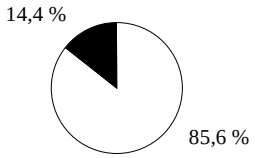
Commercial
Discard

Discard length (TL) = SL50 o
discard mean length

Mullus barbatus

SICILY STRAIT

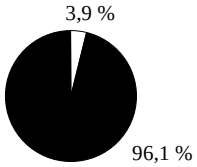
Discard length (TL) = 11,7 cm



Trachurus trachurus

SICILY STRAIT

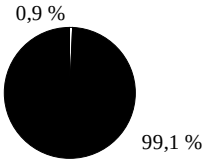
Discard length (TL) = 30,4 cm



Micromesistius poutassou

SICILY STRAIT

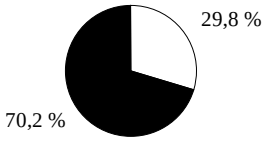
Discard length (TL) undeterminable



Pagellus erythrinus

SICILY STRAIT

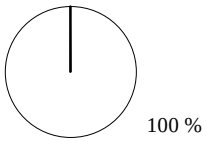
Discard length (TL) = 15,1 cm



Aristeomorpha foliacea
Nephrops norvegicus

SICILY STRAIT

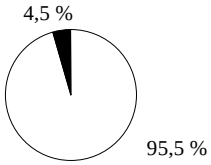
No discard



Parapenaeus longirostris

STRAIT OF SICILY

Discard length (CL) = 13,6 mm



It is worth noting that a decrease of the fraction of hake longest than 30 cm TL in the samples by trawling is evident from the seventies up today. Furthermore a different ratio of large/small hake is evident if the GSA 16 is compared with the more distant fishing-grounds of international waters (GSA 12,13, 14, 15 and 21), being the large fish more abundant in the latter.

Interactions with other fisheries

No evident interactions amongst fisheries are known, since only few artisanal boats exploit the untrawlable rocky bottoms in the offshore banks.

GSA 17 - NORTHERN AND CENTRAL ADRIATIC

FISHERY 1– CONTINENTAL SHELF

General

The Adriatic is a semi-enclosed basin characterised by the largest shelf area of the Mediterranean which extends over the Northern and Central Adriatic. Northern Adriatic is shallower, with depth no more than 75-80 metres, while in the Central Adriatic a maximum depth of 260 metres is reached in the Pomo/Jabuka pit. The whole Northern and Central Adriatic can be considered shelf areas and this fact gives reason for the development of an important bottom trawl fishery. Moreover bottom sediments in this area ranges from muddy to muddy-sandy to sandy, this allows the presence of different bottom fish assemblages. The whole Northern and central Adriatic is trawlable and the approximate bottom shelf surface available to the fishery is about 85,000 km^2 but the area where EU fleets can fish is about 55,000 km^2 (International+Italian national waters). This calculation is not taking into account the possibility of the establishment of the mid-line between Italy and Croatia which could substantially reduce the fishing ground for EU fleets.

Fishing grounds

Given the fact that Adriatic is whole suitable to bottom trawling the fishing ground of the individual harbours fleet are delimited by time, technical and economical constraints. Fishing vessels do not generally make long fishing trips, the fish is stored in ice and not frozen, therefore each local fleet tends to exploits fishing ground closer to its harbour. Moreover bottom sediments and benthic fauna change rather abruptly and this require long term skill from skippers which are used to their traditional fishing grounds. In general the area close to western coast is muddy and smoother whilst the area from the middle to the Croatian coast is sandy, with more benthic non commercial macroinvertebrates; the rigging of the bottom trawl shall be varied accordingly. There are also “seasonal” fishing grounds as for instance the Italian coastal area in late summer and autumn, where young of the year of many commercial species concentrate (in particular red mullet *Mullus barbatus*). Or the Pomo/Jabuka Pit area in summer, the season of maximum availability of Norway lobster (*Nephrops norvegicus*) to bottom trawl.

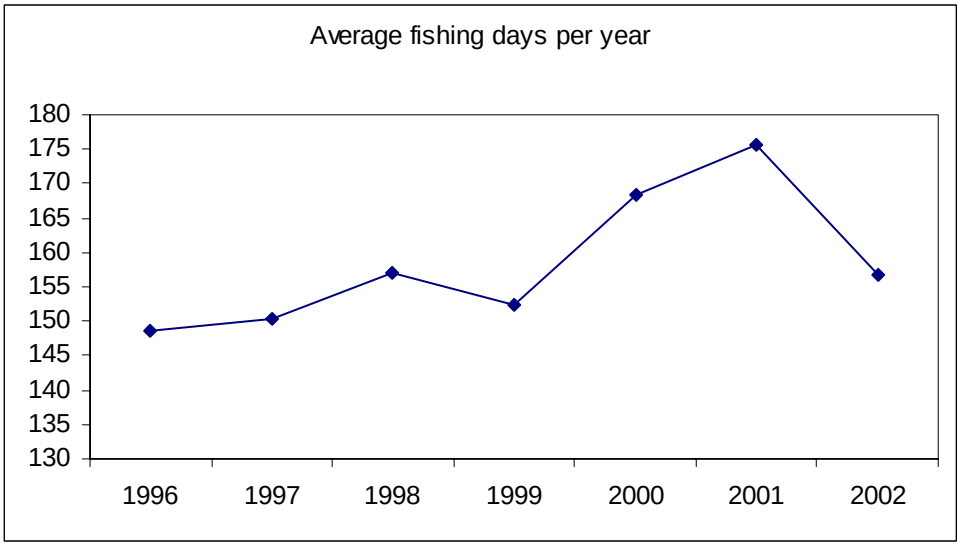
Fleet

Bottom trawling is the most important fishery in GSA 17 and accordingly its fleet is the largest in terms of total GT. The Italian licensing system allows for the presence of “multiple licence” vessels which mostly are bottom trawlers, but this prevents the possibility of a precise census statistics of the bottom trawlers. This problem is currently in the process of being overcome by the enforcement of EU regulation 1543/2000. To give a reasonable number of bottom trawlers and of their characteristic we rely on a survey conducted by UNIMAR in 2000-2001 (*Sassu et al., 2002*) which divided the fleet by gear predominantly used, and by data provided by IREPA (2003) which gives also main technical characteristics of the bottom trawlers. Bottom trawlers in Northern and Central Adriatic should be about 1200 for the Italian fleet and, to this number, at least another 400-500 boats from Croatia, exploiting the same stocks should be added (Dragic, 1992). Size of the vessels of the Italian fleet is very variable and ranges from less than 10 GRT to more than 100 GRT. The average is 35 GRT but in Central Adriatic bottom trawlers are larger (about 45 GRT on average) than in the Northern part (about 20 GRT on average). This is obviously reflected in engine powers, where the same decreasing South to North trend exists with an overall average of 220 kW.

Fishing time over a year

Fishing is carried out 5 days a week, all about the year. There is usually an interruption of

about 45 days in summer due to a seasonal ban of trawling activities. The average number of fishing days per year is 158 (IREPA 2003) and the trend over the period 1997-2002 is slightly increasing (fig. 1), although this could be partly due to the fact that in 1999 the fishing activities were stopped for more time due to the war in Bosnia.

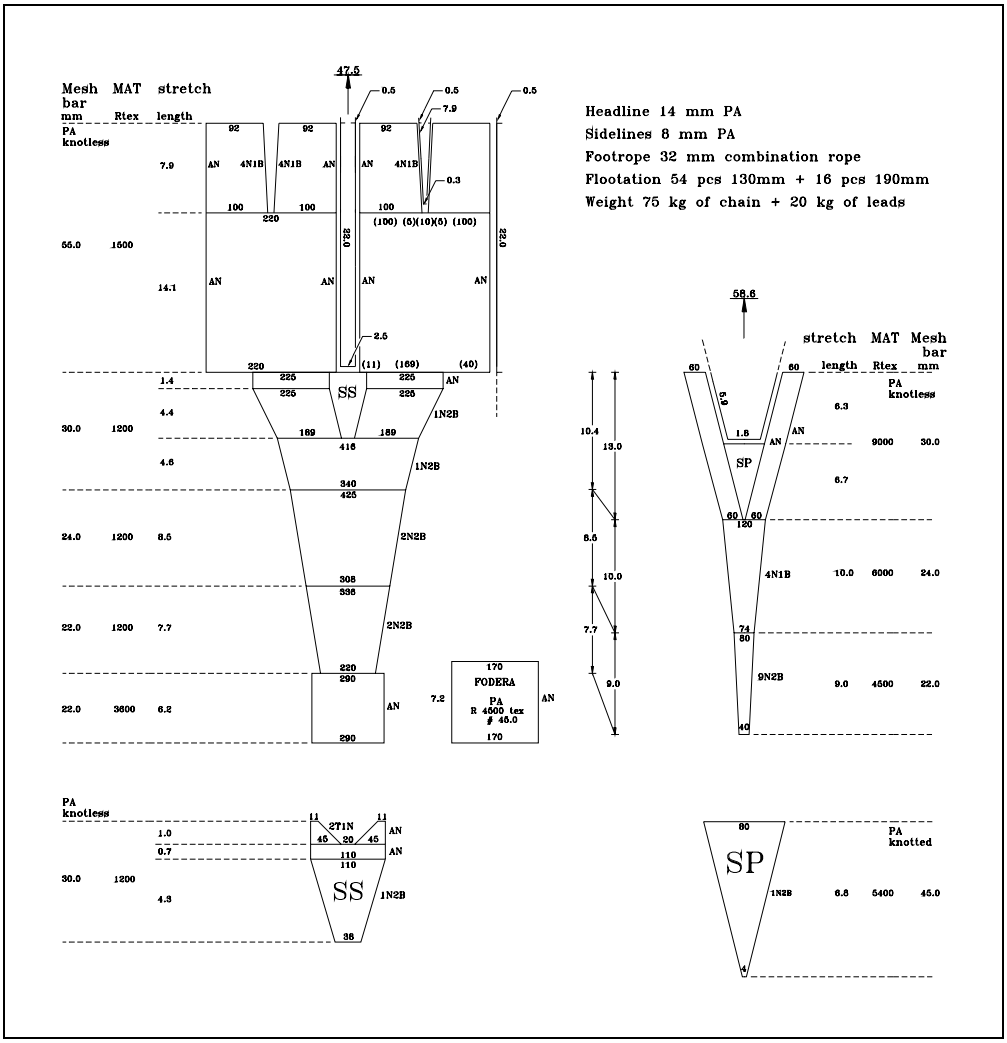


Average number of fishing days per year in bottom trawl fishery in Northern and Central Adriatic (*from IREPA data*).

More difficult is to discuss long term changes in fishing time over a year, also because the fishing day can be defined as a 24 hours period where the fleet fish at night (most of the Central Adriatic) or a 12 hours period where the fleet fish only by daytime as in many fishing harbours of the Northern Adriatic. Moreover this habits has changed significantly over the last 50 years (Arneri and Piccinetti, 1988).

Fishing equipment

The bottom trawl net usually used is the "tartana" and is characterised by a 15-20 m horizontal opening and a 0.8-1 m vertical opening. Adriatic bottom trawl nets are made most of knotless polyamide with other materials, such as knotted polyester, sometimes used for wings or belly sections. In the recent years some fleets are adopting a slightly different bottom trawl where the final part of the wings is split in two to provide a higher vertical opening (1.4-1.7 m). The legal mesh size at the cod-end is 40 mm stretched (±10%). Otter doors once wooden are now progressively being replaced by oval and V shaped steel otter doors.



Example of the new high opening version of bottom trawl used in Central Adriatic (*Fiorentini et* al., *1999*). ***Main characteristics for a boat of 500 HP : headline 47.5 m, footrope 58.6 m.***

Deck layout and machinery involved

The use of hydraulic net drums is spreading, in addition to the always present drums for bridles and warps. Net is always shot and hauled in from stern. Nearly all the vessels have a refrigerator and some have an ice-making machine.

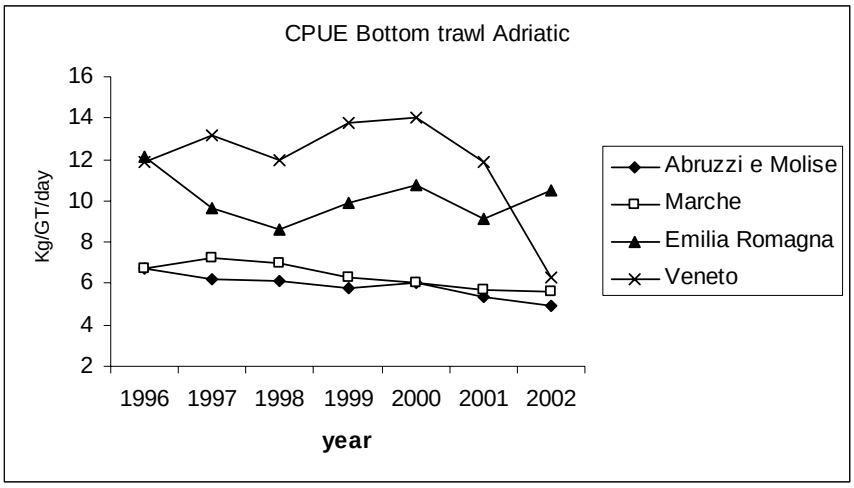
Electronic equipment

Radar and echo sounder are always present. The use of GPS is also very developed, sometimes in connection with plotters and computerised charting. This has allowed a better localization of bottom obstacles to trawling and therefore slightly increased the available fishable area and probably the fishing mortality.

Data on catch

Official catch statistics do not separate catches by gear therefore it is not possible to separate catches from bottom trawlers. This is further made difficult by the above mentioned problem of the multiple licence vessels. Data by species and by gear will be available with the EU regulation 1543/2000. As a general information it can be safely said that some important species in this area are caught mainly if not exclusively by bottom trawling. For instance hake (2100 tons landed in 1999, official data); red mullet (2900 tons landed in 1999), most cephalopods (5000 tons landed in 1999); Norway lobster (1000 tons in 1999) and mantis shrimp (3500 tons in 1999). IREPA reports a figure of 27000 tons of landings (all species)

from bottom trawlers in 2002, this figure does not include the polyvalent vessels but includes beam trawlers. CPUE (all species) trends in the last 7 years show a slightly decreasing trend for 5 Italian regions of GSA 17. Data for Friuli Venezia Giulia are not given but its fleet is substantially smaller than the others.



Trends in CPUE for all demersal species (*IREPA 2003****). Values are expressed in Kg/(GRTxday)****.***

Interaction with other fisheries

There is an interaction with beam trawl fishery for some species (e.g. cuttlefish, soles mantis shrimp, etc.) which are vulnerable to the two gear. Moreover cuttlefish and mantis shrimp are also targeted by coastal small scale fixed net fisheries. Bottom long line fishery for hake is not very developed in this area so there is no interaction.

Special features

Nothing to mention except that GSA 17 is one area where EU member and non-EU member fleets exploit the same resource, this calls for international coordination at management level.

Relationships between fishing effort, fishing mortality and catch rates

No detailed analytical assessments and effort data are available for demersal resources of this area, therefore it is impossible to quantify the relationship between fishing effort and fishing mortality. Effort and CPUE show both a slightly decreasing trend over the last seven years (IREPA, 2003) but at present no clear conclusion can yet be drawn.

GSA 18 - SOUTHERN ADRIATIC

General

Trawling represents the most important fishing activity in this area. A yearly catch of about 30,000 tons could be estimated for the last decade (ISTAT, 1997). Demersal species catches are landed on the Western side (Italian coast) and the Eastern side (Albanian coast), with an approximate percentage of 97% and 3% respectively (*Mannini and Massa*, 2000). Trawling is targeting a species pool (more than thirty commercial species), the European hake (*Merluccius merluccius*) contributing for 20% (approx.) of the total catches while Norway lobster (*N. norvegicus*), deep-water rose shrimp (*P. longirostris*), red mullet (*M. barbatus*), horse mackerels (*Trachurus* spp.) and octopuses (mostly *Eledone* spp) 5-10% each (*Ungaro et al.*, 2002).

Demersal species contributing to the commercial trawl catches in GSA 18

Alloteuthis spp.	Little squid
Aristaeomorpha foliacea	Red shrimp
Arnoglossus spp.	Scaldfish nei
Boops boops	Bogue
Cepola macrophthalma	Red bandfish
Conger conger	Conger eel
Dentex dentex	Common dentex
Dicentrarchus labrax	European seabass
Diplodus spp.	Seabream nei
Eledone spp.	Horned and musky octopus
Octopus spp.	Octopuses nei
Helicolenus dactylopterus	Blue mouth scorpion fish
Illex spp., Todaropsis spp.	Shortfin squid, flying squid nei
Lepidopus caudatus	Silver scabbardfish
Lepidorhombus spp.	Megrim nei
Loligo spp.	Inshore squid nei
Lophius spp.	Anglerfish nei
Merluccius merluccius	European hake
Micromesistious poutassou	Blue whiting
Mullus barbatus	Red mullet
Mullus surmuletus	Striped mullet
Mustelus ssp.	Dogfish sharks nei
Nephrops norvegicus	Norway lobster
Pagellus spp.	Porgies, seabreams nei
Parapenaeus longirostris	Deep water pink shirmp
Penaeus,Plesionika,Solenocera spp.	Shrimps and Prawns nei
Phycis blennoides	Greater forkbeard
Raja spp.	Rays nei
Scomber japonicus	Chub mackerel
Scomber scombrus	Mackerel
Scorpaena spp.	Scorpionfish nei
Scyliorhinus spp.	Catsharks nei
Sepia officinalis	Cuttle fish
Sepiola spp., Seppietta spp., Sepia spp.	Lesser cuttlefish, Cuttle fish nei
Serranus Spp.	Combers nei
Solea spp.	Soles nei
Solea vulgaris	Common sole
Spaurus aurata	Gilthead seabream
Spicara spp.	Picarels nei
Squalus spp.	Spurdogs nei
Squilla mantis	Mantis squillid
Trachinus spp.	Weevers nei
Trachurus spp.	Jack and horse mackerels
Trigla,Eutrigla spp.	Gurnards, searobins nei
Trisopterus minutus capelanus	Poor cod
Umbrina cirrosa	Shi drum
Uranoscopus scaber	Stargazer
Zeus faber	John dory

The bottom surface potentially exploited by trawlers is 15,000-17,000 km^2 (70% on the Western side, 30% on the Eastern side). The extension of the trawlable area follows a latitudinal gradient, increasing from the South to the North of the basin.

Demersal resources are exploited by both Italian and Albanian fishery fleets, which often operate on the same stocks (shared stocks) and fishing grounds.

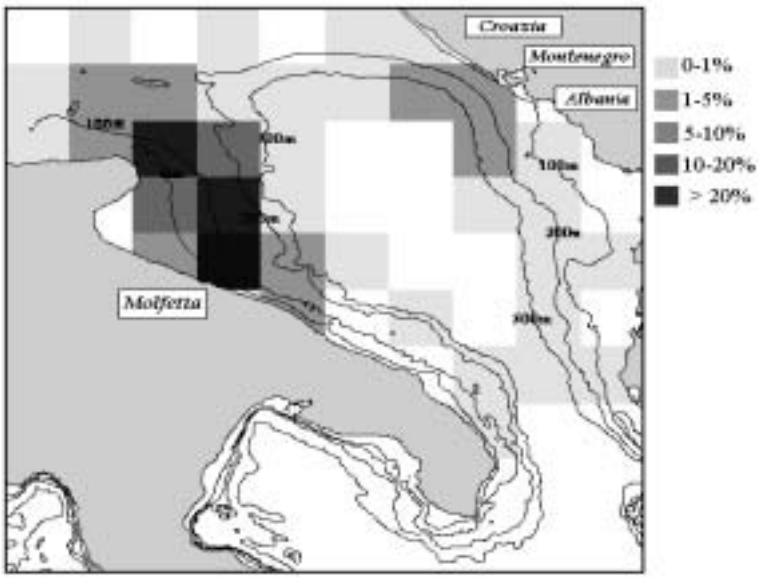
Bottom trawling is carried out almost exclusively by means of the traditional “Italian” trawl net.

Bottom trawling targeting deep-sea red shrimp isn't carried out because of the lack (or scarcity) of the resource due to the geo-morphologic and environmental features of the basin (*Marano et al., 1998*).

FISHERY 1: BOTTOM TRAWL MIXED FISHERY (SHELF-SLOPE)

Fishing grounds

Bottom trawl exploit most of the accessible bottoms in the GSA 18 mostly up to 400 m depths. An example referred to the distribution of fishing grounds exploited by Molfetta's trawl fishery fleet is reported.



Distribution of fishing effort in the GSA 18 from Molfetta's trawl fishery fleet (*from Ungaro et al., 2002*).

Fleet

This area is exploited by 500-600 Italian vessels (including multipurpose units) and 100-120 Albanian vessels (*IREPA 1996-2002 data source; Negroni, 2001; Albania Fishery Directorate and FAO-AdriaMed, unpublished*).

The Italian departments belonging to this area are: Manfredonia, Molfetta, Bari and Brindisi. With respect to the Italian South Adriatic trawl fleet, Manfredonia roughly represents 45% in number and 35% in GRT, Molfetta 30% and 40%, Bari 20% and 20%, Brindisi 5% and 5%. The numerical abundance of the Italian trawl fleet in the GSA 18 remained quite stable in the last twenty years (or decreased slightly) while Albanian fleet increased.

The rough estimation of mean GRT, length and engine power for the Italian South Adriatic trawl fleet is 20-25 tons, 16-17 m and 160-170 kW respectively (*IREPA data source*).

Fishing time over a year

Trawl fishery is carried out all along the year. The fishery is operative for 190-200 days each year (*from IREPA*) depending on weather and sea conditions as well as temporal fishing bans.

Fishing equipment

The general information on the characteristic of the trawl net used in the GSA 18 is reported in the following table.

Some features of the trawl net used in the GSA 18 (*example fitted to approx. 250 kW powered vessel*)

WARP Diameter (mm)		12
DOORS	Type 1	Rectangular (wood made)
	Type 2	Oval (steel made)
	Approx. measures (cm x cm)	155 x 135
	Approx. weight (kg)	130
BRIDLE	Materials	Mixed rope
	Diameter (mm)	34
	Length (m)	200
BIG DIAM. BRIDLE (RESTONE)	Diameter (mm)	50
	Length (m)	40
CHAIN (LIBANI)	Diameter (mm)	10
	Length (m)	10
HEADROPE	Material	Polyamides
	Diameter (mm)	12
	Length (m)	42
FLOATS	Diameter (mm)	100
	Number	20
FOOTROPE	Material	Mixed rope
	Diameter (mm)	34
	Length (m)	53
	WEIGHT (kg)	45

The mesh size (stretched) at the cod-end is 40 mm +/- 10%. Diamond meshes are used.

Deck layout and machinery involved

With regard to the changes in machinery occurred in the last 10 years, an increasing use of steel-made doors as well as of net drums has been detected. No significant changes occurred regarding the measures of the nets and the swept areas.

Electronic equipment

The increasing use of GPS didn't produce remarkable modification in the distribution and availability of fishing grounds in the last 10 years.

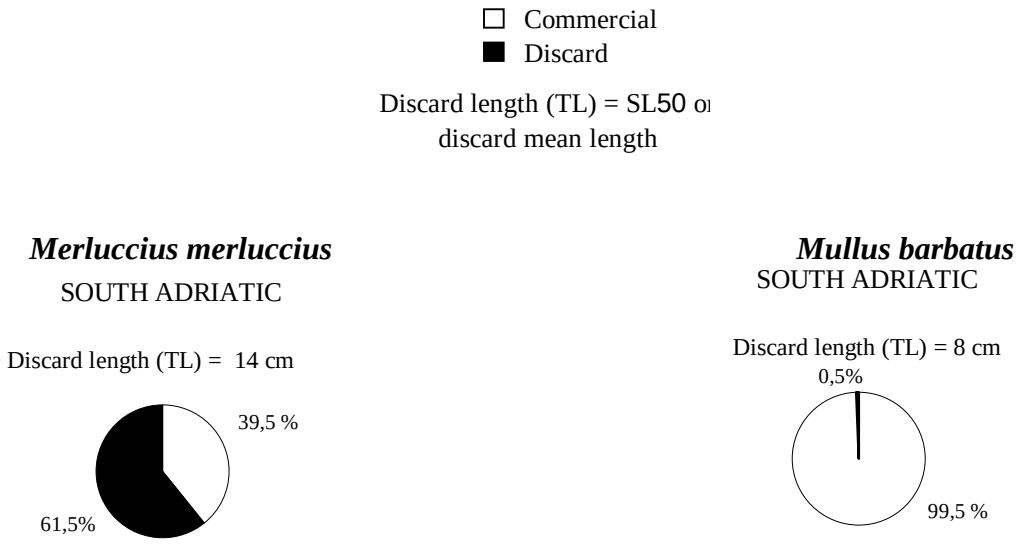
Data on catch

The commercial catches in the GSA 18 are characterised by a large number of species but the first ten "top species" account for more than 70 % of total quantities.

Relative importance (%) of demersal species in the catches by Molfetta's trawling fleet *(from Ungaro et al., 2002*).

Merluccius merluccius	21,4	*Lepidopus caudatus*	0,4
Nephrops norvegicus	9,9	*Helicolenus dactylopterus*	0,4
Trachurus spp.	8,4	*Loligo spp.*	0,3
Eledone spp.	8,0	*Liocarcinus spp.*	0,3
Mullus barbatus	7,7	*Argentina sphyraena*	0,3
Parapenaeus longirostris	4,9	*Scorpaena spp.*	0,3
Scomber scombrus	4,3	*Sepiola spp., Seppietta spp., Sepia spp.*	0,2
Sepia officinalis	3,3	*Cepola macrophthalma*	0,2
Lophius spp.	3,3	*Uranoscopus scaber*	0,2
Scomber japonicus	3,1	*Pagellus spp.*	0,1
Illex spp., Todaropsis spp.	2,7	*Zeus faber*	0,1
Triglidae	2,4	*Serranus Spp.*	0,1
Squilla mantis	1,9	*Galeus melastomus*	0,1
Conger conger	1,8	*Scyliorhinus spp.*	0,1
Micromesistious poutassou	1,8	*Mustelus spp.*	0,1
Boops boops	1,7	*Mullus surmuletus*	0,1
Octopus vulgaris	1,2	*Penaeus kerathurus*	0,1
Phycis blennoides	1,1	*Spicara spp.*	0,1
Octopus salutii	1,0	*Solea spp.*	0,0
Arnoglossus spp.	1,0	*Aristaeomorpha foliacea*	0,0
Trisopterus minutus capelanus	1,0	*Squalus spp.*	0,0
Lepidorhombus spp.	0,9	*Palinurus elephas*	0,0
S.membranacea, Plesionika spp.	0,9	*Centrolophus niger*	0,0
Engraulis encreasicolus	0,6	*Raja spp.*	0,5
Alloteuthis spp.	0,5	*Trachinus spp.*	0,5

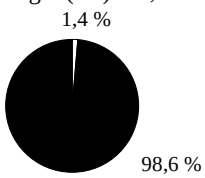
The incidence of discarded species at the sea could be estimated to 10-15% of the total catches from the trawlers. Most of the fully discarded species are selachians (most of *Galeus melastomus* specimens, *Etmopterus spinax*, etc.) or crustaceans (*Liocarcinus depurator, Macropipus tuberculatus, Munida* spp.). Finfish as *Macroramphosus scolopax, Capros aper, Hoplostetus mediterraneus* and grenadiers are discarded at all also. The composition of discard, as well as the catch, is strongly related to the depth-distribution of fish assemblages (*Ungaro et al., 1998; Ungaro et al., 2001*)



Trachurus trachurus

SOUTH ADRIATIC

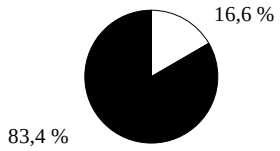
Discard length (TL) = 9,5 cm



Micromesistius poutassou

SOUTH ADRIATIC

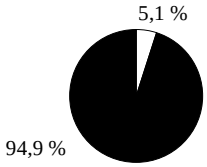
Discard length (TL) = 11,4 cm



Pagellus erythrinus

SOUTH ADRIATIC

Discard length (TL) = 14,2 cm



Aristeomorpha foliacea

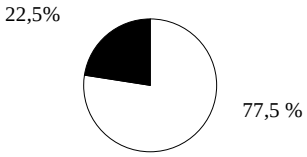
SOUTH ADRIATIC

No catch

Parapenaeus longirostris

SOUTH ADRIATIC

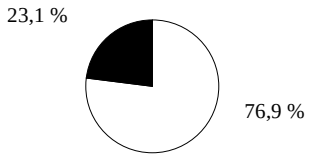
Discard length (CL) = 15,8 mm



Nephrops norvegicus

SOUTH ADRIATIC

Discard length (CL) = 21,1 mm



Commercial species are sorted by length as a rule, thus smaller specimens are discarded at the sea and they aren't landed. With regard to the most important target species, all hake specimens smaller than 10 cm TL are discarded at the sea, and they could represent 5-10% of the total hake catches. Red mullet specimens are discarded at sizes smaller than 70-80 mm TL, mostly during late summer and autumn when the discarded percentage could be high. Deep water rose shrimp is discarded in low quantities at size smaller than 10 mm CL. Norway lobster specimens are rarely discarded (1-2% of the total catch).
The composition of commercial catches from trawl fishery carried out in GSA 18 could be different according to seasonal availability of resource, as it is shown in the example reported in the following figure. Fishing effort spatial distribution is linked to the mentioned availability also (*Ungaro et al.*, 2002).

The available data on up-dated time-trends mostly came from experimental trawl surveys carried out in the western part of the GSA 18. Data for total catches (trawl surveys data) and for the European hake (as the most important target species) are reported.

Technical interaction with other fisheries
The technical interaction of trawl fishery is related to the use of long-lines, and mostly bottom long-lines targeting hake. In fact, some fishing ground are exploited by both the trawl nets and the bottom long-lines although targeted to different fractions of population (hake large individuals for long-lines). Usually long-liners operate when the trawlers don't works (during week-end and/or trawl ban) but sometimes conflicts can grow up.

Special features
No derogation to the current general rules.

Relationship between fishing effort, fishing mortality and catch rates
Trawl fishery in the GSA 18 could affect mortality rates of long-lived species such as the hake mostly on first age cohorts although the catch rates don't highlight significant trends.

GREECE

General

According to the Greek administrative classification criteria in the so-called open sea fishery are included the trawlers and purse seines. These types of fisheries represent 3.5% of the fleet in terms of number of vessels (334 trawlers, 316 purse seines), contribute to the total engine power by 28.2% and have 47.7% of the total tonnage, according to the census of the Ministry of Agriculture. Furthermore, bottom trawlers during the period 1990-2000, fished 18% of the total catch of the Greek fishery (National Statistical Service of Greece, 1990-2000).

Concerning the data about the fleet, the Ministry of Agriculture conducts periodically surveys on specific subjects to cover the service statistical needs in the fields of management and long-term planning of the fisheries policy. In the field of fleet and employment statistics a specific census survey was conducted in 1988. This was an ad-hoc survey that covered all professional fishing vessels under Greek flag, motorised or non-motorised, and collected information on the number, construction characteristics, fishing typology, engine power, tonnage and registration port of vessels and the personnel employed. These data were utilised to construct a national registry of professional fishing vessels, which is updated at regular time intervals by monitoring the constructions, withdrawals and modifications of vessels. The data that are being reported below cover the period until the end of December 2003.

The trawlers fleet of Greece consists of 334 vessel, 215 of them have license for bottom trawling and 119 have licences for bottom trawling and purse seining. We included the later in the trawling fleet because they work almost exclusively with bottom trawl as shown in the data of the National Statistical Service of Greece. They have total engine power of 98,320 kW and total tonnage of 28,203 GT. Their average length is 24.15 m. According to the data of the Ministry of Agriculture, the number of the bottom trawlers decreased from 1991 to 2003 by 18%.

The bottom trawlers in Greece are, more or less, using the same type of traditional Mediterranean trawl. Each skipper, according to his experience and to the specific conditions of the different fishing grounds is modifying slightly the net. For example, while targeting *Nephrops*, they add chains on the foot rope to make the gear heavier, or fishing during the night, they are generally using a smaller, lighter net. Lately, in the Ionian Sea, some fishermen are using a new net with higher vertical opening. Apart from the traditional trawl net described bellow, the last 10-15 years trawl nets from the Western Europe are imported. These trawl nets have not been officially recorded yet.

The traditional trawl net consists of many rectangular pieces of netting with numerous selvages. The length of the gear ranges from 40 m to 80 m with 55 m being the most common. The main sections of the gear are: the bag, the lengthener, the shoulders and the wings.

Bag: It consists of 1-4 pieces of net; its length ranges from 5.4 m to 10.8 m; its width ranges from 300-400 meshes; the mesh size is 40 mm full mesh and the twine thickness ranges from 210/24 to 210/60 Denier. Usually it is covered with a strengthening piece of netting.

Lengthener / Extension piece: It consists of 5-6 pieces of net of 100 meshes wide each; its length ranges from 11 m to 23 m; the mesh size is 36-40 mm full mesh and the twine thickness ranges from 210/15 to 210/45 Denier.

Shoulders: They consist of a triangle located in central and upper part of the panel and 5-7 rectangular pieces of netting (100 meshes wide) equally placed right and left of the triangle. The length of the shoulders ranges from 15 m to 23 m; the mesh size ranges from 28 mm to 48 mm full mesh and the twine thickness ranges from 210/15 to 210/36 Denier.

Wings: They consist of 1-4 pieces of net; their length ranges from 9 m to 22 m; the mesh size ranges from 42 mm to 120 mm full mesh and the twine thickness ranges from 210/18 to 210/45 Denier.

The vertical opening ranges from 0.7 m to 1.5 m, and the horizontal opening ranges from 9 m to 13 m. The circumference of the mouth opening ranges from 47 m to 81 m. The head line is made of PA or MAN ∅ 18 mm–24 mm and the ground rope of PA+FE or PP+FE ∅ 24 mm–60 mm.
The otter boards of the traditional trawl are rectangular and weigh 200 kg to 400 kg depending on their material. In the traditional trawl net, there are no spreading wires; the net is joined directly to the spreaders.
The sweeps are made of PA+FE or MAN+FE; their length is from 180 m to 280 m and their thickness 24-50 mm.
Generally, all the bottom trawl fisheries in Greece are multispecies fisheries. However the main target species or group of species could be defined and is related to the depth, substrate type and time of fishing.
In addition, there are various adaptations to the geomorphology of each area. We could roughly distinguish the following classifications according to the target species or group of target species:

***Mullets*, Sparidae.** This fishery takes place in shallow waters, down to 100 m, should be carried out deeper than 50 m or out of 3 miles from the shore, but very often, it takes place inside of 3 miles or in shallower waters. The main catch is *Mullus barbatus* and species of the Sparidae family (*Pagellus erythrinus, Pagellus acarne*).

Spicara smaris, Loligo vulgaris. This fishery exists in the Ionian Sea and support considerably the income of the bottom trawlers. In many cases is performed illegally and takes place always during the night in shallow waters and frequently inside the limit of the 3 miles.

***Hake*.** This species was the main bottom trawl fishery species but during the last years the stock declined. Fishery takes place at depths 100-300 m on muddy bottoms.

Nephrops and **pink shrimps**. This fishery takes place over muddy bottoms at depths 200-400 m. According to the official data, the *Nephrops* stock declined during the last years (the production decreased by about 80%) but at the same time in the same fishing grounds the production of the pink shrimps increased considerably.

***Deep water red shrimps*.** This fishery has just beginning to develop in Greece. During the last years a sporadic exploitation of waters 400-600 m has started in the Ionian Sea, the Argosaronikos region and in the north of the Crete Island, targeting mainly to *Aristaeomorpha foliacea*.

According to the data of National Statistical Service of Greece, the total catch of bottom trawlers for the most abundant species for the period 1990-2000 (in metric tonnes), and their percentages, are presented in the table below.

The following data cannot be considered as accurate. Documented evaluation of the quality of the data collected by the National Statistical Service of Greece has been done by Anon. (1994).

	1990	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**
Others	10,096	14,773	11,977	11,219	16,688	14,992	15,032	16,518	11,340	9,665	11,609
Merluccius merluccius	2,513	1,928	2,325	2,953	3,647	2,806	2,386	2,111	1,670	1,752	1,839
Trachurus sp.	991	1,529	1,772	1,064	2,709	2,150	2,335	2,207	1,115	752	807
Mullus barbatus	2,010	1,823	1,688	1,635	1,760	1,559	1,553	1,765	1,147	1,031	1,199
Micromesistius poutassou	1,108	1,018	1,322	1,659	1,915	1,798	1,067	1,284	674	509	536
Spicara smaris	1,227	1,439	1,000	690	1,210	641	1,197	1,586	899	692	695
*Shrimps**	1,221	978	1,471	1,306	4,573	1,270	1,899	2,365	1,913	1,492	1,965
Mullus surmuletus	634	542	984	480	1,361	1,109	913	1,011	454	406	352
Eledone sp.	408	390	680	700	1,057	1,321	629	651	645	631	787
Others	50.0	60.5	51.6	51.7	47.8	54.2	55.7	56.0	57.1	57.1	58.7
Merluccius merluccius	12.4	7.9	10.0	13.6	10.4	10.1	8.8	7.2	8.4	10.3	9.3
Trachurus sp.	4.9	6.3	7.6	4.9	7.8	7.8	8.6	7.5	5.6	4.4	4.1
Mullus barbatus	9.9	7.5	7.3	7.5	5.0	5.6	5.8	6.0	5.8	6.1	6.1
Micromesistius poutassou	5.5	4.2	5.7	7.6	5.5	6.5	3.9	4.4	3.4	3.0	2.7
Spicara smaris	6.1	5.9	4.3	3.2	3.5	2.3	4.4	5.4	4.5	4.1	3.5
Shrimps	6.0	4.0	6.3	6.0	13.1	4.6	7.0	8.0	9.6	8.8	9.9
Mullus surmuletus	3.1	2.2	4.2	2.2	3.9	4.0	3.4	3.4	2.3	2.4	1.8
Eledone sp.	2.0	1.6	2.9	3.2	3.0	4.8	2.3	2.2	3.2	3.7	4.0

*(Under the name shrimps are included the species *Penaeus kerathurus* and *Parapenaeus longirostris*).

GSA 20 - EASTERN IONIAN SEA

FISHERY 1 – CONTINENTAL SHELF AND SLOPE

Fleet description

The open sea fishery in the Ionian Sea is mainly concentrated in the port of Patras, the most important fishing market in the Western Greece. From a total of 36 trawlers operating in the area, more than 50% (19 vessels) is registered in Patras and the rest are distributed in several minor ports in the Ionian Sea.

The total engine power is 9,454 kW and the total GT 2,446 with a mean boat length of 22.32 m. In the port of Patras, the registered bottom trawls have total engine power 5,465 kW, total GT 1,269 and average length 22.19 m.

The Ionian Sea fishing vessels usually perform daily trips, starting early in the morning (04:00) and coming back in the afternoon (18:00 or 19:00). However, there are many vessels that work almost 24 hours per day with a short break for landing their catch at nearby ports or perform 2-3 days trips.

Fishing time over a year

The fishery is closed in the entire Greek territory from 1/6 until 30/9 every year. There are some other local restrictions concerning closed gulfs in the area. In Amvrakikos Gulf bottom trawl fishery is prohibited over the year and in Patraikos and Korinthiakos Gulfs, fishery is opening two months later (1/12 instead of 1/10).

Fishing equipment

The net is similar to the traditional Mediterranean bottom trawl. During the last years, some vessels are using nets imported from the Western Europe with higher vertical opening. The mesh size is the legal one (it was 28 mm until recently and following the Council Regulation 1624/94 changed to 40 mm). The vessels carry navigation equipment (Radar), echosounders and hydraulic winches. During the last years, the introduction of plotters offered the skippers the chance to exploit fishing grounds that were rarely exploited before.

Deck layout and machinery involved

The fishing efficiency of the vessels improved during the last 10 years but there are no data to quantify the changes.

Electronic equipments

The use of plotters led to an expansion of the exploited fishing grounds. Tows that were traditionally avoided by the skippers, due to high probability of damaging the net, are now exploited intensively. In addition, new tows have been discovered. However, the size increase of the fishing grounds is unknown.

Data on catch

Time series data concerning the bottom trawl catches of the commercial bottom trawl fisheries in the Ionian Sea are available from the National Statistical Service of Greece, but these data are considered unreliable. Attempt to use the data of the landing port of Patras, as an index of the total catch of the Ionian Sea, in order to determine trends, was unsuccessful. The main reason is that the proportion of the catch that is landed and recorded in Patras is not constant but is affected by many factors (local market demand, prices in other ports, imported fish, etc). Another source of catch statistic data is the national database kept in the Institute of Marine Biology of Crete since 1995.

An analysis of the monthly catch per day data for the period 1995-2000, for trawlers in the Ionian Sea showed a significantly decreasing trend.
Additional available data derive from on board observation on professional vessels, collected during the DISCARDS projects and during a national project for boat seine (Petrakis et al., 2001). The results that are presented below come from the boat seine project and they should be considered as indicative and not as a systematic catch recording, since the space and time coverage of the area was restricted.

Catch, Landings and Discards composition (% by weight)

CATCH		LANDINGS		DISCARDS	
Trachurus trachurus	16.3	*Merluccius merluccius*	22.5	*Trachurus trachurus*	31.1
Lepidopus caudatus	12.4	*Loligo vulgaris*	13.2	*Lepidopus caudatus*	25.3
Merluccius merluccius	11.6	*Mullus barbatus*	11.3	*Sardina pilchardus*	6.5
Loligo vulgaris	6.7	*Parapenaeus longirostris*	8.3	*Spicara flexuosa*	6.2
Mullus barbatus	5.8	*Spicara smaris*	6.6	*Boops boops*	4.6
Boops boops	4.4	*Boops boops*	4.2	*Lepidotrigla cavillone*	2.8
Parapenaeus longirostris	4.3	*Aristaeomorpha foliacea*	3.0	*Argentina sphyraena*	2.7
Spicara smaris	3.9	*Trisopterus minutus capelanus*	2.7	*Spicara maena*	1.7
Sardina pilchardus	3.2	*Trachurus trachurus*	2.2	*Conger conger*	1.4
Others	31.4	*Pagellus erythrinus*	2.0	*Spicara smaris*	1.0
		Lophius budegassa	1.8	Others	16.5
		Others	22.4		

According to the DISCARDS project the mean yield and the relative proportion of marketable and discards fraction in each depth stratum, in different seasons are presented below (Anon., 1997).

Landings and Discards composition (Kg/hour and % by weight)

Season	Depth zone	Marketable		Discarded	
		Kg/hour	%	Kg/hour	%
Summer	0-150 m	22.8	89	2.9	11
	150-300 m	12.2	69	5.5	31
	> 300 m	12.7	53	11.4	47
Autumn	0-150 m	22.9	80.2	6.1	19.8
	150-300 m	16.6	84	3.2	16
	> 300 m				
Winter	0-150 m	14.6	65	7.9	35
	150-300 m	22.5	68	11.6	32
	> 300 m	24.3	22	96.7	78

Technical interactions with other fisheries

There is competition between the trawl and artisanal fisheries for almost all demersal resources.
Illegal bottom trawl fishing close to the coasts or in depths less than 50 m creates conflicts with the small scale fishermen.

Special features

There is problem with the regulation regarding the operating distance from the coast and the isobath of 50 m.

Two of the most important species in this area are *Spicara smaris* and *Loligo vulgaris*. Very often, these species are being fished by trawlers in shallow waters, between 25-40 m. The surveillance of the port authorities was never efficient and the fishermen have been working and still work, illegally. This activity is going to stop when the VMS will start to operate in Greece. In addition, the use of the 40 mesh size will result in loss of the catch of *Spicara smaris*. Probably, the fishing capacity of the trawl fleet will have to be reduced. Socio-economic problems may arise as a consequence and they should be evaluated.

Relationship between fishing effort, fishing mortality and catch rates

No data available

GSA 22 -AEGEAN SEA

FISHERY 1 - CONTINENTAL SHELF AND SLOPE

Fleet

The Aegean Sea is a quite large and very heterogeneous area in terms of geomorphology and consequently in terms of fishing activities. The spatial allocation of the fishing effort and of the catch varies according to the specific features of each sub-area, which define the target species and their abundance. It is difficult to consider the entire area as one management unit, since then the local characteristics would not be taken into account. For example, Thracian Sea (N. Aegean Sea), the most extended continental shelf in Greece with waters affected by the Black Sea and large rivers, is completely different from the Cyclades area or the Argosaronikos Gulf.

Probably, it will be useful to divide the GFCM area in sub-areas taking into consideration the geomorphology, the natural barriers and the specific conditions of exploitation.

According to the census of the Ministry of Agriculture, there are 282 trawlers registered in ports of the area of Aegean Sea, with 87,004 kW total engine power, total tonnage of 24,954 GT and mean boat length of 24.28 m.

The Thracian Sea is the largest trawl fishing ground in Greek waters. The main ports of the area are Kavala and Alexandroupolis and they concentrate the majority of the trawlers that operate in the Thracian Sea (80%). At the port of Kavala 17 trawlers are registered having a 5,625 kW total engine power, total tonnage of 1,266 GT and mean boat length of 24.18 m. At the port of Alexandroupolis 17 trawlers are registered, having a 5,083 kW total engine power, total tonnage of 1,379 GT and mean boat length of 24.46 m.

10-15 more trawlers from other areas, mainly from Thessaloniki, also exploit the Thracian Sea. The trawlers fleet usually perform 2 days trip starting early in the morning (03:00-04:00) and returning the afternoon of the second day (17:00-19:00) restricted by the lack of freezing equipment that could otherwise allow long lasting trips.

In the Cyclades Islands area only 9 trawlers are registered with average length 20.79 m, their total engine power being 2,123 kW and total tonnage 476 GT. However, a significant number of vessels from Piraeus (the major fishing port of Greece with 64 trawlers) and Chalkida (an important fishing port of Euboia Isle with 21 registered trawlers) operate for a substantial time of the year in the Cyclades islands.

The fleet of Piraeus and Aargosaronikos Islands consists of 62 trawlers with 18,917 kW total engine power, total tonnage 5,897 GT and mean boat length 24.69 m.

In the port of Thessaloniki there are 73 registered trawlers with 21,930 kW total engine power, total tonnage 7,697 GT and mean boat length 26.3 m.

The ports of Chalkidiki peninsula have 24 trawlers with 7,875 kW total engine power, total tonnage 1,952 GT and mean boat length 24.74 m.

In the ports of Evia Island, 24 trawlers are registered with 6,959 kW total engine power, total tonnage 1,765 GT and mean boat length 22.63 m.

Fishing time over a year

The fishery is closed in the entire area from 1/6 until 30/9 every year. There are some others local restrictions. For example, in Pagassitikos and S. Euboikos Gulf and in the National Marine Park of Alonnisos Northern Sporades bottom trawl fishery is closed all year about.

Fishing equipment

The net is similar to the traditional Mediterranean bottom trawl. During the last years, some vessels have been using nets imported from the Western Europe with higher vertical opening. The mesh size is the legal one (it was 28 mm until recently and following the Council Regulation 1624/94 increased to 40 mm).

Electronic equipments

The vessels carry navigation equipment (Radar), echosounders and hydraulic winches. During the last years, the introduction of plotters allowed the skippers to exploit fishing grounds that were rarely exploited in the past leading to an expansion of the fishing grounds. Tows that were avoided by the skippers, due to the high risk of damaging the net, are now fished regularly. In addition, new tows have been discovered. However, the increase in the fishing grounds is not quantified.

Data on catch

Time series data concerning the bottom trawl catches of the commercial bottom trawl fisheries in the Aegean Sea are available from the National Statistical Service of Greece but these data are considered unreliable. Another source of catch statistic data is the national database kept in the Institute of Marine Biology of Crete since 1995. An analysis of the monthly catch per day data (1995-2000) for trawlers in the Aegean Sea showed a significantly decreasing trend in the Northern Aegean Sea, which is a main fishing ground. The catch, landings and discards composition of the bottom trawl in the Thracian Sea are shown in the following table (data from on board observation during DISCARDS project).

Catch, Landings and Discards composition (% by weight)

CATCH		LANDINGS		DISCARDS	
Parapenaeus longirostris	17.8	*Parapenaeus longirostris*	25.3	*Serranus hepatus*	8.6
Merluccius merluccius	17.1	*Merluccius merluccius*	23.6	*Trachurus trachurus*	8.0
Mullus barbatus	7.3	*Mullus barbatus*	11.4	*Merluccius merluccius*	5.8
Trachurus trachurus	3.6	*Eledone cirrhosa*	4.2	*Engraulis encrasicholus*	4.9
Serranus hepatus	3.1	*Lophius budegassa*	3.6	*Parapenaeus longirostris*	4.7
Eledone cirrhosa	2.7	*Raja clavata*	3.4	*Trachurus mediterraneus*	4.2
Lophius budegassa	2.6	*Octopus vulgaris*	2.8	*Sardina pilchardus*	3.6
Scyliorhinus canicula	2.5	*Illex coindetii*	2.3	*Scyliorhinus canicula*	3.5
Raja clavata	2.2	*Scyliorhinus canicula*	1.9	*Citharus linguatula*	3.1
Engraulis encrasicholus	1.8	*Nephrops norvegicus*	1.3	*Cepola rubescens*	2.4
Others	39.4	Others	20.1	Others	51.1

According to the DISCARDS project the mean yield and the relative proportion of marketable and discards fraction in each depth stratum, in different seasons are presented below (Anon., 1997).

Area	Season	Depth zone	Marketable		Discarded	
			Kg/hour	%	Kg/hour	%
Thracian	Summer	0-150 m	34.9	26	101.3	74
	Autumn		55.7	51	54.3	49
	Winter		26.4	49	27.1	51
Cyclades	Summer	0-150 m	25.9	61	16.3	39
		150-300 m	15.7	47	18.0	53
		> 300 m	27.8	60	18.2	40
	Autumn	0-150 m	42.7	41	62.0	59
		150-300 m	46.1	37	79.2	63
		> 300 m	35.5	63	20.6	37
	Winter	0-150 m	17.8	10	165.5	90
		150-300 m	14.4	67	7.1	33
		> 300 m	11.1	59	7.8	41
Saronikos	Summer	0-150 m	29.8	49	30.6	51
		150-300 m	27.7	38	44.9	62
	Autumn	0-150 m	30.7	47	36.1	53
		150-300 m	65.1	59	45.0	41
	Winter	0-150 m	39.5	59	27.9	41
		150-300 m	48.8	53	42.5	47

Technical interactions with other fisheries

During the last years, the bottom trawler skippers developed a technique to catch anchovies by bottom trawl net. This activity provoked conflicts between bottom trawlers and purse seiners. The case is well known in the local port authorities and in the Fisheries Council of the Ministry of Agriculture.

Special features

According to the Greek legislation, the total amount of anchovies in the catch of bottom trawl cannot exceed 10%. However, when trawlers target anchovies, anchovy is very often more than 50%. Many skippers have been prosecuted and the subject came to the Fisheries Council where the decision was negative for the bottom trawlers but the subject is still open. The problem is significant for the management of the species and for the allocation of the resources between the different fishing gears. Bottom trawl is producing an unaccounted fishing mortality, which should be estimated and taken into account in the stock assessment. The amount of discards (young specimens) is not known. Considering that during winter (15/12-1/3) purse seine fishery is closed in Greece, the problem becomes more complicated. The purse seine skippers argue that while they are not allowed to fish, others catch illegally (or destroy by discarding) their resources.

Relationship between fishing effort, fishing mortality and catch rates

No information available.

GSA 23 - CRETE ISLAND

FISHERY 1 - CONTINENTAL SHELF

Fleet description

Generally, due to the very narrow continental shelf, bottom trawling is very restricted in the area. There are a few vessels operating mainly in the Northern coasts of the Island, while in the southern coasts there is almost no bottom trawl fishing activity. According to the census of the Ministry of Agriculture 6 bottom trawlers are registered in the ports of the Crete Island, with average length 27.96 m, 1,863 kW total engine power and total tonnage of 803 GT.

The recent finding (after 1996) of red shrimps in exploitable abundance in the Ionian Sea (Anon. 1999; 2001; 2003) and the accidental catches of them in some hauls in the Southern Aegean Sea (Kallianiotis et al., 2000) is creating the speculation that probably robust populations exist about the Island in deep waters that have not been exploited yet. A research project to investigate the existence of these species in the deep waters about the Island would be useful. If the results prove positive, something that seems very likely, then the fishing grounds of bottom trawl will be extended significantly.

Fishing time over a year

The fishery is closed in the entire area from 1/6 until 30/9 every year.

Fishing equipment

The net is similar to the traditional Mediterranean bottom trawl. During the last years, some vessels have been using nets imported from the Western Europe with higher vertical opening. The mesh size is the legal one (it was 28 mm until recently and following the Council Regulation 1624/94 changed to 40 mm). The vessels carry navigation equipment (Radar), echosounders and hydraulic winches. During the last years, the introduction of plotters allowed the skippers to expand their activities to fishing grounds that were rarely exploited in the past.

Changes of the electronic equipments

The use of plotters led to an increase of the potentially exploited fishing grounds. Tows that were avoided by the skippers before, because of the high risk to damage the net, are now frequently exploited. In addition, new tows have been discovered. However, the increase in the fishing grounds is unknown.

Data on catch

Time series data concerning the bottom trawl catches of the commercial bottom trawl fisheries in the Cretan Sea are available from the National Statistical Service of Greece but these data are not considered reliable. Another source of catch statistic data is the national database kept in the Institute of Marine Biology of Crete since 1995. An analysis of the monthly catch per day data (1995-2000) for trawlers in the Cretan Seas showed a significantly decreasing trend.

Technical interactions with other fisheries

The number of bottom trawls is very small and the fishing grounds where the bottom trawlers are operating are restricted. Generally there are not significant problems with the other gears.

Special features

The bottom trawl fishing activity is restricted by the narrow continental shelf, especially in the south. The recent discovering (after 1996) of the red shrimps in exploitable abundance in

Ionian Sea and the accidental catches of them in some hauls in the South Aegean Sea is creating the speculation that probably robust populations exist about the Islands in deep waters that have not been explored yet. In the framework of CINCS project in the Cretan Sea, the crustaceans *Aristaeomorpha foliacea* and *Aristeus antennatus* contributed a significant proportion in biomass and numbers (5.71 and 16.29% and 5.68 and 14%, respectively) in the 500-800 m depth zone (Kallianiotis et al., 2000). A research project, aiming to investigate further the existence and the abundance of these species in the deep waters about the Island should be initiated. If the results are positive, case that seems very possible, then the fishing grounds of bottom trawl will be significantly extended.

Relationships between fishing effort, fishing mortality, catch rates

No information available.

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1.2 – Pelagic trawling

SPAIN

This fishing practice is prohibited in Spain.

FRANCE

GSA 7 - GULF OF LIONS

FISHERY 1 -CONTINENTAL SHELF

Fishing grounds

Pelagic trawling is practised exclusively in the continental shelf of the Gulf of Lions.

Fleet

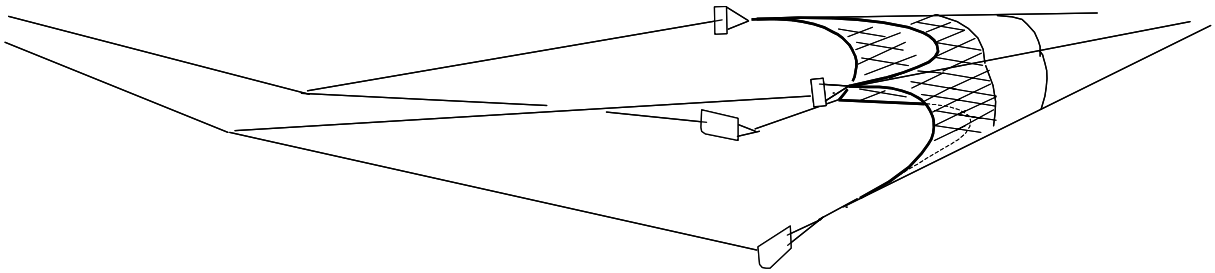
Information missing.

Fishing time over a year

As for the bottom trawling, pelagic trawling is carried out only during the day. According to regional fishing time regulation, each fishing trip do not last more than 17 hours for 3-8 h/trip. This duration can be reduced according to the importance of the first catch of the trip.
The pelagic trawlers work for about 200-220 fishing days/year and consequently 1000-1800 h/year/boat.

Fishing equipment

All trawls consist of four panels. The front part of these trawls is made either of long ropes (60m, the longest), large meshes (800-1600mm, stretched) or very large meshes (16m stretched mesh).Their vertical opening is around 20m. Cod-end mesh size used is 20mm of mesh opening, according to the legislation.



Four doors trawl used for pelagic species fishing

The net is generally rigged with 4 doors: two, which are fixed at the wings of the lower panel, are similar to the bottom trawling doors (their weight corresponds to the engine power) and 2 small pelagic doors of about 50 kg each, fixed to the extremities of the upper panel wings. These pelagic doors help keep the net vertically opened whereas the bottom doors maintain the trawl close to the bottom.

Over the last 40 years, the mouth opening of trawls targeting pelagic species were increased 10 times. The towing speed also increased of 2 knots, then the towing duration is lower than in the past.

Deck layout and machinery involved

Same as for the bottom trawlers.

Electronic equipment

Same electronic equipment is installed as for bottom trawling, with introduction of sonar for the most recent trawlers.

Data on catch

The annual landings for a “pelagic trawler” are between 300 to 400 Mt, composed of 70-90% of pelagic fish (mainly sardines).

Technical interaction

Technical interaction with bottom trawlers targeting hake could seasonally occur, mainly during the first haul in the morning.

Special features

Same French regulations define the pelagic trawl as a trawl with unprotected bottom rope and with a codend mesh size of 20mm. Morever the catch must be composed at least of 70% of anchovy and sardine and don’t have more than 10% of by-catch other than small pelagic, mackerel, horse mackerel, bogs.

Pelagic trawling is also submitted to the same licence regime as for the bottom trawling.

Relationships between fishing effort, fishing mortality, catch rate

The same remarks as for bottom otter trawling could apply.

ITALY

GSA 17: NORTHERN AND MIDDLE ADRIATIC

General

Three different types of pelagic trawls are commonly used in Italy: the mid-water pair trawl ("volante"), namely a pelagic trawl towed by two fishing boats, the otter pelagic trawl, towed by one fishing boat, and the surface trawl ("*agugliara*").

The best known pelagic trawl is the mid-water pair trawl, towed by two fishing boats working in pair and holding a tow-line, each one tethered to the head rope, and the other one to the foot rope. The mid water pair trawling is used mainly in the Adriatic Sea.

For ease of use and to prevent the two fishing boats from coming too close, four 30 m long mixed-line bridles are fit between the end of the towline and the rope before net haul and hauling aboard. A big weight (slightly less than 1 kg per fishing boat horsepower) is placed at the end of the line linking up to the foot bridle.

In Italy, the most commonly used mid-water trawl is pyramid-shaped and has a rectangular base whose smaller side is half the bigger side. The mesh is very large in the first part (200 – 600 mm in length) then becoming increasingly reduced in size towards the codend, whose mesh size is 20 mm in length (EU Regulation no. 1626/94).

The target species of the mid-water trawl are mainly sardines and anchovies, even if also other species living mid-water or in the proximity of the bottom could be caught.

The mid-water trawl could also be towed by only one fishing boat, but this method is used very seldom owing to the technological difficulties and regulation problems it implies. On occasions, only few fishing boats (approximately ten) use this fishing system in the Tyrrhenian Sea.

In order to tow mid-water trawl with one fishing boat, it is essential to use pelagic otter boards that are hardly to be regulated.

Finally, the *agugliara* trawl is a peculiar trawl whose float line is placed on the water's surface to prevent garfish to leap out of the trawl itself.

Contrary to the most fish species that tend to swim deeper and closer to the bottom when they feel endangered, garfish tend to break. Therefore, since the float line of the surface trawl is a few dozen centimetres above the water's surface, garfish are caught despite their leaps.

This trawl is not commonly used, with the exception of small fishing boats that use it occasionally. It guarantees good results especially at night. Target species are obviously garfish and sometimes grey mullets. Anyway, this type of trawl is very selective.

Generally, a strengthening bag protects the cod end of a pelagic trawl. The circumference of the strengthening bag is smaller than the circumference of the cod end.

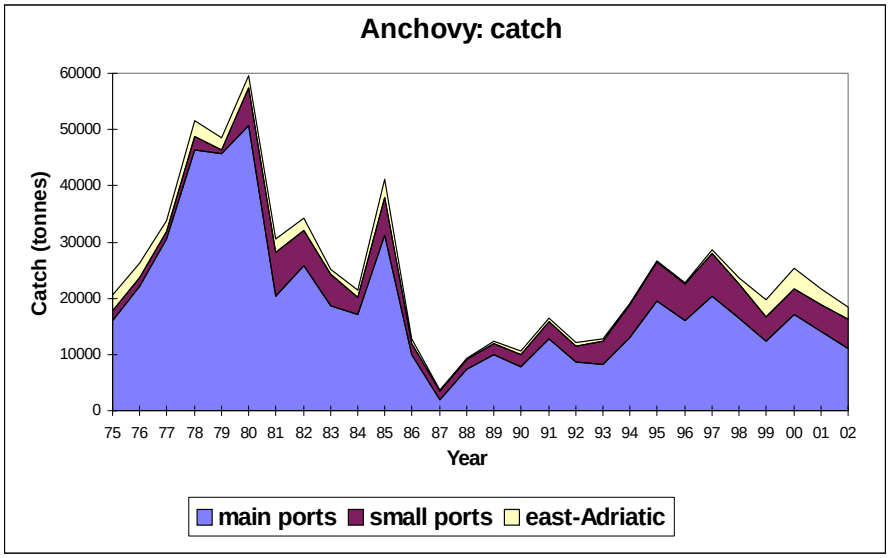
In the Adriatic Sea two areas could be identified: the Northern and Central Adriatic, characterised by a shallow area and a wide continental shelf, and the Southern Adriatic characterised by deeper water and a narrow continental shelf. This situation is directly related to the fishing productivity, which is higher in the Northern and Central Adriatic than in the Southern Adriatic.

Mid-water pair trawling is the most common fishing method for anchovy in the Northern Adriatic. "Volante" vessels generally fish only by daylight, and land their catches every evening: each fishing trip lasts about 11-15 hours.

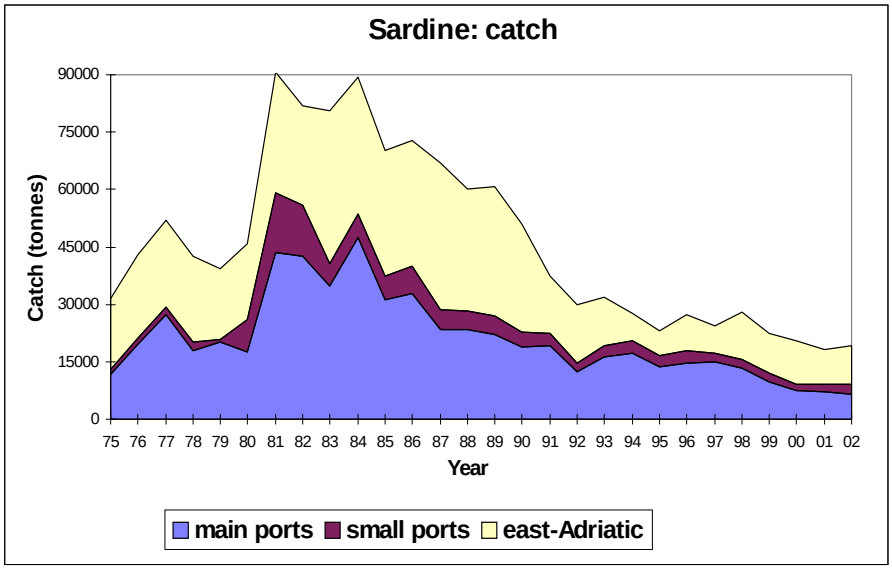
Target species are: anchovy (Engraulis encrasicolus, L.) and sardine (Sardina pilchardus, Walb.).

FISHERY 1 - PELAGIC TRAWLING

The small pelagic species (Anchovy - *Engraulis encrasicolus*, L. and Sardine - *Sardina pilchardus*, Walb.) are of key importance for Adriatic fisheries. They represent about 85% of the Italian small pelagic catches.
The small pelagic fishery has developed on both Adriatic sides; however, more than 90% of the anchovy catches are landed by the Italian fleet.



Adriatic (Northern and Central) anchovy landed catches



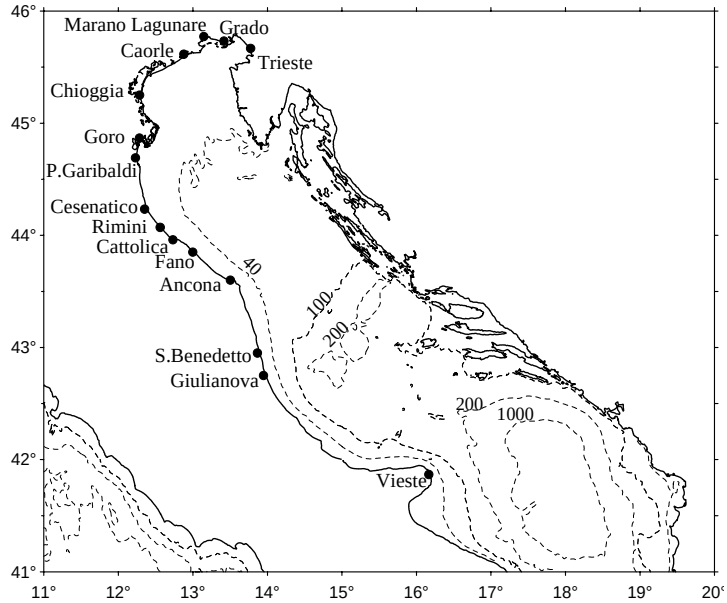
Adriatic (Northern and Central) sardine landed catches

Anchovy and sardine are the most important species of the shared small pelagics stocks: in Italy, sprat and sardinella are almost completely absent from the landed catches, and mackerel represents about 4-5% of the catches in the total of anchovies and sardines. Sprats are fished in the North Adriatic, while the fishing area of sardinella is in the South. In terms of market price, anchovies are considerably more valuable than sardines.
Italian Northern and Central Adriatic catches of sardines reached a maximum value (59,000 t), in 1981, decreasing in successive years; current catches are about 9,000 t.

Present Adriatic sardines catches are about 20,000 t. A high percentage of sardine catches is directed to the fish processing industry. Anchovy catches in Italy reached a maximum value in 1980 (57,328 t) followed by a quick decay in successive years until the crash of the 1987 (3,375 t). In the last years, Adriatic anchovy population showed a recovery. Present catches of anchovies in the Adriatic are about 20,000 t.
The Italian pelagic fleet is distributed along the Adriatic coastline from Trieste, in the North, to Molfetta in the South. The small pelagics fishery is very important in the Adriatic fishery (in particular, anchovy and sardine) for both economic (total value of catches) and social reasons (number of fishermen involved). Fish market preferences (anchovies are appreciated on the Western coast, while sardines are appreciated on the Eastern coast) should help a joint exploitation of small pelagics. It could avoid the discarding of sardines, a common practice in Italy due to their very low price. The economically most important small pelagics stocks are: anchovy (*Engraulis encrasicolus*), sardine (*Sardina pilchardus*), mackerel (*Scomber scombrus*), sprat (*Sprattus sprattus*) and sardinella (*Sardinella aurita*).

Fleet

The Italian fishing fleet for small pelagics is dominated by *volante*, operates only by day and lands its catches in the evening. It was introduced in the 1950s but did not begin to replace *lampara* purse seining until after the mid 1960s. There are about 120 *volante* vessels (60 pairs) in the Northern and Central Adriatic. Their average engine power is 400 HP and the average size is 50 GRT, but there are wide variations in both size and engine power. The Italian fishing fleet is distributed in the major fishing ports for pelagic fish along Italian coast: Trieste[1], Chioggia, Porto Garibaldi, Cesenatico, Cattolica, Ancona, San Benedetto del Tronto, Vieste, and in other fishing ports such as Grado, Marano Lagunare, Caorle, Goro, Rimini, Fano, Giulianova, where the landings are not as high as in the major ports.



Italian ports for small pelagic fishery in the Adriatic

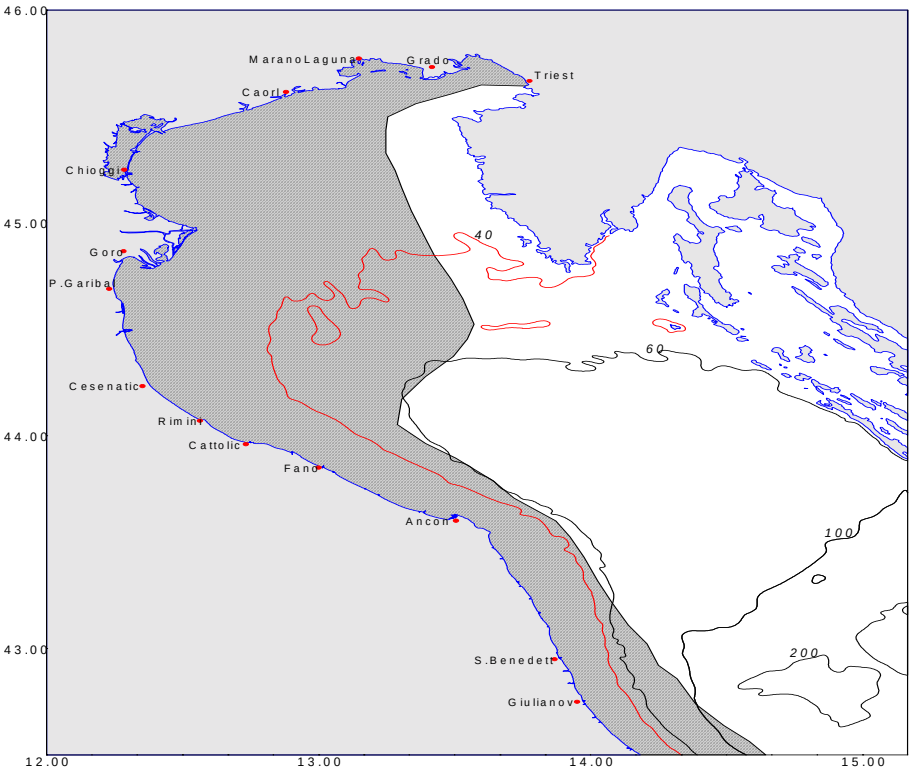
Artisanal fishery is active on small pelagics in the Gulf of Trieste, with two “volanti” fishing units. Fishing activity stops in winter because sardines migrate in the cold season.

[1] Trieste, Cesenatico, Cattolica and Vieste are traditionally considered as bigger ports for small pelagics fisheries. Nevertheless their importance diminished strongly during the ninetees.

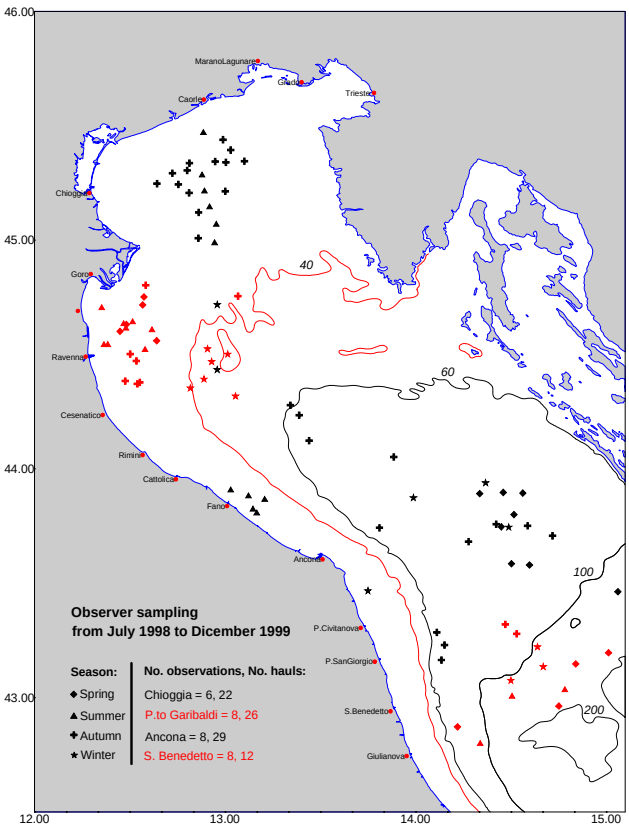
A deeper description of the small pelagics Adriatic fishery is given in the following paragraphs.

Chioggia - 12 pairs of *volanti* fishing vessels usually operate. Among them, 10 are over 50 GRT, and 2 approximately of 20 GRT. The number of couples can vary because some of them switch to beam trawling sometimes in winter. Although anchovy is always more valuable, the fleet may also target sardine, which is required for the processing industry.
The boats leave the harbour at 2.30-3.30 a.m. and come back between 11.00 a.m. to 7.00 p.m. depending on the success of the fishing day. The working week is from Monday to Friday. Sometimes, vessels target sardines in the early morning or night, close to the coast, then they land the fish and go further offshore looking for anchovy. This happens in particular when they have an agreement with fish dealers for a fixed amount of sardine: once they reach this amount, they then fish for anchovy if the market demand is high. The fleet moves extensively throughout the Northern Adriatic up to 40-50 miles from harbour. In general, the vessels fish together all in the same area, or they may split into two or three groups. In the winter months some vessels can move south and land the fish in Rimini, and in very rare cases even in Ancona. The wide range covered by the fleet from Chioggia is a traditional feature of this fishing harbour, and it has been well reported for the fifties and the sixties (*Mozzi, 1967 and Varagnolo, 1967*).
Porto Garibaldi - About 17 pairs of *volanti* fishing vessels are active in this harbour. They can be split in two groups according to size and fishing behaviour: 14 pairs of larger vessels (over 60 GRT) which tend to fish more offshore and more anchovy, and 3 of smaller vessels (less than 50 GRT) which stay more inshore and usually fish a higher percentage of sardine. The boats leave the harbour between 4 and 5 a.m., depending on how far they envisage going; the end of the fishing trip can vary from 1 p.m. to 7 p.m. The working week is from Monday to Friday. The boats usually stay together or split up to a maximum of three groups. The net is normally towed rather close to the bottom (where pelagic fish stay during the daytime) but, in front of the Po River mouth, the net is towed close to the surface in very early morning when it is still dark and the fish is still close to the surface.
The distance of the fishing grounds from the harbour can vary from 10 to 50 nm or more. When vessels reach more than 60 miles from their harbour, they land the catch in other more southern ports as Rimini or Ancona. These long trips are made only by the group of larger *volanti* which target more specifically anchovy, whereas the smaller vessels remain closer to Porto Garibaldi catching sardines, mullets, small anchovies and generally landing their catch at noon. The winter southward movements of the fleet have been recorded already in the sixties (*Piccinetti, 1970*).
Ancona - In Ancona 9 pairs of *volanti* are active: the size of the vessels is between 70-120 GRT, so they all can be considered as large vessels. The fishing trips start between 3.30 and 5.00 a.m. and end between 3.00 and 8.00 p.m. The working week is from Monday to Thursday, with the possibility of fishing on Friday in case of bad weather. This fleet has also enforced its own quota system and each vessel pair cannot fish more than 18 t per week (about 2000 boxes) of anchovy. The commercial value of sardine on the Ancona market is very low and catches too are low: the fleet targets exclusively anchovy and a large amount of sardines is discarded at sea, in particular in the period 1987-2000. In the recent years sardine discards at sea diminished. The Ancona fleet usually forms one only group but occasionally can split in two or three groups. The fleet tends to go generally offshore but sometimes also exploits inshore waters. The range reached from the harbour is very wide, from 10 to 60 nm. The area of Adriatic covered nowadays by the Ancona fleet is much wider than that reported by Piccinetti (1970) for the 1960s. In particular, over the last ten years (since 1992) the fishermen developed a technique of using the pair trawl also in water deeper than 80-100 m, thus they can fish bigger anchovies in areas once accessible only to purse seining.
San Benedetto del Tronto - This harbour is characterised by the presence of about 12 big fishing vessels (from 80 to 120 GRT) which from April to November operate as *lampare* (purse seiners with light), plus one couple of vessels fishing with *volante* gear and in the coldest months lampara

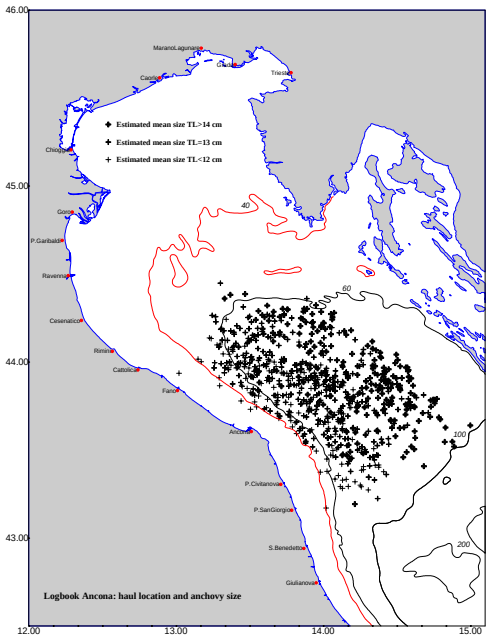
fisheries stop because the bad weather, while 6 *lampare* in winter switch gear to *volante*. Indeed they behave as two different fishing fleets. The *volanti* follow more or less the timetable and the number of working days per week of the Ancona fleet.
The boats tend to change fishing grounds when they switch fishing gear: in winter, *volanti* stay closer inshore and in shallower water than *lampare* in the warm season. The fleet targets mainly large anchovy but lands also good quantities of mackerels and horse mackerels. The amount of sardine landed depends on the market, but in general each boat does not land more than 1-2 tonnes per day of sardines: the excess may be discarded. In winter, they can catch occasionally large quantities of mullet when they fish by pair trawling. Also in San Benedetto the vessels tend to stay all together in the same area during a fishing day or to split into two or three groups.



Area exploited by the Italian small pelagic fishing fleet in the sixties (*redrawn from Piccinetti, 1970*)



All ports: map of observer fishing trip from July 1998 to December 1999



Port of Ancona: map of vessels logbook (No. 735 haul point from January to December 1999)

Fishing time over a year

The *volante* vessels are active all the year, except in Summer during the closing fishing season ruled by Italian government (about 45 days fishing stop). During the eight weeks following the fishing stop, the *volante* vessels are allowed to fish only by four days a week.

Normally, the fishing days are five in a week.

The following table shows the closing fishing season in Adriatic over the last five years.

Closed fishing season for volante vessels

Year	1998	1999	2000	2001	2002
Closing fishing season	45 days from 20 July to 2 Sept	44 days from 17 July to 31 Aug	44 days from 20 July to 1Sept.	30 days from 1 to 30July	45 days from Trieste to Rimini: 22 Jul–4 Sept; from Pesaro to Pescara: 5 Aug.-18 Sept.; from Termoli to Molfetta: 8 Jul-21 Aug

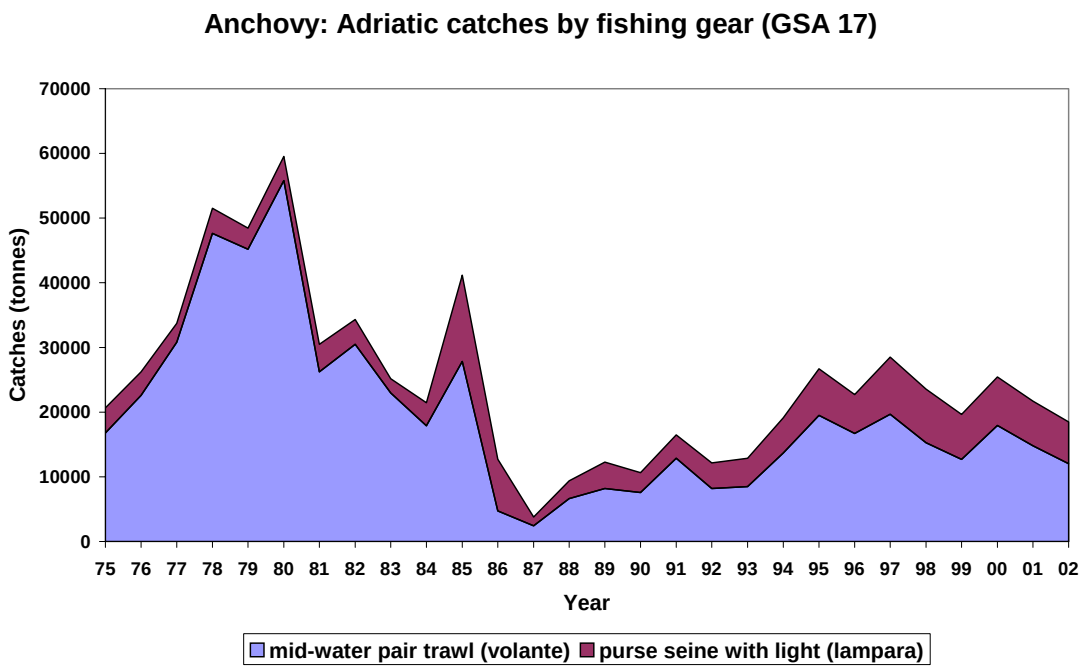
Fishing equipment
Recent modifications of the fishing gear occurred, allowing the fishing vessels to exploit former unexploited fishing grounds.

Deck layout and machinery involved
All the vessels have a net drum.

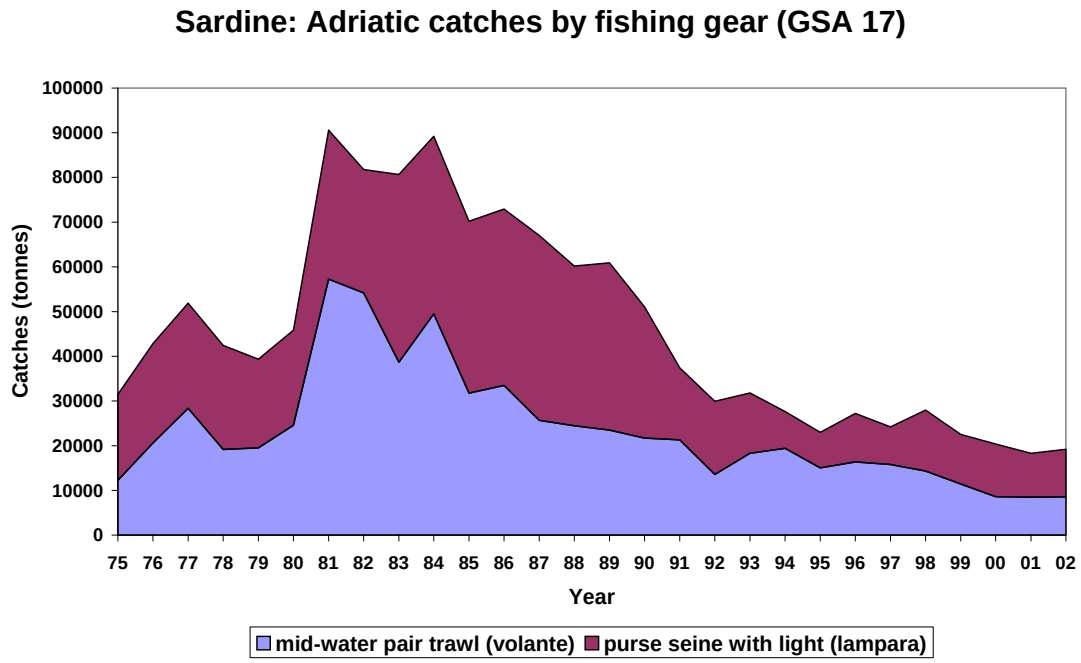
Electronic equipments
Between 1990 and 1996, some new electronic equipments have been installed on board fishing vessels. At the beginning of nineties, a double frequency echo-sounder was introduced (50 kHz, 120/200 kHz). With higher frequencies the swept area decreases, but the definition is better. It is widely used by *volante* vessels.
Plotter was introduced on board fishing vessels since the end of eighties and was used to record the route of vessels. In the recent years cartography has been added to plotters.
The navigation computer, the most recent electronic equipment (1995-1996), has not reached a wide diffusion. GPS equipment was introduced around 1992 and now it is universally used.

Data on catch[2]
Main target species are anchovy and sardine but mid water trawl catch also other species as mullets, sprats, sardinella, mackerels and horse mackerels, occasionally bonitos.
It should be clearly shown the relative importance (% weight) of the different major species.
The following figures show catches of anchovy and sardine by fishing gear/year in this GSA. The relevant quantity of caught with lampara is due to the fleets of Eastern Adriatic countries in which this kind of fishing gear is mainly used.

[2] Some parts of this paragraph is an updating of STCF (2002) report.



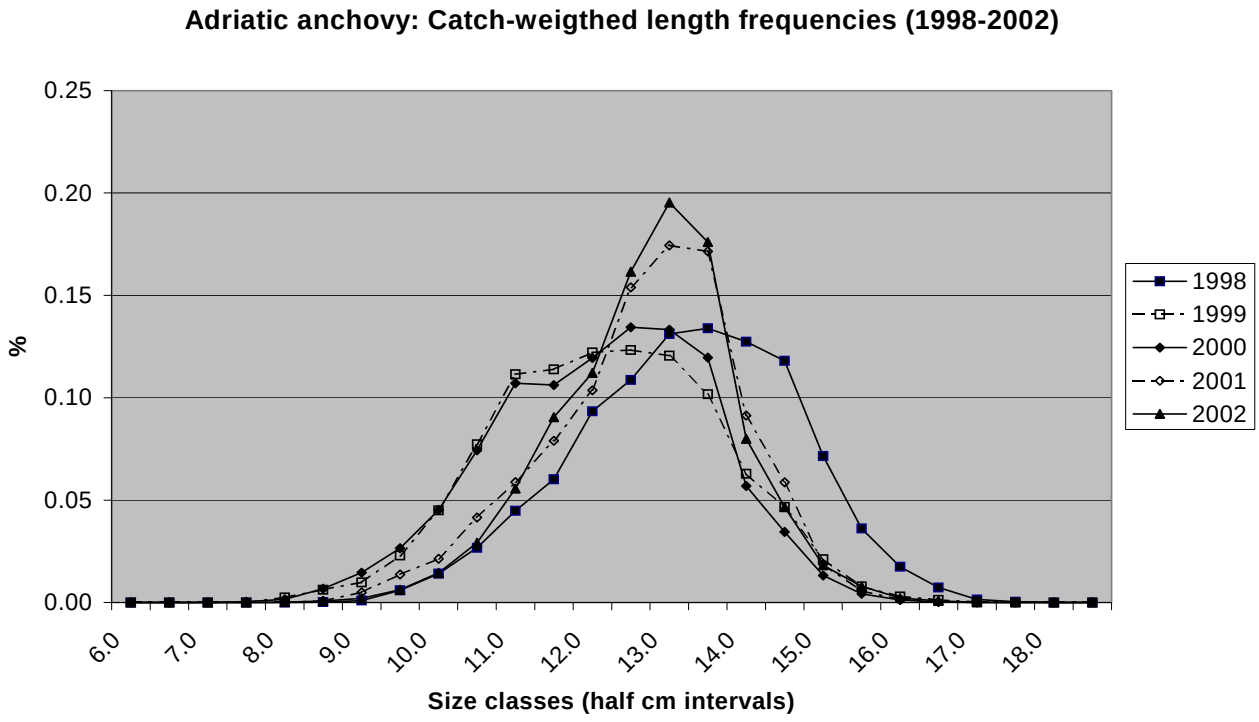
Anchovy catches by fishing gear (GSA 17)

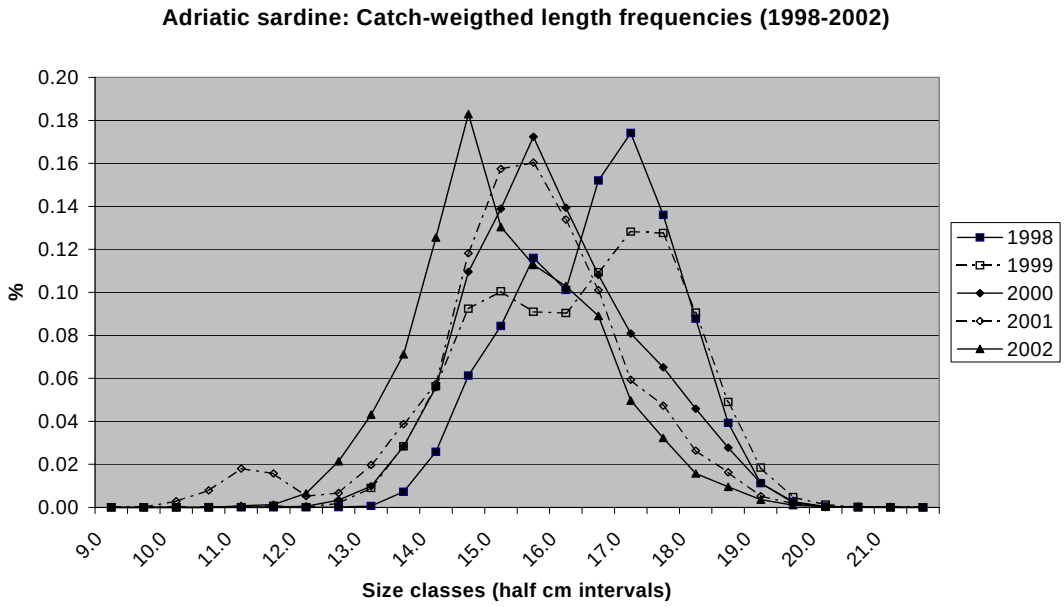


Sardine catches by fishing gear (GSA 17)

In the period 1975-1981 catches of anchovy were concentrated around the size of 12 cm. The catch length-size increases in the year before the anchovy collapse of 1987 (in this year the catch length-size of anchovy fell to about 12 cm). During the period 1988-1992 the modal length of anchovy catches distribution increased till to 13.5 cm, values confirmed in the period 1993-1997. Instead, in the period 1998-2002, the modal length of catches distribution seems rather variable. The modal length of catches distribution of sardine seems to show a cycle with a period of about ten years. During the years 1975/1976 catches of sardine were concentrated around the size of 16 cm. Then the medium size increase in the successive years till the value of 17 cm, while, in 1984/1985 (about ten year later), the modal length of catches is again 16 cm. Figure shows a new increase of medium

size till to 17 cm during 1986/1989 and it comes back to 16 cm during 1990/1992. During the nineties a new increase of the modal length of catches distribution till to 17 cm, has been observed. After about ten years (2000/2002) the value becomes lesser than 16 cm (15.5 cm).





Technical interactions with other fisheries
No technical interactions with other fisheries have been detected.

Special features
It should be pointed out here, whether, when and where such a fishery is currently operating under a certain derogation to the current general rule of mesh size, distance from the coast etc. and how the derogation is managed at national/regional level.
No special derogations exist for small pelagics fishery carried out by volante.

Relationships between fishing effort, fishing mortality, catch rates[3]
Tables show some parameters concerning biomass, average catches of the last three years (2000-2002) and fishing mortality estimated by VPA with a given value of natural mortality (*Cingolani et al., 2003a,b*). Further comments can be found in STECF (2002).

Anchovy SCSA 2003: Biomass, catches, mortality

Criterion	Value	Trend	Comments
B_{now}	89,000 t 109,000 t	Slight increase	Mid-year biomass at sea estimated by VPA under two different hypothesis: average on the period 2000-2002. The corresponding spawning biomass values are 49,000 t and 61,000 t.
Y_{now}	22,150 t	Slight decrease[4]	Average catch on the period 2000-2002. Discards are negligible.
F_{mean}	0.36-0.26		Average on the period 1976-2002 estimated by VPA under two different hypothesis[5] (unweighted mean for the age interval 0-3).
F_{min}	0.21-0.14		Minimum value estimated by VPA under two different hypothesis (unweighted mean for the age interval 0-3).
F_{max}	0.72-0.56		Maximum value estimated by VPA under two different hypothesis (unweighted mean for the age interval 0-3). They were obtained for the year 1986.
F_{now}	0.33-0.27		Average on the period 2000-2002 estimated by VPA under two different hypothesis (unweighted mean for the age interval 0-3).
F/(F+M)	0.35-0.31		Exploitation rates: average on the period 2000-2002 (M = 0.6, F estimated by VPA under two different hypothesis, as unweighted mean for the age interval 0-3); with 0.4 being the threshold suggested by Patterson (1992).

[3] Some parts of this paragraph is an updating of STECF (2002) report.

[4] Croatian cacthes of anchovy increased since 1999 (from about 500 t to about 2,500 t).

[5] Two hypothesis were made to estimate values of F: (1) the first one, more conservative, uses the standardised effort of 2002, the second one, less conservative, uses the mean value of standardised effort over the whole split year period 1976-2002 (Cingolani *et al* , 2003a).

Sardine SCSA 2003: Biomass, catches, mortality

Criterion	Value	Trend	Comments
B_{now}	99,000 t	Slight increase	Mid-year biomass at sea estimated by VPA: average on the period 2000-2002. The corresponding spawning biomass is 66,000 t.
Y_{now}	19,292 t	Quite stable	Average catch on the period 2000-2002. Catch takes, partially, into account discarded sardine.
F_{mean}	0.25		Average on the period 1975-2002 estimated by VPA (unweighted mean for the age interval 0-5).
F_{min}	0.16		Minimum value estimated by VPA (unweighted mean for the age interval 0-5).
F_{max}	0.35		Maximum value estimated by VPA (unweighted mean for the age interval 0-5). It was obtained for the years 1981 and 1982.
F_{now}	0.31		Average on the period 2000-2002 estimated by VPA (unweighted mean for the age interval 0-5).
F/(F+M)	0.38		Exploitation rate: average on the period 2000-2002 (M = 0.5, F estimated by VPA, as unweighted mean for the age interval 0-5); with 0.4 being the threshold suggested by Patterson, K. 1992. Fisheries for small pelagic species: an empirical approach to management targets. Rev. Fish Biol. Fish., 2: 321-338.

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GREECE

According to Greek legislation pelagic trawls are forbidden in Greece.

1.3 - Dredges

SPAIN

General
The dredging fishery is located along the Spanish coast, both in the peninsula and in the Balearic Islands. However, in wide zones of Northern Spain and in all Balearic Islands, the incidence of this fishery is relatively small.
Only one fishery is developed in Spanish subareas. The gear used is always a boat dredge, which is mechanically operated from the boat. Usually more than one dredge is deployed at the same time. Target species can vary among zones, but always are bivalves. A bigger diversity of species is fished in the Southern than in the Northern area.

GSA 1 - NORTHERN ALBORAN SEA

Fishing ground
The fishing area is always very close to the shore, being usually no more than two nautical miles far. The nature of the bottom is variable which different proportions of sand and mud.

Fleet
Fleet of dredges in North Alboran Sea consists of 118 vessels of 6.2 m mean size length. The total power used in the fishery is 3769 HP, with a mean value of 31 HP per boat. The total GRT of the fleet is about 329, and the mean value is 2.8. The fishery is developed along the coast of the Alboran Sea, between Gibraltar Strait and Cabo de Gata, however the highest concentration of vessels appears in the western zone of the sub-area.

Fishing time
The dredges are used all year, however there are a lot of regional (Autonomous Governs) laws affecting this fishery. Therefore close seasons by areas and/or species are implemented in the different areas, in many cases owing to the existence of toxic algae blooms.

Fishing equipment
A dredge consists of an iron frame linked to a codend where the catch is retained. In the lower part of the frame there are several teeth of different size depending on the target species. These teeth penetrate in the sediment to get the bivalves out.
Usually more than one dredge is used at the same time, reaching occasionally up to 6. Only one dredge per haul is used in Pecten maximus fishery due to the bigger size of the dredge are and the fishing operation is different in,

Deck layout and machinery involved
The deck is equipped with a winch to recover the rope fixed to a special anchor used to do the fishing operation.

Electronic equipment
No particular electronic devices, other than the navigational ones, are put on board.

Data on catch
In Northern Alboran Sea subarea up to six species are regularly fished, these are: *Donax* spp., *Chamelea Gallina, Venerupis rhomboides, Acanthocardia tuberculata, Callista Chione* and *Pecten maximus*.

Technical interactions
In Northern Alboran Sea subarea there is an interaction between this fishery and the trawl fishery operating in the shallower continental shelf targeting Octopus vulgaris.

Special features
The Autonomous Government regulates the fishery. The fishing ground is divided in different areas that are alternatively exploited by the fleet. In the last years this fishery is being affected of a red tide that produce the temporal closure of the fishing grounds.

Relationships between fishing effort, fishing mortality, catch rates
No information available

GSA 5 - BALEARIC ISLANDS

Fleet
In Balearic Islands, only 12 vessels less than 7 m long form the fishery.

Fishing time
The dredges are used all year, however there are a lot of regional (Autonomous Governs) laws affecting this fishery. Therefore close seasons by areas and/or species are implemented in the different areas, in many cases owing to the existence of toxic algae blooms.

Fishing equipment
Usually more than one dredge is used at the same time, being occasionally up to 6 dredges used at the same time. Since the dimensions of the dredge are bigger than in other cases, and also the operation of fishing is different in the Pecten maximus fishery, only one dredge is used in each haul.

Deck layout and machinery involved
Information not available

Electronic equipment
No particular electronic devices, other than the navigational ones, are put on board.

Data on catch
The following species are regularly fished: *Donax* spp., *Chamelea Gallina, Venerupis rhomboides, Acanthocardia tuberculata, Callista Chione* and *Pecten maximus*.

Technical interactions
There is an interaction between this fishery and the trawl fishery operating in the shallower continental shelf targeting Octopus vulgaris.

Special features
Information not available

Relationships between fishing effort, fishing mortality, catch rates
Information not available

GSA 6 - CATALAN COAST

Fleet
In Northern Spain sub-area, 48 vessels with a mean length of 7 m practice this fishery. The total power used is 2178 HP and the total GRT is 181. The mean values of the vessels are 45 HP and 3.77 GRT.

Fishing time
The dredges are used all year, however there are a lot of regional (Autonomous Governs) laws affecting this fishery. Therefore close seasons by areas and/or species are implemented in the different areas, in many cases owing to the existence of toxic algae blooms.

Fishing equipment
Usually more than one dredge is used at the same time, being occasionally up to 6 dredges used at the same time. Only one dredge per haul is used in fishing the *Pecten maximus* due to the dimensions of the dredge which are bigger than others and also to the different fishing operation.

Deck layout and machinery involved
Information not available

Electronic equipment
No particular electronic devices, other than the navigational ones, are put on board.

Data on catch
Up to six species are regularly fished, these are: Donax spp., Chamelea Gallina, Venerupis rhomboides, Acanthocardia tuberculata, Callista Chione and Pecten maximus.

Technical interactions
There is an interaction between this fishery and the trawl fishery operating in the shallower continental shelf targeting the Octopus vulgaris.

Special features
Information not available

Relationships between fishing effort, fishing mortality, catch rates
Information not available

FRANCE

General
There is a general misunderstanding between dredge and beam trawl because these gears are very similar and distinguish themselves only by the ability to penetrate into the sediment or to pull up fixed animals.
According to the French legislation, a dredge must be used only for clams, oyster and grooved sea squirt (*Microcosmus sulcatus*). There are 2 types of dredges:
- manual dredges used for clams buried into the upper sediment as Donax clams (*Donax trunculus*)
- towed dredges used for oyster (*Ostrea edulis, Crassostrea gigas*), for (*Microcosmus sulcatus*), or for sea urchin (*Paracentrotus lividus).*

However we included also in this category the towed gear commonly used for *murex (Bolinus brandaris*) fishing.

GSA 7 – GULF OF LIONS

Fishing grounds
All the activity of these boats is restricted to the coastal waters within the 3 nm offshore.

Fleet
Fishing boats are ranging from 5 to 12 m length and from 14 to 169 kW. Being 41 years old in average, they are the oldest boats of the French small-scale fisheries.

	LOA (m)	GT	P(kW)
min	5	0	14
max	12	12	169
mean	**7**	**2**	**58**

This fleet is polyvalent and can practice 1 to 4 techniques more, as gillnetting, longlining, coastal beam-trawling or shellfish culture.

FISHERY 1 - DONAX DREDGE FISHERY

Fishing grounds
This fishery mainly operates in shallow waters, less than 2 m deep.

Fleet
For the manual dredge no boat is needed. About 86 fishermen were practising this technique in 1998.

Fishing time over a year
All the year round.

Fishing equipment
The fishing gear for clams (*tellinier*) is a light and small dredge of 1 by 1,2 m. It is handled by hand in very shallow waters (less than 2 m) from shore or from a small boat. The mesh size must not be less than 60 mm.

Deck layout and machinery involved
Unjustified

Electronic equipment
Unjustified

Data on catch
Around 1000t are fished per year. Individual catch are estimated to be between 48 and 446 kg/month.

Technical interactions
Nothing

Special features
This fishery is submitted to a licence regime limiting the number of fishermen.

Relationships between fishing effort, fishing mortality, catch rates
No data available

FISHERY 2 - OYSTERS DREDGE FISHERY

Fleet
268 vessels are currently involved in dredging for oyster mainly in gulf of Lions but also some bays of Provence coast.

Fishing time over a year
This technique is practised for 8 months per year.

Fishing equipment
The characteristics of oyster dredge are defined by a national legislation. The bottom of the dredge ("cutter") is limited to a maximum length of 2.5 m, must not be sharp and must not have teeth. The total weight with its backstrop must not exceed 50 kg. The minimum mesh size for the cod-end must not be less than 80 mm.

Deck layout and machinery involved
The machinery involved is the same as for murex dredging.

Electronic equipment
Echo sounder and GPS[1]

Data on catch
No data available

[1] Aldebert Y., Recasens L. and Lleonart J., 1993.- Analysis of gear interactions in a hake fishery: the case of the gulf of Lions (NW Mediterranean). Sci. Mar., 57 (2-3): 207-217.

Technical interactions
With static gears.

Special features
Both use and gear characteristics are ruled. The production must not be sold directly without any sanitary control.

Relationships between fishing effort, fishing mortality, catch rates
No data available.

FISHERY 3 - SEA URCHIN DREDGE FISHERY

Fleet
Eighty nine vessels are involved in dredging for sea urchins, mainly on the Eastern Gulf of Lions and Provence coast of gulf of Genova.

Fishing time over a year
Dredging for sea urchins is practised for 5-6 months/year/boat.

Fishing equipment
The gear is similar to the oyster dredge.

Deck layout and machinery involved
Often open deck with small wheelhouse, winch and gantry for the biggest boat.

Electronic equipment
Echo-sounder and GPS.

Data on catch
No data available

Technical interactions
Nothing

Special features
Nothing

Relationships between fishing effort, fishing mortality, catch rates
No data.

FISHERY 4 - MUREX DREDGE FISHERY

Fleet
About 20-28 fishing boats are practising dredging for sea snail (*Bolinus brandaris*) mainly in the Gulf of Lions.

Fishing time over a year
Dredge for murex is used from April to September on muddy and sandy bottom, at depths between 5 and 40 m. The whole fleet spent fishing a total of 85 months per year.

Fishing equipment

The traditional dredge used for murex (*radasse*) is built with a steel beam 2-4 m long and of 50-200 kg. Furthermore, this beam is weighted by a set of chains to scrape the bottom. A set of old nets is fixed on this beam for entangling the snail. Nevertheless, at present, a dredge with a bag and a fixed opening frame ("gangui"), of length between 2 and 4 m, is the most used gear.

Deck layout and machinery involved

Trawl winch with stern gantry or power-block and a steel roller.

Electronic equipment

Echo sounder and GPS.

Data on catch

If a traditional gear captures essentially Murex, the new dredge catches are more largely diversified:

Espèces	Production estimée (**Kg**)
murex	39032
soles	3110
coquille St Jacques	2485
poulpes	1186
moule	730
seiches	246
raies	221
violet	190
barbue	186
turbot	156
baudroies	146
divers poissons	419

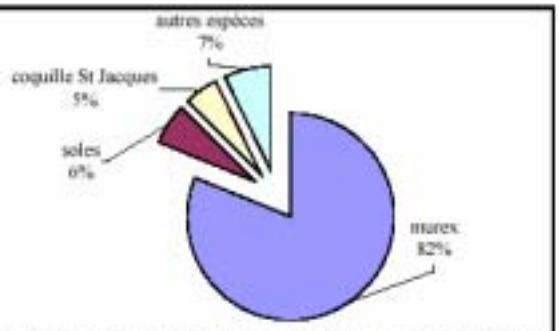


Figure 25 : Proportions des principales espèces dans la capture annuelle des dragues à escargots, en mer côtière (Région LR 2000-2001)

Technical interactions

With trammel metier for sea snail

Special features

The gear width is stated by legislation.

Relationships between fishing effort, fishing mortality, catch rates

No data available**.**

ITALY

In Italy, more than 700 fishing boats practise clam fishing using hydraulic dredges. This type of fishing is strictly regulated and is aimed at catching clams that, when fully grown, make extremely limited movements; as a matter of fact, the regulations in force envisage a fixed number of licenses for each port of registry.
The dredging fishery is well-developed throughout the entire western Adriatic Sea from Trieste to Bari, and to a lesser extent in the Tyrrhenian Sea. The fishery targets bivalve molluscs, the clams *Tapes philippinarum* and *Chamelea gallina* being by far the most important.
The following table (from IREPA, modified) gives a quantitative consistence of the Italian fleet using dredges:

Dredgers		N	GRT /N	Length/N	HP/N	Days at sea
GSA 9	**LAZIO**	**28**	**10**	**12**	**103**	**1858**
	CAMPANIA	14	9	12	137	0
GSA 18	**APULIA**	**75**	**9**	**13**	**100**	**5906**
	MARCHE	222	11	15	106	25097
	ABRUZZI	115	11	14	109	8812
	EMILIA R.	56	10	14	105	4844
	TRIVENETO	217	10	13	112	30462
GSA 17		**610**				**69215**

Hydraulic dredging is the most widespread activity in the Adriatic Sea.
The hydraulic dredge comprises a rectangular cage mounted upon two sledge runners to prevent the dredge from digging into the substratum to more than the desired depth. The front of the cage is connected to a hose, which runs along the side of the boat to a centrifugal water pump and serves to eject water under pressure from the nozzles at the mouth of the dredge and inside the dredge cage. Gear design, penetration and selectivity vary according to the species targeted. Hand and mechanical boat dredges comprise a metal frame mounted onto a pole, with a mesh bag in which the catch is retained. The metal frame is equipped with teeth which penetrate into the sediment.
Three hydraulic dredges, fully regulated, there exist: one for clams (minimum distance between rounds: 12 mm), one for razor-shells (minimum distance between rounds: 7 mm) and one for hard clams (minimum distance between rounds: 25mm).
All of them are 3 metres in width, have a maximum weight of 600 kg and work at a maximum pressure of 1.8 bars.
A few years ago, some pilot Consortia for clam management in specific fishing ground were set up in order to establish fishing days and allowed fishing quantities for each type of clam.

GSA 9 - LIGURIAN AND NORTHERN TYRRHENIAN SEA

Fishing ground
Fishing area varies according to the target species but never is always included between 3m depth inshore and 3 nautical miles offshore. For all species, with the exception of razor clams, *Ensis* spp and *Solen* spp., hydraulic dredging is forbidden inshore of 3 m depth. Fishing grounds are prevalently sandy-silty.

Fleet
The dredging fleet is concentrated in the Southern part of this GSA and comprises a total of 27 vessels whose mean tonnage is 8.5 GRT, for a total of 229 GRT. The mean power of the

fleet is 101 kW, for a total of 2713 kW. Most vessels in this area are equipped with mechanical dredges, but hydraulic dredges do operate.

Fishing time
The fleet operates all year round with the exception of two months (to be chosen by each Maritime District within the area) between April and October. Harvesting of razor clams in the Tyrrhenian Sea is forbidden for 2 months yearly, between 1 April and 31 May; harvesting for *Donax trunculus* is forbidden for one month yearly between 1 April and 30 April. The mean number of fishing days per vessel is 58 days yearly.

Fishing equipment
Two mechanical boat dredges are fished per vessel. Only one hydraulic dredge is fished per vessel.

Deck layout and machinery involved
Vessels fishing mechanical boat dredges are generally smaller than those fishing hydraulic dredges. As for hydraulic dredges, towing involves warping on an anchor.
Hydraulic dredges are hauled from the bow of the vessel and towed astern either by warping on a big anchor or by moving backwards by means of the propeller. Vessels adopting the anchor method are equipped with a winch used to recover the anchor. Hydraulic dredgers, except for those harvesting razor clams, are equipped with an on-board mechanical vibrating sieve comprising 2 or 3 superimposed grids for size-selection of catch.

Electronic equipment
Most hydraulic dredgers are equipped with navigation equipment (radar, GPS etc..)

Data on catch
The following species are harvested by dredges (either hydraulic or mechanical): *Ensis* spp., *Solen* spp., *Chamelea gallina*, *Donax trunculus*. In 2002 the total catch of molluscs reported for all dredges was 108 t, of which 93 t of *Chamelea gallina*.

Technical interactions
Interactions exist between dredging and the inshore artisan fishery using pots, trammel nets and gillnets.

Special features
As for the Adriatic, the Tyrrhenian inshore fishing grounds are divided into Maritime Districts. The dredging fishery for molluscs is locally managed by management consortia within each District, which operate within the limits set by both national and European laws. Consortia are responsible for setting either catch quotas or temporal and spatial fishing closures.

GSA 17 - NORTHERN ADRIATIC SEA

Fishing ground
Fishing area varies according to the target species but is always included between 3m depth inshore and 3 nautical miles offshore, with the exception of hydraulic dredging for *Callista chione* whose stocks are exploited further offshore (up to 10 nm). For all species, with the exception of razor clams, *Ensis* spp and *Solen* spp., hydraulic dredging is forbidden inshore of 3 m depth. Fishing grounds are prevalently sandy-silty, although *Callista chione* in the northernmost portion of the Adriatic Sea is exploited on coarser grounds.

Fleet
The dredging fleet of the northern Adriatic Sea comprises a total of 599 vessels whose mean tonnage is 10.5 GRT, for a total of 6367 GRT. The mean power of the fleet is 110 kW, for a total of 64789 kW. The fishery is well developed across the entire area from Trieste to Vieste, although the greatest concentration of vessels is recorded in the Marche region whose coastal sands support 37 % of the entire fleet.

Fishing time
The fleet operates all year round with the exception of two months (to be chosen by each Maritime District within the area) between April and October. Harvesting of razor clams in the Adriatic Sea is forbidden for 6 months yearly, between 1 April and 30 September. The mean number of fishing days per vessel is about 107 days yearly.

Fishing equipment
Only one dredge is fished per vessel.

Deck layout and machinery involved
Hydraulic dredges are hauled from the bow of the vessel and towed astern either by warping on a big anchor or by moving backwards by means of the propeller. Vessels adopting the anchor method are equipped with a winch used to recover the anchor. Hydraulic dredgers, with the exception of those harvesting razor clams, are equipped with an on-board mechanical vibrating sieve comprising 2 or 3 superimposed grids for size-selection of catch.

Electronic equipment
Most hydraulic dredgers are equipped with navigation equipment (radar, GPS etc.)

Data on catch
The following species are harvested by means of dredges (hydraulic or mechanical): *Callista chione*, *Ensis* spp., *Solen* spp., *Tapes philippinarum*, *Chamelea gallina*, *Paphia aurea*. In 2002 the total catch of molluscs reported for all dredges was 13296 t, of which 11669 t of *Chamelea gallina*.

Technical interactions
Interactions exist between hydraulic dredging and the inshore artisanal fishery with pots, trammel nets and gillnets.

Special features
The western Adriatic inshore fishing grounds are divided into Maritime Districts. The dredging fishery for molluscs is locally managed by management consortia within each

District, which operate within the limits set by national and European laws. Consortia are responsible for setting catch quotas and temporal/spatial fishing closures.

GSA 18: SOUTHERN ADRIATIC SEA

Fishing ground
Fishing area varies according to the target species but is always included between 3m depth inshore and 3 nautical miles offshore. For all species, with the exception of razor clams, *Ensis* spp and *Solen* spp., hydraulic dredging is forbidden inshore of 3 m depth. Fishing grounds are prevalently sandy-silty.

Fleet
The dredging fleet of the Southern Adriatic Sea comprises a total of 74 vessels whose mean tonnage is 9.2 GRT, for a total of 678 GRT. The mean power of the fleet is 99.4 kW, for a total of 7355 kW. The fishery is well-developed in the area from Vieste to Bari. Most of the vessels registered in Manfredonia (GSA 18) fish in both GSA 17 and GSA 18.

Fishing time
The fleet operates all year round with the exception of two months (to be chosen by each Maritime District within the area) between April and October. Harvesting of razor clams in the Adriatic Sea is forbidden for 6 months yearly, between 1 April and 30 September. The mean number of fishing days per vessel is 150 days yearly.

Fishing equipment
Only one dredge is fished per vessel.

Deck layout and machinery involved
Hydraulic dredges are hauled from the bow of the vessel and towed astern either by warping on a big anchor or by moving backwards by means of the propeller. Vessels adopting the anchor method are equipped with a winch used to recover the anchor. Hydraulic dredgers, with the exception of those harvesting razor clams, are equipped with an on-board mechanical vibrating sieve comprising 2 or 3 superimposed grids for size-selection of catch.

Electronic equipment
Most hydraulic dredgers are equipped with navigation equipment (radar, GPS ecc..)

Data on catch
The following species are harvested by means of dredges (hydraulic or mechanical): *Callista chione*, *Ensis* spp., *Solen* spp., and *Chamelea gallina*. *Venus verrucosa* is allowed to be fished only by mechanical dredges. In 2002 the total catch of molluscs reported for all dredges was 1034 t, of which 757 t of *Chamelea gallina* alone.

Technical interactions
Interactions exist between hydraulic dredging and the inshore artisanal fishery with pots, trammel nets and gillnets.

Special features
The western Adriatic inshore fishing grounds are divided into Maritime Districts. The dredging fishery for molluscs is locally managed by management consortia within each

District, which operate within the limits set by national and European law. Consortia are responsible for setting catch quotas, and temporal and spatial fishing closures.

GREECE

GSA 20, 22, 23 – IONIAN, AEGEAN AND CRETAN SEAS

General

The dredging fishery in Greece is conducted mainly in the Northern part of the country and is mostly used for harvesting bivalve molluscs. Dredging is operated by hand or by small vessels towing one to four dredges in coastal waters in depths down to 15m. The catch is lifted off the seabed by the raking bar and passes back into the bag. After being brought aboard by hand or by a powered winch the catch is emptied by lifting the dredge from the rear so the catch is dumped out through the mouth.

Fleet

In Greece there is not a fleet devoted to dredging fishery. According to the census-1988 updated until the end of December 2003- of the Ministry of Agriculture, a small number of coastal vessels -572- hold official permit to use dredges among other coastal gears but only 25 of them use dredge as the main gear. The active number of the vessels using dredges is not known and the fishing effort has not been assessed. The vessels have average length 7.45m, mean engine power is of 36.6 KW and mean gross tonnage 2.91 GT. In the ports of Aegean Sea 534 vessels are registered and the fishery is carried out along the coasts of North Aegean Sea and the islands of Thassos, Lemnos and Lesvos. Of the total number of the vessels using dredges 38% are moored in the ports of Thermaikos Gulf and fish in the nearby fishing grounds and 28% in Lesvos Island and fish mainly in the Kalloni's Gulf.

Fishing time over a year

The fishing period for dredging fishery in the entire Greek territory is from 1st of October to31st of May every year. According to the target species there are also some more prohibitions. Thus, for *Venus sp*. fishing is not allowed from 1st of August to 31st of October, for *Callista chione* from 1st of April to 30th of June, for *Modiolus barbatus. Donax trunculus Pecten sp., Venerupis sp.* from 1st of April to 31st of October.

Fishing equipment

A typical dredge consists of a triangular metal frame (usually iron) of 1.2m length of each side and 20mm thick. The lower edge of the frame has a raking bar with or without teeth. When teethes exists they are up to 3cm long and the distance between them should be at least 1.5cm. A net bag is attached on the frame. The mesh size of the netting is 35-40mm (bar length) and the twine thickness is usually 210/35-60 denier. The length of the bag is 2-6 m and the height 0.3-0.4m. One or two dredges are usually used at the same time and some times up to four.

Deck layout and machinery involved

No specific deck layout and machinery is used for this type of fishery other than the already existing on the vessels.

Electronic equipment

No particular electronic devices, other than the navigational ones are put on board.

Data on catches
In the Northern Aegean Sea the species that are usually fished are: *Venus sp., Pecten sp., Arca noe, Callista chione, Cerastoderma glaucum, Donax trunculus, Spisula subtruncata, Modiolus barbatus.*

Interaction with other fisheries
The gear operates on sandy and muddy bottoms and the competition with the others small scale fisheries is not important.

Special features
According to the legislation in force, the lower side of the triangular metal frame should be up to 1.2 m long and the thickness of the frame up to 20 mm. Concerning the netting, it should be of synthetic fibre (metallic is prohibited) and the mesh size should be at least 35 mm bar length. The total weight of the gear should be up to 12 kg.

Relationships between fishing effort, fishing mortality and catch rates.
Data not available

1.4 – fixed opening trawls

SPAIN

This metier is not practised in Spain.

FRANCE

GSA 7 – GULF OF LIONS

FISHERY 1 - COASTAL BEAM TRAWLING

Fishing grounds

This fishing metier is carried out on Posidonia meadows, on the same grounds where coastal Provençal bottom trawls ("ganguis à panneaux") operate. Few fishing boats practice also this activity in the coastal waters of the Gulf of Lions.

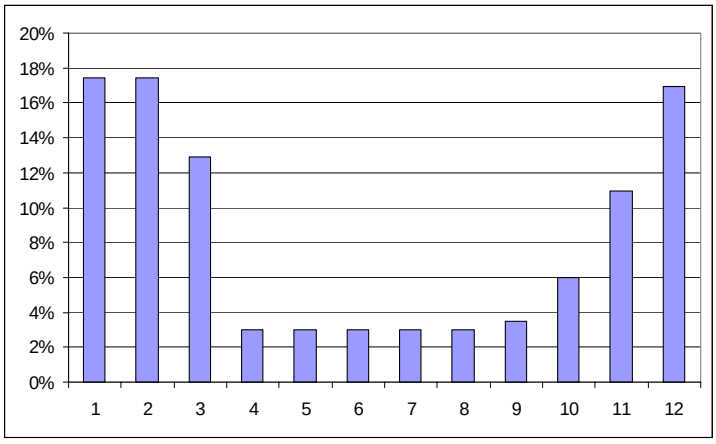
Fleet

Twenty-eight "gangui" beam trawlers (average age: 44 years) remain along East Provence coast. Their length ranges between 4 and 11 m; their average power is 51 kW.

	LOA	GRT	GT	P (kW)
min	4	1	1	13
max	11	10	10	137
mean	8	4	3	51

Fishing time

In Provence, the "small gangui" activity consists of 4-6 shots per day and of 50-100 days/year, mainly from October to March. Each shot does not last more than 1 hour. In the other months, these boats use beam-trawl for urchins and violets.



Percentage of fishing activity per month

Fishing equipment

The beam-trawl has a 2m wide and 0,7m high opening: the net length ranges between 15 and 20 m; cod-end mesh size is 12 mm. The towing speed is about 1,5 knots.

Deck-layout
The boats generally have an open deck and a small wheelhouse; a trawl winch is installed and sometimes a stern gantry.

Electronic equipment
Echo sounder and GPS.

Data on catch
Targeting fish soup and shrimp, the annual production of all the fleet is around 23 t/year for 50÷100 fishing days/year.

Technical interactions with other fisheries
Interactions with static gear fisheries.

Special features
National and regional legislation ("Prudhomie") establishes sizes and use of the beam trawl according to the specificity of the fishing area.

Relationships between fishing effort, fishing mortality, catch
No data.

ITALY

There are two types of fixed-opening trawls: rapido and ganghero. Their horizontal and vertical opening is ensured by a rigid, steel made framework.
Rapido is mainly employed to exploit soles (*Solea vulgaris*) and scallops (*Aequipecten opercularis*, *Chlamys glabra* and *Pecten jacobaeus*) in the Northern and central Adriatic Sea. Ganghero is used in Sardinia, Apulia and Campania to catch shrimp, crab and bottom species.
The rapido trawl is a gear planned in Italy where it has replaced the beam trawl as it allows greater and constant catches, and also withstands higher towing speed. The rapido's rigid opening is provided in its lower portion with curved teeth which penetrate into the soft bottom and force soles to swim upwards, entering inside the trawl, and whose upper portion features an inclined wooden board acting as a depressor.
The slides, placed at regular intervals, prevent the teeth from sinking deeper into the mud.
The vertical opening of rapido is rather small (20 cm), while the horizontal one, which depends on the boat's power, usually does not exceed 4 metres. Each boat may tow from two to five rapidos, and the towing speed must be rather high for the gear to operate properly.
The net, directly sewed on the opening, is made up of netting differing in terms of mesh size. Usually, chafer protects the net from wear deriving from friction against the seabed, even though the net is made out of a rather thick, knotless yarn.
Hauls made by resorting to rapido are usually quick.
Rapido is used on smooth and muddy seabed at a relatively small depth, and is therefore a fishing practice widely used in the central and northern Adriatic sea, whereas it is little used in the Tyrrhenian sea.
Ganghero is very similar to the French "gangui". Its opening is made up of a steel pipe with bent ends horizontally measuring 4-5 metres, the two ends measuring 1 metre approximately. Its opening is therefore a rectangle measuring 5x1 metres. The upper portion of the opening acts as a floating rope, while the lower one is made of a loaded cable (Ø = 22 mm) attached to the bottom end of the side bends, on which two small slides are located, enabling the piece of gear to stand. The side bends ensure the vertical opening of the fishing gear.
The net body is made of different netting of trapezoid shape, with mesh of various size. Overall body length from opening to codend reaches 20m. It is generally made of knotless PA, however it is also found in knotless polythene fibre (PE knotless). The knotless net codend is tied at the end by means of a line, and its lower portion is covered by chefer. Ganghero is towed individually and is hauled from the side of the boat, and not from the stern as in the case with other trawls.

Technical features of fixed-opening trawls

FEATURES	RAPIDO	GANGHERO
Horizontal opening	max 4 m	5 m
Vertical opening	20 cm	1 m
Net length	7 m ca	20 m ca
Net mesh	≥ 40 mm	40 mm
Number of gear per boat	2-5	1
Teeth	Yes	Yes
Slides	Yes	No
Fishing depth	10-80	20-40 m
Fishing hours	Day & Night time	Night time
Time of the year	All year round	Winter
Towing system	2-5 ropes	1 rope (it splits at 50 m from the net, then again at 5 m)
Rope fastening points on the net	4	4
Target species	Sole, variegated scallop, great scallop	Scorpion fish, cephalopods, white seabream, sole, picarels, seabasses, blotched picarel
Ground rope	No	PA TR Ø 22 mm. Length 12 m
Sinkers	No	A few kg
Codend length	3 m	2 m
Lining	Yes	Only under the codend

According to Presidential Decree 1639/68 and EU Regulation no. 1626/94, fixed-opening trawls must have a codend mesh size exceeding 40 mm, and must be used outside the three miles from the coast, or on grounds deeper than 50 m.

GSA 9 – LIGURIAN AND NORTHERN-CENTRAL TYRRHENIAN SEA

FISHERY 1 - RAPIDO FOR SOLES

General

In the GSA 9 only a few number of vessels utilise rapido trawl because of the unsuitability of the seabed generally characterised by a narrow continental shelf and rocky outcrops. In addition, according to the national fishing regulations, no new licences may be granted in this area for rapido trawl.

Fishing ground

The area exploited by the vessels of Viareggio consists of the muddy or sand-muddy bottoms occurring from 20 m to 60 m of depth in a wide zone extending from Meloria Bank at South to the Gulf of La Spezia at North, for a surface of about 800 km^2. The rapido trawl vessel of Fiumicino exploits an area of the central Tyrrhenian Sea located between Montalto di Castro (North) and Capo d'Anzio (South), between 10 m and 80 m of depth, for a surface of about 1,000 km^2.

The fleet

In the GSA 9 vessels using rapido trawl are spread out only in a few small fishing harbours along the Tuscany (South–Eastern Ligurian sea) and Latium coasts (Central-Northern Tyrrhenian sea), with a maximum of one-two vessels for each fleet. The fishing vessels utilising rapido trawl belong to the fleet of Viareggio (2 vessels) and Fiumicino (1 vessel).The boats of Viareggio are medium-sized trawlers having an overall length of about 20 m, GRT of 25 and engine power from 162 to 206 kW. The crew includes two people and each vessel tows contemporarily 2 rapido trawls at each haul. The boat of Fiumicino is characterised by 22.7 m of overall length, 316 kW of engine power and GRT of 38.

Fishing time over a year

Rapido trawl trips are generally of 10-12 fishing hours per day and for five days a week (from Monday to Friday). The number of fishing days carried out in each season varies from 47 (fall) to 95 (winter). Due to the medium size of these vessels, bad weather conditions strongly affect the fishing activity all the year round. In addition, one of the two vessels of Viareggio works continuously with rapido trawl, while the other one substitutes this gear with bottom trawl net, especially in winter-spring.
The boat of Fiumicino often alternates rapido with bottom trawl net in the same fishing day, while in a few periods it uses only this last gear.

Fishing equipment

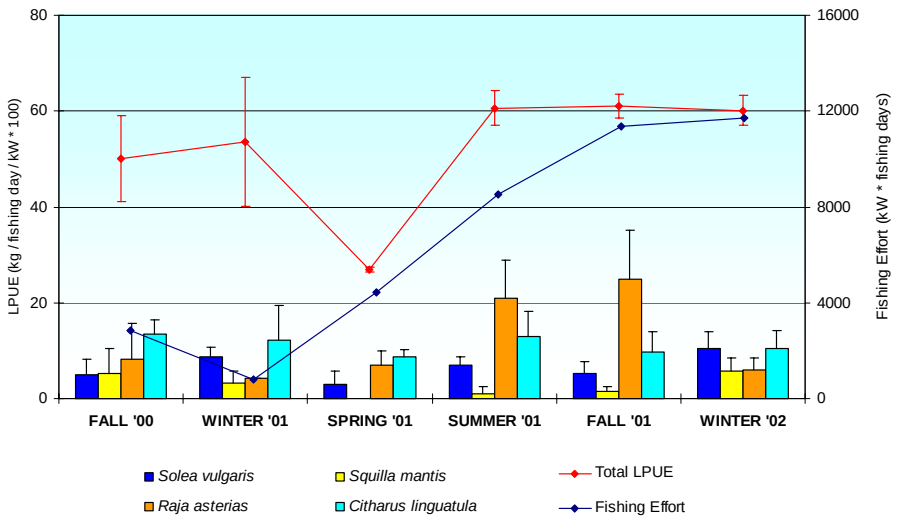
The rapido trawls are very similar to those utilised by the fleets of the northern and central Adriatic sea as regards their technical features, but they have smaller dimensions, being only 3 m wide. They are provided with 4 skids, each 12 cm wide and 70 cm long and the wooden plank (300x32x2.4 cm) placed above the upper side of the iron frame has an angle of about 30° to the ground. Thirty-three iron teeth are fixed to the lower side of the rapido mouth at a distance of 7 cm from each other; they have a diameter of 12 mm and extend 0.5-1 cm behind the tooth bar. The net is 4.8 m long and consists of two portions: the first one is bounded on the rapido mouth; the second one is the codend. The lower portion of the net is protected by a reinforced rubber diamond-mesh matting (stretched mesh size 24x30 cm). Each gear has a total dry weight of about 180 kg.
Two rapido trawls are usually towed at once at a speed of 4-5 knots and each haul lasts about one hour and half. The fishing activity is carried out each day without stopping for about 12 h

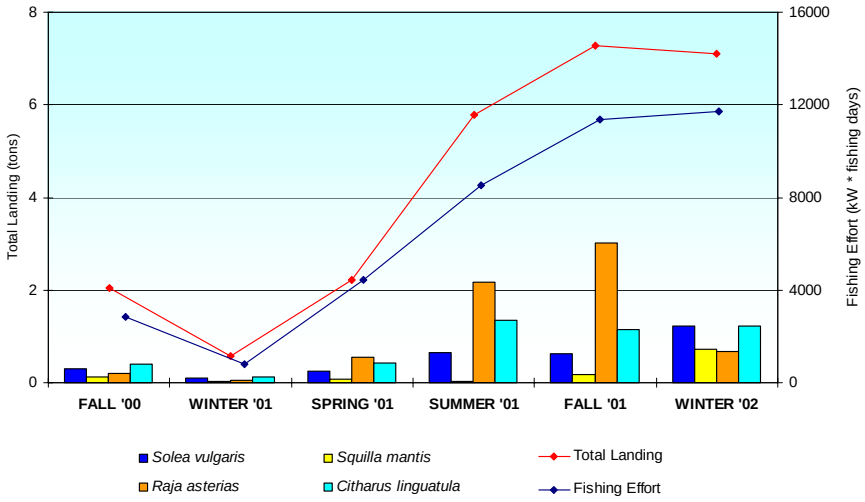
and a total of 7-8 hauls per fishing day are performed.

Deck layout and machinery involved
No particular devices are used by the boats included in this fishery. No changes neither in the gear characteristics nor in the time spent fishing were observed in the last years.

Electronic equipment
All vessels utilise GPS, color echo-sound, plotter and computerised geo-referenced charts.

Data on catches
In Viareggio, the seasonal total landings (all species) showed high fluctuations in the different seasons, ranging from 4.2 t (fall ’00) to 10.1 t (fall ’01). The species accounting for the highest percentage of the landing was *Raja asterias* (33%), followed by *Sepia officinalis* (19%), by *Solea vulgaris* (12%) and by the categories other Cephalopoda and “mixed other fishes” (10%). Lower contributions were given by the category “mixed fried” and by *Squilla mantis* (7%). Other highly valuables species, such as *Scophthalmus rhombus* and *Penaeus kerathurus*, represented each one only 1% of the total landing. The commercialised fraction ranged from 48% to 59% of the total catch in weight according to the different seasons. The discard of non commercial species were crustaceans, gastropods and bivalves. The most important species were *Turritella communis*, *Aporrhais pespelicani* and *Astropecten irregularis* and ranged from 25 to 51% and discard of commercial species from 1 and 17% of the total catch. The most important species of the discard of commercial species were *Liocarcinus depurator*, *Arnoglossus laterna* and *Galeodea echinophora*.
In addition to the total catch of biologic material, noticeable amounts of “debris” are caught. More than 50% of the weight of this material is constituted by stones and wood, mostly due to the intense river supplies which affect the area. Another considerable fraction of “debris” is constituted by dead shells or their fragments of gastropods and bivalves, belonging to the local thanatocenosis.
In Fiumicino the maximum landing value was observed in fall ’01 (7.3 t) and the lowest one in winter ’01 (0.6 t). The species accounting for the highest percentage of the overall landing was *R. asterias* (27%), followed by the spotted flounder *Citharus linguatula* (19%), by the “zuppa” category (16%), by *Solea vulgaris* (12%) and by the other cephalopoda (12%). Other species of high commercial interest, as *P. kerathurus* and the Scophthalmidae (*Psetta maxima* and *S. rhombus*) represented only 0.2% and 1% of the total landing respectively.
The total landing (all species) per unit of effort in Viareggio varied in a fairly narrow range in the different seasons, going from 42 kg/fishing day/kW*100 (winter ’01) to 71.1 kg/fishing day/kW*100 (summer ’01) without a clear seasonal trend. The seasonal LPUE of *S. vulgaris* showed similar values, ranging from 5.5 kg/fishing day/kW*100 (winter ’01) and 7.8 kg/fishing day/kW*100 (summer ’00) with the exception of winter ’02 (3.4). The values of *R. asterias* ranged in a wider interval, reaching the maximum values in spring-summer and the minimum ones in fall. Only the LPUE of *Sepia officinalis* and *S. mantis* showed a clear seasonal pattern. The commercial fraction ranged from 31% to 62% of the total catch in the different seasons, while the discard of non commercial species amounted to the 23-53% and the discard of commercial species to 6-16%.In the fraction of discard of commercial species *C. linguatula* was the most important species and other relevant discarded species were the fishes *A. laterna*, *Gobius niger* and *Buglossidium luteum*.
The discard of non commercial species was mainly constituted by gastropods, bivalves and echinoderms. The most important species were the gastropod *T. communis* and the echinoderms *A. irregularis* and *Trachythyone* sp. “Debris” was recorded also in Fiumicino, but it had a lower importance in respect to Viareggio.





In Fiumicino, according to the seasons, the total landing per unit of effort ranged from 26.9 kg/fishing day/kW*100 (spring ’01) to 61.1 kg/fishing day/kW*100 (fall ’01). The LPUE of *S. vulgaris* showed a seasonal trend with the highest values in winter and the lowest one in spring. A clear seasonality was also observed for *P. kerathurus* and *S. officinalis*. On the contrary, *R. asterias*, showed a fluctuating trend without clear seasonal variations. Seasonal pattern of the average seasonal landing s per unit of effort (LPUE) and of fishing effort of the Fiumicino fleet using rapido trawls in the period summer’00-winter ’02. The average seasonal LPUE of the most important species are also reported.

The size of the specimens of *S. vulgaris* caught in the overall sampling period in Viareggio ranged from 19 cm to 38 cm TL, whose majority (99%) falling in the range 20-34 cm TL. They had an average length of 27.1 cm TL and a modal size at 28 cm TL.

As regards *R. asterias*, the specimens caught fell in the range 8-69 cm TL, although 95% of them are included between 36 and 60 cm TL. The mean total length of the overall catch is 47.8 cm and the modal size is 48 cm TL. The cuttlefishes range from 3 to 17 cm ML, but 95% of them fall into the range 6-13 cm ML. The total catch is characterised by an average mantle length of 9.3 cm and modal size at 8 cm ML.

Interaction with other fisheries

Interactions may occur with bottom trawlers fishing in the same areas. As regards to the competition for the same resource, this type of interaction is found between rapido and set

nets (gillnet, trammel net) operating in the coastal area and mainly exploiting flat fishes (*S. vulgaris*, *R. asterias*). Other resources, such as *S. officinalis* and *S. mantis*, are important species also in the landing of bottom trawlers and of artisanal boats with set nets.

Special features

Relationships between fishing effort, fishing mortality and catch rates

In Viareggio a clear direct relation between the seasonal total landing and the correspondent total fishing effort is observed. The only exception was recorded in winter '02, when the increase of the effort was associated to a slight decrease of landings. Differently from what detected for the total landings, the LPUEs of each species do not show a clear relation with the exerted fishing effort.

In Fiumicino the total landings are directly related to the evolution of the fishing effort which, in this case, reflects the fishing activity. Only the seasonal landing of *R. asterias* shows a good correspondence with the applied fishing effort with the only exception of winter '02, when the landings noticeably decreased conversely to the effort trend.

GSA 17 – NORTHEN AND MIDDLE ADRIATIC

General description of the fishing metier

At present, rapido trawl fishery is very widespread along the Italian coast of the central and Northern Adriatic Sea to exploit soles and scallops. On the basis of ISTAT data in the last 15 years it results that about 50% of the Italian production of sole comes from the Adriatic sea and about its 70% comes from GSA 17 which represents the main spawning and nursery area of common sole in the whole Adriatic basin and coincides with the highest concentration of the species (*Giovanardi, 1984; Piccinetti and Giovanardi, 1984*). The most abundant Adriatic stocks of scallops are also concentrated in this Sub Area. All these resources are shared among Italy, Slovenia and Croatia.

Listing of various fisheries using this fishing metier

Rapido trawls targeting common sole and/or scallops can be considered as belonging to only one fishery, as part of vessels of the northerner departments (Chioggia, Venezia, Monfalcone) may alternate rapido trawl for sole with the rapido trawl for scallops (*Pecten jacobaeus* and *Aequipecten opercularis*), either during the year or from year to year depending on the abundance of the resources. The two types of gears are very similar to each other and the main difference between them is represented by the fishing grounds.

Although the rapido trawl fishery is considered as more selective than bottom trawl net, besides to common sole it catches a pool of other commercial species, some of which can play the role of "secondary" target species thanks to their high commercial value or to their great amounts.

FISHERY 1 - RAPIDO FOR COMMON SOLE

Fishing grounds

The fishing grounds consist of the soft, trawlable bottoms of the continental shelf between 3 and 18 nautical miles offshore and from 10 to 70 m depth.

Fleet

On the basis of a recent census updated to 2003 it results that approximately 146 rapido vessels exist in the maritime departments included in GSA 17: 127 of them are currently targeting the common sole, 6 spend a part of the year catching common sole and the remaining part targeting scallops, while 13 are catching mainly scallops. These two last categories of vessels are concentrated in the northerner departments. Anyway, fluctuations can occur from year to year because the vessels can also turn on other trawl gears (i.e. otter trawl net, pelagic mid-water trawl net) depending on the relative abundance of the different resources.

Description of rapido trawl fleets of the maritime departments included in GSA 17 (2003) and of their activity over the year

Departm.	L_{FT}	N	LFT±se	GRT±se	kW±se	Rapido trawls		Activity		Crew	Target
						N.	Width	Hours/ week/ boat	Months/ year		
Termoli	>12 m	5	22.1±2.0	61.1±12.5	302.8±50.1	3-5	2.8-3.5	80	7	3-5	sole
Pescara	>12 m	6	22.1±0.9	48.2±5.8	247.1±27.3	4-5	3.2-3.6	82	11	4	sole
S.Benedet-to del Tronto	≤12 m	24	10.0±0.3	5.2±0.3	67.4±4.5	2	1.2	48	11	1-2	sole
	>12 m	9	15.8±1.1	14.6±2.8	119.6±12.2	2-4	1.2-3.6	84	11	2-4	sole
Ancona	>12 m	21	23.9±1.1	65.5±8.7	357.6±45.8	2-4	1.9-4.0	72	11	2-6	sole
Pesaro	≤12 m	1	11.5		88	2	2.0	60	6		sole
	>12 m	5	17.5±1.5	30.6±7.0	159.1±20.3	2-4	2.5-3.2	66	8	3-5	sole
Rimini	>12 m	16	20.9±1.2	44.7±9.9	285.9±33.1	2-4	2.4-3.5	79	11	2-6	sole
Chioggia°	>12 m	38	22.3±0.4	54.6±3.1	368.2±20.4	4	3.0	76	6-11*		sole
	>12 m	4	21.8±1.3	51.5±10.8	369.3±92.1	4	3.0	60	11		scallops
Venezia	>12 m	3	15.5±1.6	18.2±8.3	230.9±52.9	2-4	2.0-3.0	35	11		sole + scallops
Monfalc.	>12 m	2	17.9±0.2	22.2±2.0	262.5±87.5	4	2.0	26	10	3	sole
	>12 m	9	16.6±0.4	19.4±1.1	203.6±15.6	4	2.0	26	11	3	scallops
	>12 m	3	15.3±0.6	18.4±6.1	234.0±54.6	4	2.0	41	8	3-6	sole + scallops

° Data from ICRAM-Venezia

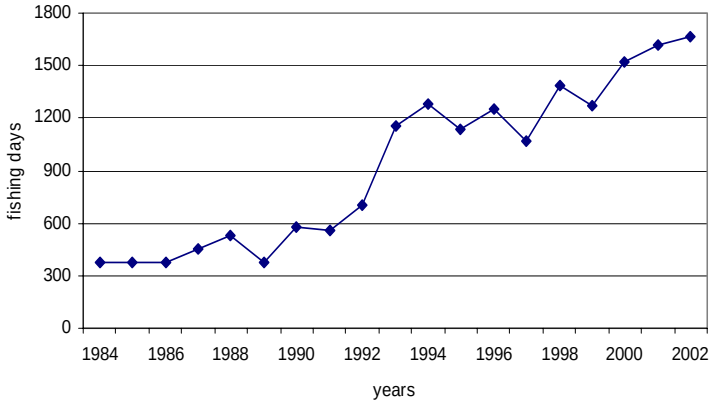
* N. 5 vessels change to pelagic trawls in spring-summer

The capacity of fleets devoted to this fishery showed a tendency to increase both as number of vessels and engine power in a few areas during the last decade.

Fishing time over the year

The haul lasts about one hour. In the past, rapido trawl was mainly fished by night, alternated with bottom otter trawl by day. Since the beginning of 1990's, the largest vessels of a few harbours (i.e. Ancona and Rimini) began to use it night and day without stopping for about 24h and a total of 15-18 hauls per fishing day.

The smaller vessels usually fish from early morning to afternoon, for an average of 12 hours/day. As shown in the above table, most of fleets fish five days a week (from Monday to Friday) up to a maximum of 84 hours/week all the year round, but some of them operate from Monday to Thursday (i.e. Monfalcone, Ancona, San Benedetto del Tronto). The following picture shows the increasing trend of the fishing activity carried out by the Ancona fleet over the last two decades.



Days spent fishing over the last two decades

Fishing equipment

As already mentioned, the rapido trawl used in the GSA 17 resembles a toothed beam-trawl and is made of an iron frame provided with 3-5 skids and a toothed bar on its lower side. The teeth are fixed at a distance of 6-7 cm from each other and extend 0.5-1 cm behind the toothed bar. A wooden plank having an angle of about 30° to the ground is fitted to the front of the iron frame to act as a spoiler keeping the trawl in contact with the seabed. A nylon net bag is tied to the frame and its lower side is protected by a reinforced rubber diamond-mesh matting.

The codend mesh size is generally larger than the minimum legal size (40 mm; EC Reg. 1626/94), ranging from 48 to 52 mm (stretched) in the rapido trawls for common soles. The rapido trawls employed to catch scallops usually have larger mesh sizes and longer teeth (*Hall-Spencer, 1995; Hall-Spencer et al., 2000*).

Size (width of mouth opening) of gears can vary from 1.2 m to 4.0 m, mostly in function of the size and the engine power of the boat. As a general rule, the smallest vessels use gears of smaller dimensions.

Over the time, technical changes have been made to the gear in order to increase its efficiency. These changes mainly consisted of an increase of mouth width and of total weight of the gear, as well as of other small technical features which made the rapido trawl either more stable, so to be fished at higher speed, and able to enter more deeply into the sediment. They permitted to increase the swept area and to exploit former unexploited fishing grounds.

Similarly to the size, also the number of rapido trawls vary from 2 to 5, depending on the size and the engine power of the boat. As a general rule, the smallest vessels use a lower number of gears in respect to the biggest ones. The number of towed gears increased over the time, as a consequence of the adoption of lateral poles (see picture above), which keep the gears far from each other, and the increment of the engine power. Besides to allow of towing a high number of rapido trawls, the increased engine power also permitted a high speed, so leading to

a substantial increase of the swept area and gear efficiency. In fact, at present rapido trawls are usually towed at a greater speed (6-7 knots) in comparison to the otter trawl nets.

Deck layout and machinery involved

The deck machinery involved mainly consists of a trawl winch and two gilsons used for hauling onboard and emptying the codend. No significant changes occurred over the years on these equipments which could have substantially affected gear efficiency and fishing capacity.

Electronic equipments

The electronic equipment currently consists of one or two radars, GPS, echo sounder, navigation plotter or, in a few cases, navigation computer. Introduction of GPS, double-frequency echo sounder and navigation plotter occurred between the end of 1980's and the beginning of 1990's. These equipment were likely to increase the vessel fishing efficiency as they allowed to explore new fishing grounds not exploited before.

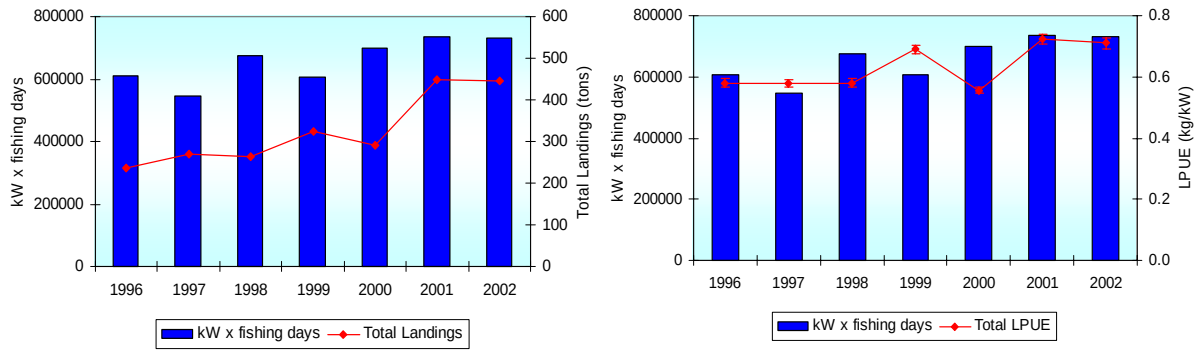
Data on catches

a) Landings and LPUEs

Landing data were collected over a period of seven years (1996-2002) using the daily auction documents of the Ancona rapido trawl fleet targeting common sole, which is one of the most representative fleet for this activity in GSA 17. Data obtained in this way were compared with those recorded directly at the landing site during periodical visits in order to evaluate the eventual percentage of product sold out of the official market. In the years 2000-2002 the same investigations were also carried out on the Rimini rapido trawl fleet inside the EU Study Project 99/51 (*Fabi and Sartor*, 2002). Because the data concerning the two fleets were very similar, in this contest only those of the Ancona fleet have been reported because they refer to a longer time period.

Comparison between the landing data reported on the auction documents and those collected at the landing site evidenced that about 30% of Ancona fleet's total landings is sold out of the official fishing market in order to get a higher income (*Fabi and Sartor, 2002*).

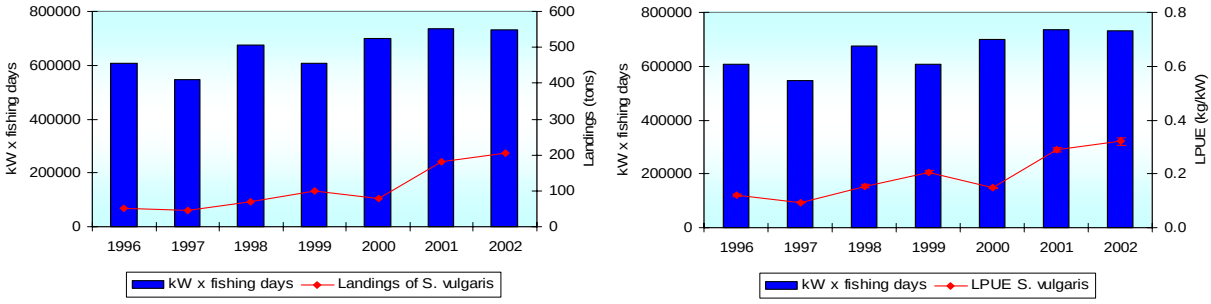
Total landings show a gradual increase, reaching in the last two years approximately 450 t, corresponding to about twice the total amounts landed in 1996. LPUE remained practically stable over the period ranging from 0.6 to 0.7 kg/kW.



Ancona rapido trawl fleet targeting common sole. Trends of total fishing effort, total landings and LPUE (1996-2002).

The most important target species, *S. vulgaris,* accounted from 17% to 46% of the annual

landed catch in weight. Over the period 1996-2002 total landings and LPUE of this species, computed on the basis of the auction documents, gradually increased until to reach in 2001-02 values corresponding to 4 and 3 times respectively those recorded in 1996-97. Also in this case data here reported are likely to be underestimated because the observations carried out at the landing sites evidenced that about 40% of the catch of this species is usually sold out of the official market.



Ancona rapido trawl fleet targeting common sole. Fleet trends of total fishing effort, total landings and LPUE of soles.

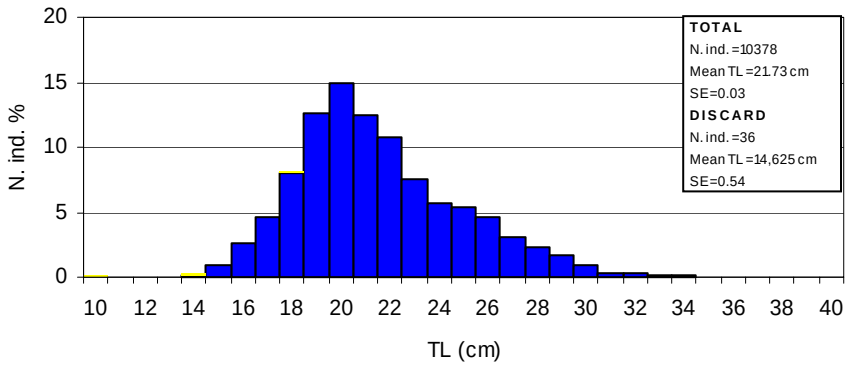
b) Catch composition

Further data on catch composition of the fleets targeting common sole were obtained through observations aboard of commercial vessels carried out over a two-years period (2000-02) at 20-days intervals (*EU Study Project 99/51; Fabi and Sartor, 2002*). Data collected in this contest are summarised in the table reported below. It shows that, besides the common sole, the rapido trawl catches also include a pool of commercial species, some of which assume the role of "secondary" target species, thanks to either their high commercial value or great amounts. These species are: *Squilla mantis*, *Sepia officinalis, Trigla lucerna, Penaeus kerathurus, Bolinus brandaris*.

Ancona rapido trawl fleet. Composition of the commercial catches (*2000-02; Fabi and Sartor, 2002*)

Rapido Trawl for Sole								
Codend Mesh Size	48-52 mm (stretched)							
	Landed Catch		Discard C		Discard NC		Total Catch	
	Weight (%)	Number (%)	Weight (%)	Number (%)	Weight (%)	Number (%)	Weight (%)	Number (%)
Solea vulgaris	**40**	**25**					**8**	**1**
Squilla mantis	22	30					5	1
Sepia officinalis	6	2					1	*
Bolinus brandaris	5	15					1	*
Trigla lucerna	5	3					1	*
Penaeus kerathurus	4	10					1	*
Raja asterias	2	*					*	*
Scophthalmus rhombus	2	*					*	*
Arnoglossus laterna	1	4					*	*
Aporrhais pespelecani			58	77			29	32
Ostrea edulis			21	7			11	3
Liocarcinus depurator			15	12			8	5
Anadara inaequivalvis					46	10	13	5
Astropecten irregularis					13	8	4	5
Corbula gibba					11	59	3	34
Anadara demiri					8	7	2	4
Goneplax rhomboides					6	2	2	1
Others	13	10	6	4	16	14	10	9

Spottail mantis shrimp (*S. mantis*) results the second most important species for this type of fishery both in terms of biomass and abundance, accounting for about 22% in weight and 30% in number of individuals of the overall landed catch, with lower values in winter-spring and higher ones in summer-fall, when the amounts of this stomatopod in catches become very similar to those of *S. vulgaris*. The percentage contribution of the other relevant species to the landed catch ranges from 4% to 6% in weight and from 2% to 15% in number of specimens.
The demographic structure of the catches of the above mentioned species is described below.
The sole catches of rapido trawls fall in the range 10.0-36.0 cm TL with an average Total Length of 21.73 cm.
Most of the total catch consist of juveniles belonging to age classes 0 and 1 as shown in the following table realised on the basis of the parameters of the Von Bertalanffy model estimated by *Froglia and Giannetti* (1985; 1986) through the otolith reading method.

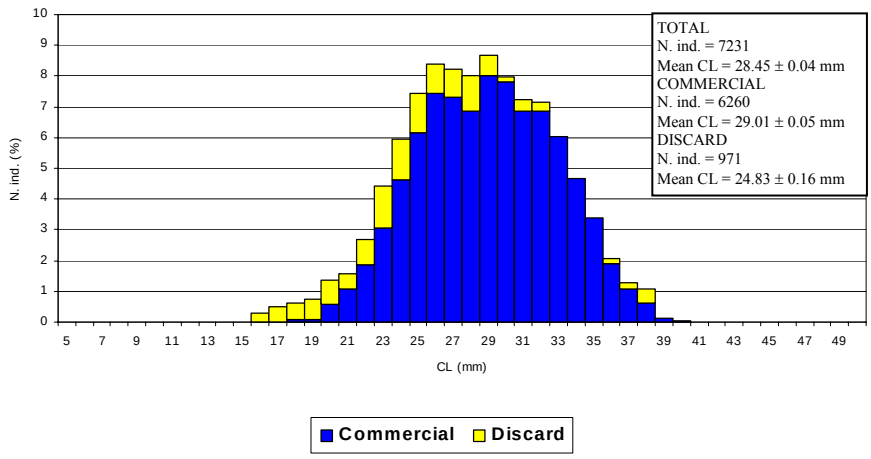


Northern Adriatic Sea. Size-frequency distribution of the overall catch of S. vulgaris recorded during the observations aboard (2000 – 02). Discarded individuals are in yellow.

Northern Adriatic sea. Length/age composition of the commercial catches of S. vulgaris

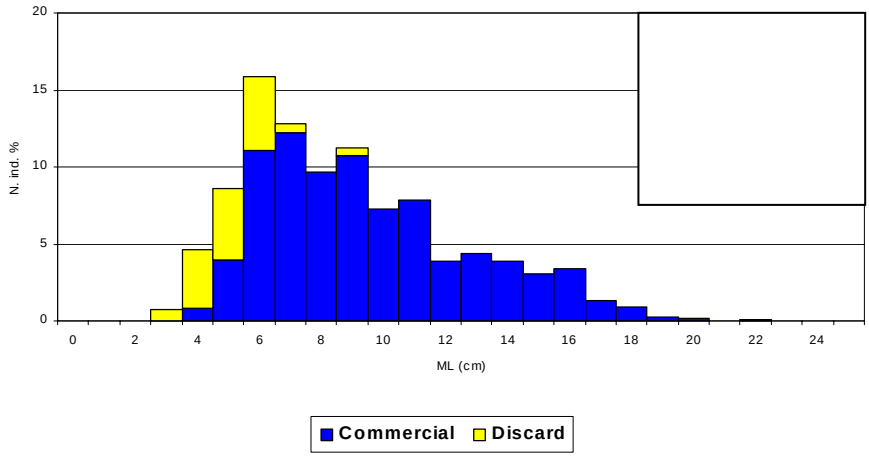
Length (cm) / Age class			13-18 / 0		19-25 / 1		26-30 / 2		31-33 / 3		34-35 / 4		36 / 5	
Species	GSA		W%	N%	W%	N%	W%	N%	W%	N%	W%	N%	W%	N%
Solea vulgaris	17	Rapido trawl - 48 mm mesh	7.47	16.51	64.31	69.88	24.97	12.63	2.64	0.83	0.47	0.12	0.14	0.03

The specimens of spottail mantis shrimp caught by rapido trawls in the two-year period measure from 15.0 mm to 44.0 mm CL, but most of them (99%) fall into the interval 16.0-38.0 mm CL. The total catch has a mean Carapax Length of 28.45 mm and a modal size at 29.0 mm CL. Considering a size at first maturity ranging between 20.0 mm and 24.0 mm CL (*Piccinetti and Piccinetti Manfrin, 1970; Do Chi, 1975; Abelló and Sardà, 1989*), from 13% to 39% of the individuals caught are smaller than this size range.



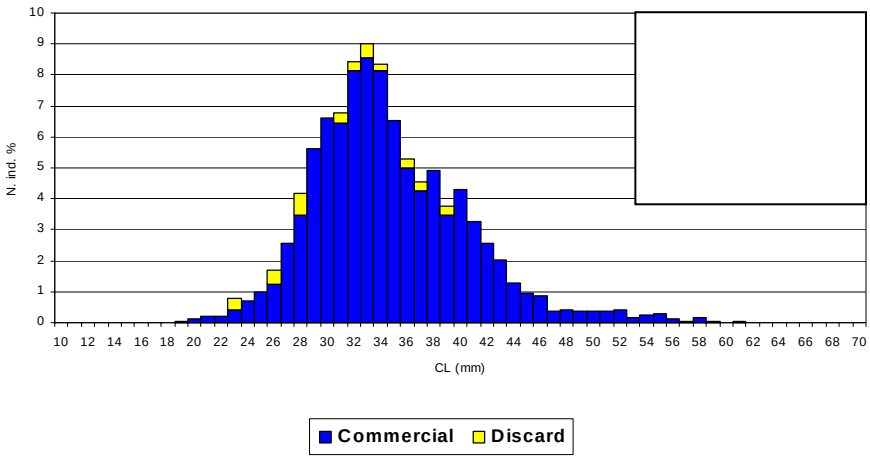
Northern Adriatic Sea. Size-frequency distribution of the overall catch of S. mantis recorded during the observations aboard (2000–02). Discarded individuals are in yellow.

The Mantle Length of the cuttlefishes caught in 2000-02 ranged from 3.0 cm to 22.0 cm, but 96% of them fell in the interval 4.0-16.0 cm ML. The average size was 9.29 cm ML and the modal size was at 6.0 cm ML.



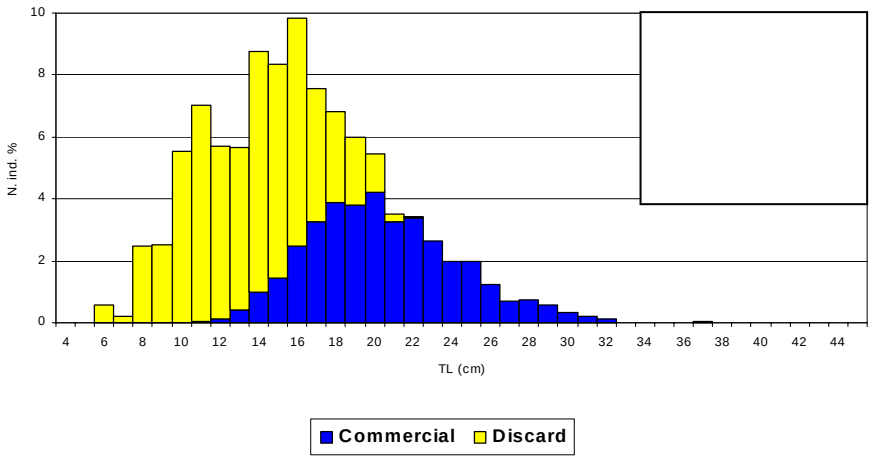
Northern Adriatic Sea. Size-frequency distribution of the overall catch of S. officinalis recorded during the observations aboard (2000 – 02). Discarded individuals are in yellow.

The size of the caramote prawns (*P. kerathurus*) in catches ranges from 19.0 mm to 61.0 mm CL, with 96% of them falling into the interval 23.0–46.0 mm CL. The total catch was characterized by an average Carapax Length of 34.61 mm and a modal size at 33.0 mm CL. Taking into account a size at first maturity of 21.0 mm CL for males and 28.0 mm CL for females (*Rodriguez, 1987*), the percentage of juveniles in the catches was 0.4% and 9.5% respectively.



Northern Adriatic Sea. Size-frequency distribution of the overall catch of P. kerathurus recorded during the observations aboard (2000 – 02). Discarded individuals are in yellow.

Catches of tub gurnard (*T. lucerna*) fall into the size range 6.0-37.0 cm TL, but about 96% of them were included from 8.0 cm and 26.0 cm TL. The total catch was characterized by an average length of 16.40 cm TL and a modal size at 16 cm TL. Most of catches (92%) consist of individuals smaller than the size at first maturity reported for this species in the area (24.0 cm TL; *Froglia, 1984*).



Northern Adriatic Sea. Size-frequency distribution of the overall catch of T. lucerna recorded during the observations aboard (2000 – 02). Discarded individuals are in yellow.

Other accompanying species of this fishery are: brill (*Scophtalmus rhombus*), turbot (*Psetta maxima*), ray fish (*Raja asterias*), scaldfish (*Arnoglossus laterna*), black goby (*Gobius niger*), horned octopus (*Eledone cirrhosa*). Some of these, such as scaldfish and black goby are sometimes not retained because of the their low commercial value and the too much work required by their sorting.

c) Discard

Discard of commercial species assumes a noticeable importance in the total catch of rapido trawls, representing up to 30% in weight and 40% in number of individuals. The most important species of this fraction are the gastropod *Aporrhais pespelecani*, the bivalve *Ostrea*

edulis and the decapod *Liocarcinus depurator* which are generally discarded because they have a too low commercial value for this fishery in respect to the work required by their sorting and, in the case of *O. edulis*, by the subsequent sanitation processes. The remaining portion of discard includes small, scarcely marketable specimens of *B. brandaris, T. lucerna* and *S. mantis*, by damaged individuals of *A. laterna* as well as by *Natica stercusmuscarum* and *G. niger* that often have a scarce commercial value. As concerns *T. lucerna*, it is worthy to note that discard is relevant in number of individuals, accounting for about 60% of the total catch of this species.
Discard of sole, caramote prawn and cuttlefish is always negligible, because also the rare damaged specimens are currently sold, even though at lower prices in respect to the intact individuals.

Technical interactions with other fisheries
There is an overlapping between this fishery and artisanal fleets using set gears and bottom trawl net fishery. In the former case there is both a spatial interaction, which restricts the small-scale fisheries in the coastal areas inside three miles offshore to avoid the risk of loosing the gears, and a competition for the same resources, especially common sole, cuttlefish and spottail mantis shrimp (*Fabi et al*., *2002*). Bottom trawl net and rapido trawl targeting common sole interact for the space, exploiting the same fishing grounds, while they overlap only for a few resources, such as gurnards and cuttlefish, having a different catch efficiency towards each single species and a different catch composition.

Relationships between fishing effort and catch rates
Trends of fishing effort (kW x days), overall LPUE and sole LPUE of the Ancona fleet over the years 1996-2002 are shown in graphics reported before.
In 2001-02 the fishing effort showed an increase of about 11% on the average calculated on the overall period. At the same time, total LPUEs remained practically constant, while the LPUEs of common sole gradually increased. In 2001-02 an increment of about 60% on the average of the overall period was recorded. Although this would seem to indicate a good reaction of the stock, the prevalence of juveniles in the catches suggests caution in the exploitation of the resource by this fishery.

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GREECE

This fishing method is not practised in Greece.

CAP. 2 - PURSE SEINE

SPAIN

The purse seine fleet from the South Mediterranean Region (SMR) continuously decreased in the last two decades, reaching a total of 321 vessels in 2003. The purse seine is not authorised in water shallower than 35 m. The minimum distance between boats is 500 m. Fishing only 5 days a week, during 23 hours a day. The fishery is forbidden from Saturday night to Sunday.

GSA 1 – NORTHERN ALBORAN SEA

FISHERY 1 - SMALL PELAGICS

The present situation of the purse seine fishery in the GSA 1 has been described by *Giráldez & Alemany (2002)* and was presented to the WG on Small Pelagics of the GFCM-SCSA meeting held in March 2002.

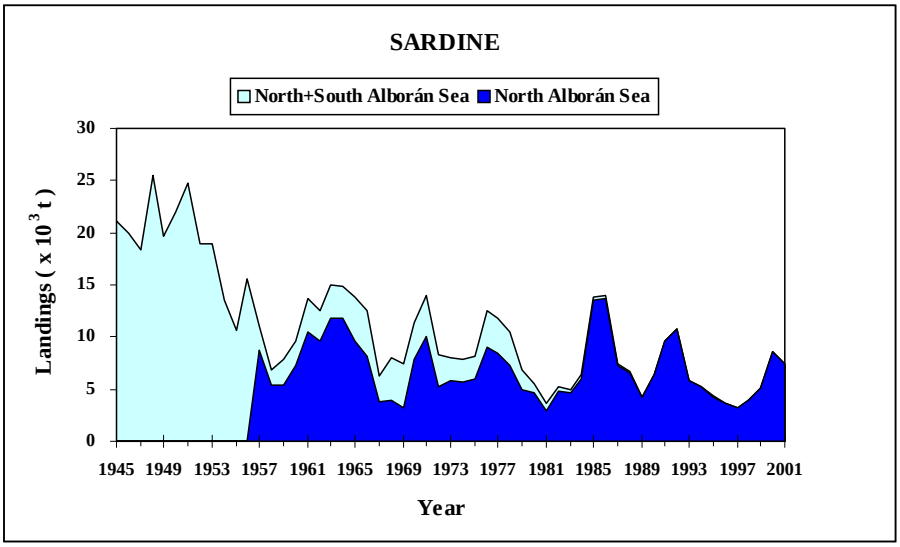
Sardine (*Sardina pilchardus*) and anchovy (*Engraulis encrasicolus*) are the main target species of the purse seine fleet, but other species with lower economical importance are also captured, sometimes representing a high percentage of the capture: horse mackerel (*Trachurus* spp.), mackerel (*Scomber* spp.), frigate mackerel (*Auxis rochei)*, Atlantic saury (*Scomberesox saurus*) and gilt sardine (*Sardinella aurita*). This report is exclusively focused on fishery of anchovy and sardine.

Main harbours of the GSA 1

Historical series of catches (from 1945 to 2001) were obtained from the files of the "Secretaría General de Pesca" (from 1945 to 1986) and "Fondo de Regulación y Ordenación de Mercado" and "Instituto Español de Oceanografía" (from 1987 to 2001).

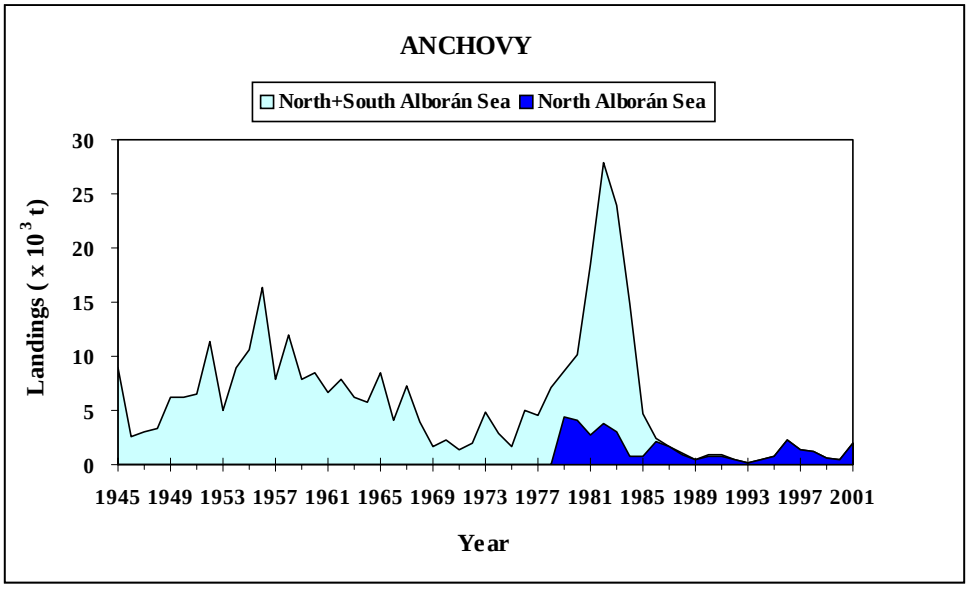
Sardine. From 1945 to 1956, a high percentage of catches were made in Northern Africa, but the independence of Morocco in 1956, as well as the loss of interest on this species by the vessels from the harbour of Melilla, originated that catches in Northern Africa decreased to undetectable amounts from 1985 onwards. On the other hand, an up-an-down pattern was observed in the Northern Alborán Sea from 1956 to the present.

Before 60's, sardine was the species with highest economical value, but the price of anchovy and sardine were balanced in 1962. Then, the value of the anchovy followed going up, originating that the purse seine fleet focused on this species rather than sardine from mid 60's onwards.



Landings of sardine in the South-Mediterranean Region (1945-2001)

Anchovy. It was impossible to discriminate the catches of anchovy from Southern and Northern Alboran Sea before 1978. The economical value of anchovy was low during 40´s and 50´s, but it was catched by fishing vessels from Ceuta and Melilla, as well as from harbours from Northern area. From the end of the 70´s to 1984, a very important catch area was located in Southern Alboran Sea, where Spanish vessels worked in the framework of an International Fishing Agreement with the Kingdom of Morocco. Twenty eight thousands metric tonnes of anchovy were landed in 1982 in the Spanish harbours from SMR, corresponding a 87% to the catches from Southern area, and a 13% from the Northern one (*Giráldez & Abad, 1991*).

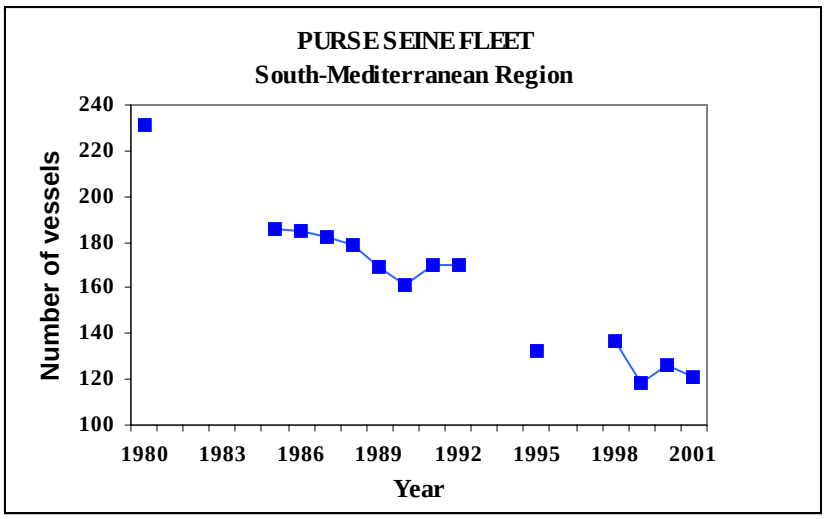


Landings of anchovy in the South-Mediterranean Region (1945-2001)

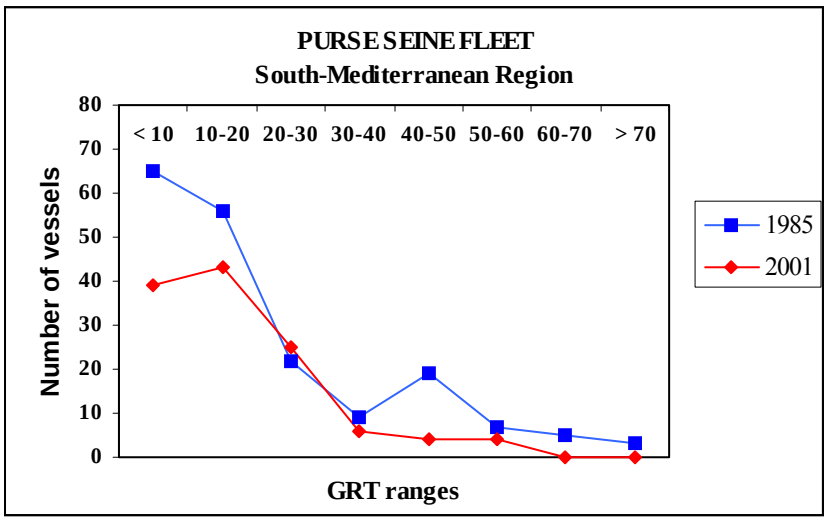
Landings in the Northern area reached a minimum of 157 metric tonnes in 1993; moreover, an unsuccessful recruitment occurred in this year, possibly linked to a demographic bloom of *Capros aper* in the Alboran Sea (*Abad & Giráldez, 1990*).

Fleet

The purse seine fleet from the SMR continuously decreased decreased in the last two decades, from more than 230 vessels in 1980 to 120 in 2001. The present fleet is characterised by low levels of GRT: 93% of the vessels are lower than 40 GRT, with an overall mean of 17.2 GRT. A strong reduction of larger vessels occurred from 1985 onwards, possibly linked to the decreasement in anchovy catches in Northern Morocco. At the present, only few vessels with a high GRT are working; typically, they move to the Spanish Levante area (from Adra and Almería).



Evolution the number of vessels in the South–Mediterranean Region



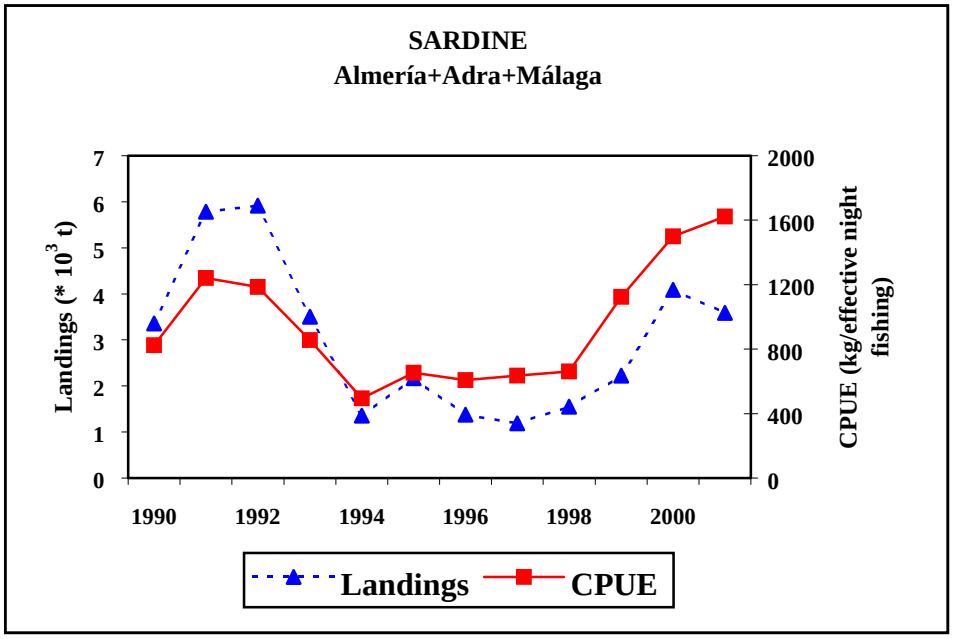
Evolution of the GRT ranges in 1985 and 2001 in the South–Mediterranean Region

Fishing time over a year
The principal fishery time periods of sardine and anchovy are summer-autumn and autumn, respectively.

Fishing grounds
At present, the sardine is caught in all the areas, but its economical importance is low. Anchovy is the most important species on the basis of its high economical value; it is caught in the Málaga Bay principally. Fleets from all the harbours in SMR concentrate in Málaga Bay during the years of high catches of anchovy, but they land in the harbour of Málaga (*Abad & Giráldez, 1990,1997; Giráldez & Abad, 1991*) because the landings are carried out in the closer harbours to the catch areas.

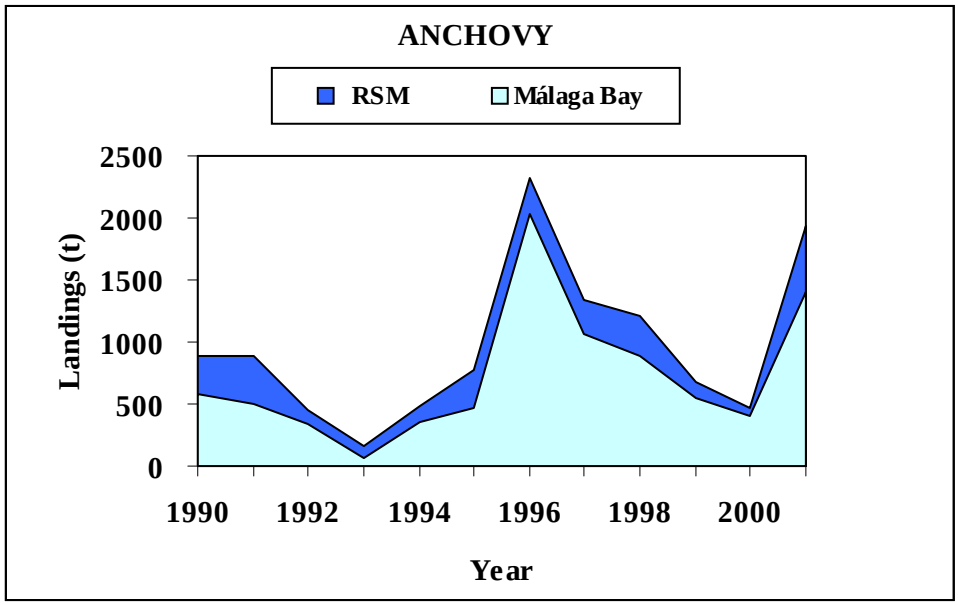
Catches and fishing effort
The selected effort unit was the effective night fishing. The historical series of catches and efforts for sardine correspond to the data from the most important harbours (Málaga, Adra and Almería) while the data from the Málaga harbour was used for the anchovy.

Sardine. A peak of landings was found in 1991-1992, but they decreased to an overall mean value of 1000-2000 metric tonnes during 1994-1998; then, landings recovered during last four years. Moreover, the CPUE values reached a peak in the last years, suggesting an increasement in efficiency of the fishery effort.

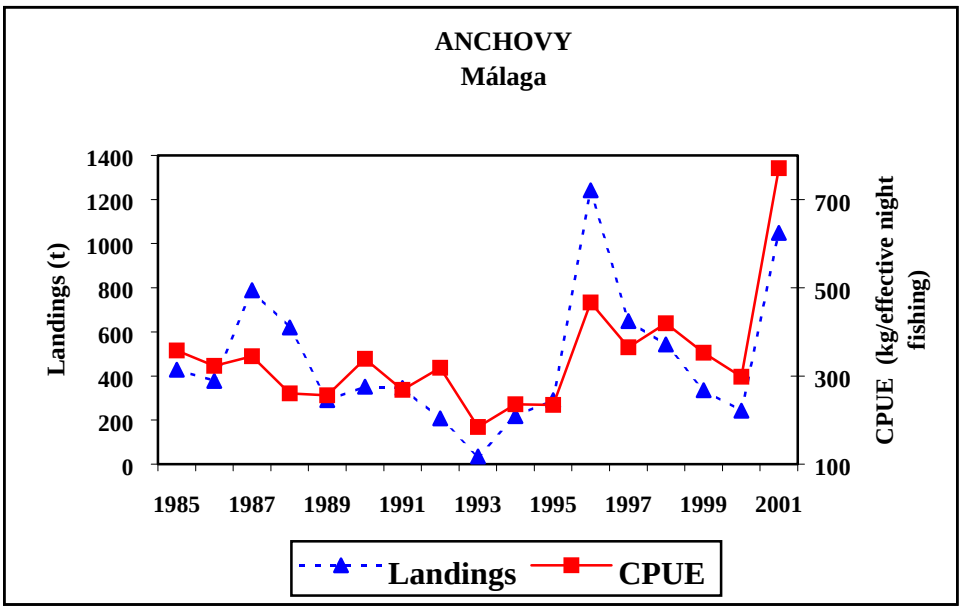


Yearly evolution of catches of sardine and CPUE, for three main harbours of the South-Mediterranean Region

Anchovy. It must be emphasised that the fishery of anchovy in the Malaga Bay is exclusively focused on individuals from early age classes because older age classes are not found: almost all the catch correspond to class 0, and few individuals from class 1 are also caught. Individuals from class ≥2 were only found in one of the years during the study period, and they were lower than 1% of the total. Therefore, high levels of catches usually correlate with successful and high recruitment periods, while unsuccessful recruitments in a given year correlate with low levels of catches.



Catches of anchovy in the SMR and Málaga Bay from 1990 to 2001.



Yearly evolution of catches of anchovy and CPUE in the Málaga Bay.

The catches of anchovy in the Málaga Bay were 85% of the total from the SMR. The catches of anchovy dramatically decreased from 1987 to 1993 (when 35 metric tonnes were landed), but then recovered in 1996. A new diminution of landings occurred in the following years, reaching a minimum in 2000. Finally, a strong increment of landings was recorded in 2001. The values of CPUE reached the highest level in 2001.

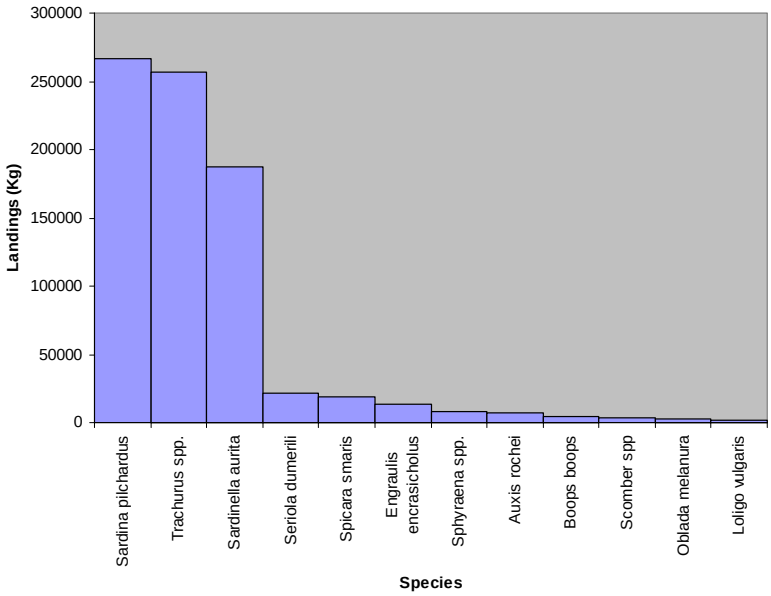
At the present, the Málaga Bay is the only one place with a catch area in the North of the Alboran Sea.

GSA 5 - BALEARIC ISLANDS

FISHERY 1 - SMALL PELAGICS

General

Purse seine fleet in this area is composed by 12 boats, with a medium size of 11.2 m. In mean each boat fish 170 days per year. Total catches amount 800 t by year, composed mainly by sardine (*Sardina pilchardus*), horse mackerel (*Trachurus* spp.), gilt sardine (*Sardinella aurita*) and anchovy (*Engraulis encrasicolus*) in order of importance of catch volume. Other species with lower economical importance are also captured, sometimes representing a high percentage of the capture: mackerel (*Scomber* spp.), amberjack (*Seriola dumerilii*), boge (Boops boops), etc..



FISHERY 2 - BLUEFIN TUNA

General

This fishery takes place in Mediterranean waters surrounding the Balearic Islands. The activity profits the spawners concentration in the spawning season. Activity takes place from April to October and is developed traditionally by one fleet composed by seven vessels. This fishery represents around the 70 % of the Spanish total catch in Mediterranean waters. The mean yearly catch for the 1999- 2002 period reached 1 580 t.

Species	***Gear***	***Year***			
Bluefin tuna		**1999**	**2000**	**2001**	**2002**
	Purse seine	1504 t	1676 t	1453 t	1686 t

Nowadays there are not abundance index calculations for the Spanish fisheries, because of the new fishing strategies (cooperation between vessels, grouping of vessel in fleets, etc.). Those circumstances makes not valid the effort measures traditionally used, because they imply that fishing mortality is not accurately reflected.

There are a multianual Recovery Plan (2003 to 2006) considering an annual TAC of 32 000 t for the East Atlantic and Mediterranean Blue fin tuna stock. It is not allowed fishing in August, as well as the use of planes or helicopters helping fishing during June. It is forbidden to keep aboard, land or sell blue fin tuna of age class 0 (weight less than 3.2 kg).

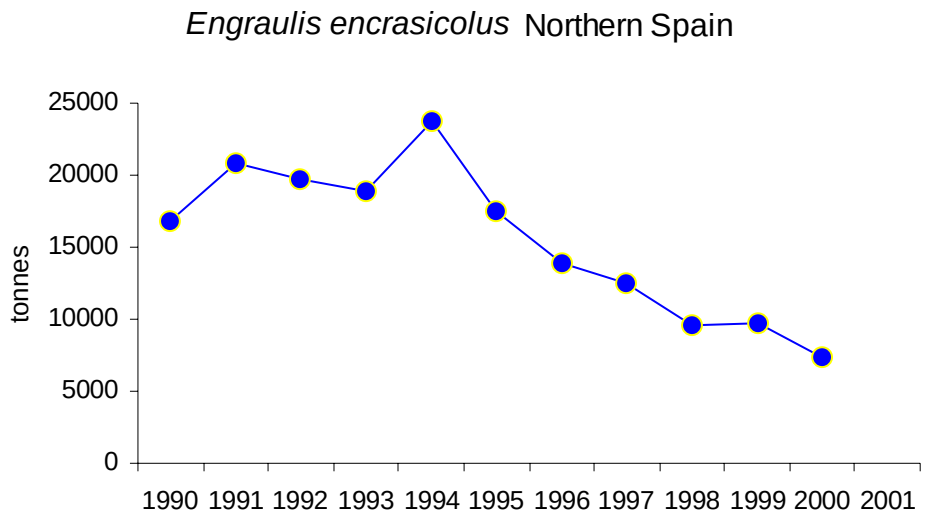
GSA 6 - NORTHERN SPAIN

FISHERY 1 - SMALL PELAGICS

General

The purse seine fishery in this Geographical subarea is carried out for 179 vessels with a medium size of 16 m length. The number of vessels decreased by 20% from 1998 to 2001. The target species is anchovy, and other small pelagics species as, sardine, *Trachurus* spp. or *Scomber* spp. also is fished. Occasionally *Sardinella aurita* is fished as bait for the long-lining fleet or as food for the fattening of tuna.

From 1990 to 1994 the annual anchovy catch ranged between 17000 t and 24000 t, maximum annual catch for the period 1990-2000. From 1994 annual catches have progressively decreased, down to 7350 t.



Anchovy catches over ten years

FRANCE

GSA 7 – GULF OF LION

FISHERY 1 - BLUEFIN TUNA

Fishing grounds

The tuna purse seiners fishing strategy follows 3 seasonal exploitation diagrams which are more dependant on the season and the fishing areas than the vessels size or the equipment.
Areas frequented by the French purse seiners are:
- Gulf of Lion and Catalan sea, which are exploited from March to April and from August to November,
- Balearic Islands waters which is the main fishery for the big tunas catch from May to July.
- Libya and Malta waters.

The Ligurian sea which was during 15th years the main fishery areas for the French fleet oriented on the catch of small tunas during the summer time and now was more or less left since 10 years ago by the fleet, partly in reason of the importance of the Balearic Islands.
Since last 5 years, the waters of the South of Malta Islands are exploited.

Fleet

The French bluefin fishery is presently exploited by a fleet, which is composed of around 33 purse seiners 13 years old; they have the following mean values: 33 m (length) and 689 kW (power).

	LOA	GT	P (kW)
min	22,9	58	316
max	45,6	347	1600
mean	33	190	689

Fishing time

The French purse seiners fleet exercises their fishing activity during about 8 months, from the end of March to the end of November, at the rate of less of 150 fishing days per year and around 250 of fitting out days registered.

Fishing equipment

The total length of the purse seine which was around of 600m in 1961 reach now in 1999 2000m for the biggest purse seiner while the stretched depth of the net pass in the same time from 70 to 230 m and the biggest mesh size from 180 to 240 mm.

Deck-layout and machinery involved

In 1976 appeared the first 27 m units in polyester built by local shipyards. Besides one steel made unit built in 1985 this type of vessels will mark lastingly the fleet as being the Mediterranean style for tuna purse seiners until this last years. Nevertheless, the need to prospect more far fishing grounds conducts some owners to look for more secured solution allowing more bigger loading capacity as 1994 see the introduction of the Atlantic steel series.
Gas oil capacity was increased from 8 m^3 in 1967 to 40 m^3 in 1996 and for water tank from 0,2 m^3 to 7 m^3 for the same period, allowing now an autonomy of 1 month for the most recent vessels.

Thanks to new type hull and increase of propulsion power, the speed is the double of the 60^{s} with a maximum around 18 knots.

Purse-winch

They had 5 tons of pulling by drum for a 1m/sec speed. The pull strength is therefore passed from 3 to 9 tonnes and the diameter of the cable from 16 to 22 mm.

Power-block

It was in 1960 that the first power-block appears on Mediterranean purse seiners. This mechanic then hydraulic rubber system was quickly replaced in 1975 by Italian type power-block in stainless steel with winks. At the end of the 80^{s} , their power are now from 3 to 4 tons of pulling. To day the biggest' reach 100 HP.

Cranes

Since the beginning of the 70^{s} a hydraulic crane begun to replace progressively the traditional beam to support the power-block; its strength passing from 4t to 32tons/m now. Around the 80^{s} one another crane of lower power was installed in the middle of the deck for brailing and storing the catch in the hold. In last a third one was recently added for hauling the lower part of the net.

Propulsion equipment

The most part of the fleet is equipped with fixed pitch propeller. They are designed for speed. Speed remaining more important than manoeuvrability, only few boats owned controllable pitch propellers in 1994 and only one big purse seiner is using a Schottel system. The most recent vessels are equipped with 2 propellers.

Side thrusters

Bow side thrusters were recently introduced (1992) as help for manoeuvring in harbour and also during the hauling net phase. Only the most recent vessels own stern side thruster. Their development and particularly their adaptation to the oldest units of the fleet are limited by the wide of the hull.

Storage Equipment

Until 1966 the fish hold capacity was not above 25m^3. It reaches more than 45 m^3 in 1973 for the new purse seiner type. But for the most part of the fleet, the main use of hulls was to store ice. Small captures did not need long time storage, and for exceptionally large catch, the capture was remained on the deck all the carrying travel to land (Legislation agreeing a limit of 20 tons limit as deck load). The fibreglass generation has introduced refrigeration for 2 or 3 days storing and from this time the capture began to be treated better and stored in hull.

The weight of stored tunas depends on the ice quantity which is passed from more than 80 % of the hold capacity in the '70 to nearly 50 % to day as a capacity of 80 m^3 was sufficient to keep cold 40 to 50 t of small tunas with ice (with an additional capacity of 20 tons on deck).

Japanese demand for big tunas and distance of fishing area called for bigger storage volume and more efficient fish processing. In 1996 the volume of the fish holds reached 180 m^3. To carry the tunas to a landing harbour, catch carrier vessels with deep freezing storage were used since 1993. These carrier vessels have reached the number of 20 in 1997. These boats have large capacities of freezing and chilling big tunas (300 to 700 t). The floating traps one used by the Australian fishermen have progressively replaced this method of storing since the end of the '80. Indeed, since 1996 the biggest catches are transferred directly from the purse seine to floating traps tugged from Spain to fishing areas. The pools system has then benefited of several improvements as "doors" in purse seine, use of divers to help fish transferring and automatic feeding system. The hold capacity of the pool is passed from 80 to 120 tons. Today the nearly totality of the catches is stored into traps.

Refrigeration equipment

Since 1992 ice machines and chilled waters are used for cooling the catch. The production capacity of the ice machines, generally installed on board today is of 2.5 tons per day. The small vessels own only one that oblige them to stock a large quantity of ice if they want

eventually to keep their fish in chilled water and they are although obliged to land quickly their catch (or to transfer it onto a carrier vessel). The biggest vessel owned 3 ice machine and according the capacity of their chilled water tanks they are able to cold 40 tons quickly.

Skiffs and speed boats

Until these 5 last years 2 working boats were used for the fishing operation: a small one used to maintain the bunt end of the purse seine while the vessel shot the net and one more powerful another used to maintain the vessel outside the net during the pursing and the hauling operations, the less powerful skiff serving to maintain the purse seine opened. The recent addition of a stern rail allows lifting the stronger skiff on board the purse seiner as this one is now used also to maintain the bunt during shooting. For the biggest units, the small boats are replaced by 2 speed boats loaded also on the purse seiner during prospecting and transit. These spider boats serve both to maintain the circle of the purse seine well opened during the net hauling operation (and during also the transfer of the fishes into floating trap) and also to keep the caught school away from the vessel during the pursing operation.

The pulling power of the biggest skiff is related to the length of the purse seine and the size of the vessel as the average of their engine power was increasing from 20 kW (1960) to 250 kW.

Electronic equipment

The electronic equipment of French tuna purse seiners have benefited of major technical improvements all along these 30 last years; the most important equipment which can play an important role in fishing efficiency is:

- Positioning equipment - Before 1970 there was no positioning equipment the first one was radar in 1973 and radiogonio in 1976. LORAN system was used since 1982 until the introduction of GPS in 1994. Drawing table appear at the beginning of the 90th. The performance of radar for watching was increased from 40 miles to 60 miles of range.

- S band birds radar

If navigation radars are present on all the fleet of the tuna vessels since the ‘70, the first bird radar appeared only since the ‘80. However the use of radar for detecting birds patched flying above tuna schools have begun earlier. Their power is generally 30 kW but is changing for a 60 kW frequency which is less sensitive to external conditions.

- Sonars - In 1992 sectorial and wet paper sonars (1980) were changed for video and multidirectional sonar. More powerful sonar with low frequency (some with 2 frequencies) have been then introduce. The most recent unit owned two sonar: one for high range for prospection and the other for low range for detection.

- Communication

With BLU, the radio equipment is completed with VHF for communication between vessel and skiff and between vessel and plane. The importance of the information for the effectiveness of the prospecting has led to protect more and each emission and on other hand to try to pick up those of the competitors. Since the ‘80 increasing investments were made in scrambler and scanner equipment. The most secured and best-protected system is now the satellite way introduced with standard C and e-mail communication.

- Sea Surface Temperature, Current profiler

- External prospecting equipment

Since 1975 the tuna fleet benefit of the support of airplanes which are generally hired for the spring and summer season. Their role is as well for prospecting than positioning correctly each boat according the in relation to the school fish movement before shooting. The airplane prospection stands during 4 hours in the morning and 4 hours in the afternoon with a maximum efficiency of detection from 9 to 10 a.m and 1 to 1.30 pm.

Data on catch
Between 4000 to 8000 tons per year.

Technical interactions
With other tuna fisheries

Special features
Quota limitations; licence regime and closed period during the beginning of summer.

Relationships between fishing effort, fishing mortality, catch
No data.

FISHERY 2 - SMALL PELAGIC FISHERY

Fishing grounds
West area of Gulf of Lions from 20 to 100 m depths.

Fleet
This fleet which involved more of 150 units in the 70th to day is reduced to only 9 vessels, in wood and of more of 30 years old. Their size are of 17,81m length., of 246 kW in average. The crew is composed of 4 to 8 men.

	LOA	GT	P (kW)
min	9,20	4	95
max	21,47	59	373
mean	17,81	34,55	246

Fishing time
These vessels work mainly from spring to autumn during approximately 148 days/year.

Fishing equipment
The length of the purse seine is between 300 to 600 m with 70 to 150 m height and 24 mm of bunt mesh size. The fishermen can use light for fishing during night or sonar during daylight.

Deck layout
The wheelhouse is to day placed on the fore part of the deck as all the stern part is used to handle and to store the purse seine ; The gear is hauled by a hydraulic power block fixed on a beam or on a crane. Catch is hauled from the bunt by scoop-net.

Data on catch
A pelagic purse seine can catch in 2 shots per night a maximum of 15 MT of sardine or 8 MT of anchovy. The annual production for a fishing unit may be between 150 to 200 MT according the weather.

Technical interactions
With pelagic trawling.

Special features
Activity submitted to a licence regime.

Relationships between fishing effort, fishing mortality, catch
No data.

FISHERY 3 - WHITE FISH FISHERY

Fishing grounds
Gulf of lions and Provençal coasts from 10 to 30 m and within 12 nautical miles

Fleet

The fleet consists of 43 small purseiners, 22 years old, 9.5 m length and 120 kW in average.

	LOA	GT	P(kW)
min	5	1	11
max	18	79	294
mean	9,5	7,22	120

Fishing time
All the year but only during daytime and mainly from August to November.

Fishing equipment
The purse seine is between 180 to 600 m length and have 30 to 80 m in depth. The minimum mesh size is around 70 mm.

Deck layout
Power-block ; purse winch

Electronic equipment
Sounder ; Sonar ; GPS.

Data on catch
This fleet target mainly sparidae (*Sparus aurata, Lithognathus mormyrus*), *Scomber japonicus*, and mugilidae.

Technical interactions
With static nets and trawling.

Special features
Nothing

Relationships between fishing effort, fishing mortality, catch
no data available

ITALY

Small pelagic purse seine

General

The main surrounding nets, also known as purse-line or lampara net, are lowered to form a circle surrounding a pre-located shoal, which is then promptly hauled aboard.
A distinction can be made between surrounding net with purse line, also known as “cianciolo” and “lampara” and purse-seines without purse line, whose name differs on a regional basis.
The lampara net is a purse-seine that attracts shoals of anchovies, sardines and mackerels through light. In practice, the net is lowered around a shoal that has formed artificially, obviously during moonless nights. In order to understand what factors impact on fishing effort, it is essential to consider how fishing operations are carried out. Purse-seines for anchovies, sardines and mackerels are used at night, therefore the fishing boat leaves port in the afternoon to reach the fishing area chosen. For some hours, the fishing boat looks for shoals of anchovies with the echo sounder or the sonar, and when a suitable ground is identified, the fishing boat stops and launches the two small boats fitted with power generators and powerful lamps. Pelagic fish, attracted by light, gathers where light is more intense, and when the fisherman onboard the small boat considers that a sufficient quantity has amassed, the fishing boat lowers a rectangular net a few hundred metres in length and 80 to 150 metres in width, depending on depth. Once the small boat and the shoal is surrounded, the crew of the fishing boat pulls the purse line to prevent fish from escaping, and when the net is closed, the small boat switches off the light. If fish is not much, it will take longer to amass the necessary quantity of fish to lower the net and the number of net hauls is reduced, however if too much fish is amassed, it will take longer to haul the net aboard and the number of hauls will be reduced anyway. Fishing effort depends on several factors: the electronic devices used to search shoals can reduce searching hours and guarantee to find a ground where there is a greater density of fish; the speed of the fishing boat has an impact on the width of the searching area, and therefore on the probabilities to find more fish, the number of rubber boats with 1 to 3 lights, given short time, determine the number of net hauls, especially if fish is scarce; the power of lamps and the transparency of waters determine the width of the attraction cone with preferential light intensity; the size of the net, length and height, determines the opportunity to surround the shoals without making them perceive it and limit escapes from the lower part; the size of the fishing boat is very important for the transport of larger nets and additional rubber boats, but also to handle the net and collect the fish; and then, the size of the refrigerated hold to contain fresh fish without covering the deck entirely; the speed of capstans to close the lower part of the net and the power block to haul the net aboard; the number and skills of fishermen who manage the rubber boats, the nets and separate fish in crates.

GSA 17 - NORTHERN AND CENTRAL ADRIATIC

FISHERY 1 - PURSE SEINING FOR SMALL PELAGIC

Fleet

Lampara vessels operate mainly in the Central Adriatic, South of Ancona, and in the Gulf of Trieste. About 25 *lampara* operate in middle Adriatic, with a further 20 smaller *lampara* in Trieste. To this resident lampara fleet, 23 further lampara fishing vessels must be added (for a total of 68 *lampare*), both registered (16) in southern Adriatic ports but fishing in middle Adriatic and (7) in Sicily. The *lampara* vessels generally are bigger than *volante* vessels (average GRT is 85), but they have lower engine power (average is 300 HP) because the *lampara* technique is not strongly influenced by this parameter.
The harbour of **San Benedetto del Tronto** is characterised by the presence of about 12 big fishing vessels (from 80 to 120 GRT) which, from April to November, operate as *lampare* (purse seiners with light), plus one couple of vessels fishing with *volante* gear and in the coldest months lampara fisheries stop because the bad weather, while 6 *lampare* in winter switch gear to *volante*. Indeed they behave as two different fishing fleets.

Sicilian fleet and lampara fleet from Southern Adriatic operating in GSA 17 - In recent years an increase of the number of *lampare* active in the Adriatic has been observed. Some of them (around 20 in recent years, 16 last year) are vessels registered in southern Adriatic ports, and which seasonally move to the central Adriatic. This has been happening for many years. However, the arrival in the early 1990s of another fleet of *lampare* from the Thyrrenian sea and the Sicilian channel is a new phenomenon: this fleet is commonly named the "Sicilians" and comprises about 30 vessels in some year, dropped to 7 in 2002. Our information on the behaviour of these fleets comes only from indirect sources: the fleets usually fish in deep water in the central Adriatic as the San Benedetto *lampara* fleet. The main difference from the San Benedetto fleet was that at first these other fleets did not stop fishing on Saturday and Sunday, however in the recent years they have been obliged to stop. During the full moon period the southern Adriatic vessels go back to their port of origin whereas the "Sicilians" go back home only at the end of the fishing season for *lampara*, which lasts in the Adriatic generally from April to November.

Fishing time over a year

The *lampare* usually leave the harbour from 3 to 8 p.m. and come back from 6 to 12 a.m., depending on the length of the night, which changes with the season. The purse seining method requires calm seas, not too much current and no full moon, therefore the number of days actually fished per month is not high. Traditionally the fleet used to stop fishing for only five days a month during the full moon, but now they are also observing a two days a week stop by not fishing on Saturday and Sunday nights. The fishing season of lampara vessels lasts from March/April to November/December. Closing fishing season is not applied to lampara vessels.

Fishing equipment

See paragraph general

Deck layout and machinery involved

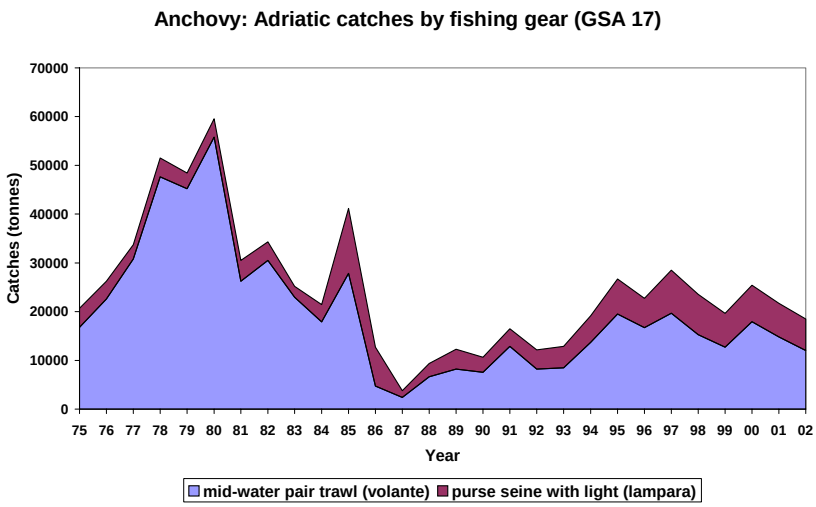
Power block winch, electricity generators (in small boats)

Electronic equipments

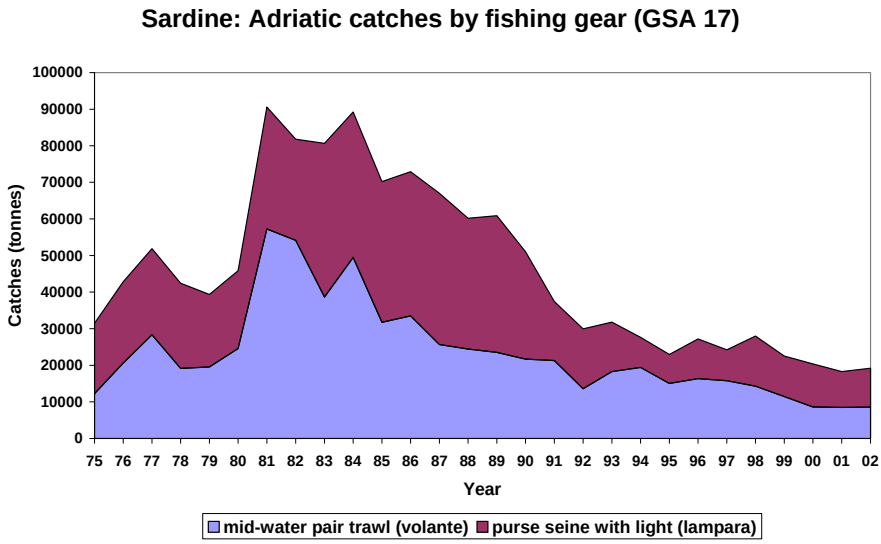
Over the last 10 years, improving fishing efficiency meant increased fishing mortality (example of improved exploitation of fishing grounds not accessible without GPS).
Around 1995, sonar was installed, in particular, on board of lampara.
The navigation computer, the most recent electronic equipment (1995-1996), has not reached a wide diffusion. GPS equipment was introduced around 1992 and now it is universally used.

Data on catch[1]

It should be clearly shown the relative importance (% weight) of the different major species.
The following figures show catches of anchovy and sardine by fishing gear/year in the GSA 17



Anchovy catches by fishing gear (GSA 17)



Sardine catches by fishing gear (GSA 17)

The relevant quantity of caught with lampara is due to the fleets of eastern Adriatic countries in which this kind of fishing gear is mainly used.

[1] Some parts of this paragraph is an updating of STCF (2002) report.

Technical interactions with other fisheries
No technical interactions with other fisheries have been detected.

Special features
No special derogations exist for small pelagics fishery carried out by volante or lampara.

Relationships between fishing effort, fishing mortality, catch rates[2]
See paragraph on pelagic mid water trawl in GSA 17

FISHERY 2 - PURSE-SEINES FOR TUNA

General
Purse-seines for tuna, also knows as tonnara volante, are bigger purse-seines used to surround shoals of tunas. The tonnara volante is the biggest movable net currently used. It can weigh several tonnes and be some 2-km long. The yarn used for the mesh has a high diameter (approx. 4 mm) to make it extremely resistant to shocks and breakings.Despite size and weight, this net is lowered and hauled aboard like the smallest purse-seine (with purse line) for anchovies, sardines and mackerels. Fishing operations are quite different, though. First of all, it is used in daylight, since it is important to locate tuna shoals. Usually, the fishing boat, alone or in group, leaves port before dawn to reach the fishing ground as soon as the sun has risen. Fishing boats are fitted with a crows-nest from where fishermen scan the sea to see some signs for the presence of tuna, for example light movements of surface waters or seagulls, or actually tunas springing out of the water to eat anchovies. In some cases, anchovies are bailed out as bait to make the shoal of tunas stop. At the most suitable time, namely when the shoal of tunas is almost still on the surface, the fishing boat launches the rubber boat and tries to surround the shoal of tunas; once surrounded, the end of the net is hauled in and the low-end cable is hauled. After a few minutes the net is closed, and the fishing boat can start hauling the net aboard hoping that some tunas or the entire shoal were trapped in the net. As a matter of fact, very often tunas, which are very fast, go past the fishing boat and get out of the net, or dive to pass below the net. If tunas are caught, the net will be hauled aboard and dead tunas amassed. Given the size of the net, about one hour is needed to haul the net in and be ready to lower it again. Usually, a fishing boat catches tunas few times during the fishing season, and their quantity depends on the size of shoals, since even 1000-quintal catches can be recorded at one blow. Should the quantity of surrounded tunas exceed the transport capacity of the fishing boat, other fishing boats will be called to transport the catch and co-operate to collection. In this context, fishing effort is influenced by some factors related to sighting capacity, ability and expertise in surrounding the shoal of tunas, size of the net, time needed to lower the net again after a failed attempt. As yet in Italy, the parameters related to the fishing effort and catches per unit effort in tuna fishing have not been considered, in that the analysis of data provided by separate fleets operating in the same basin has shown that catches per unit effort over many years do not indicate the consistency nor the distribution per age bracket, since data sources are too many.This would be quite comprehensible if we considered that only in some cases tunas get close to the surface and can thereby be sighted; hence, sighting is fortuitous, and it is even more fortuitous to catch tunas. Sometimes, under suitable oceanographic conditions, many tunas are sighted on superficial waters, but catches are almost null, since this fish is very rapid and fast and therefore very difficult to approach.Besides, the quantity of catch depends on the number of tunas that make up the shoal and on their length. Sometimes you may find hundreds or

[2] Some parts of this paragraph is an updating of STCF (2002) report.

thousands of examples weighting 8-10 kilos each, and sometimes thousands of examples weighting 80-100 kilos each. The quantity caught for each operation is very different and is not proportional to the concentration of fish in the sea.
In Italy, given this non-correlation between the quantities caught and the abundance of the species, no specific fishing effort or catch per unit effort was used as abundance index.

Although it could sound odd, a correlation was found between the quantity of catch recorded by each fishing boat and the consistency of the fleet, for a greater number of fishing boats can patrol fishing grounds better, thus obtaining higher catches per unit.

Fishing effort could be calculated on the number of standard units, and the size of the net, the speed of the fishing boat, the use of an aircraft, would be the corrective elements. In addition, the number of fishing days or the number of net hauls could provide very useful information, even though it would be difficult to exploit it at best.

Fleet

Fishing time over the year

Fishing equipment
Net about 1200-2100 m long with mesh size more than 120 mm stretched, net is high 200-350 m. See also paragraph general.

Deck layout and machinery
Power block, crane, skiff

Electronic equipment
Sonar, GPS and any kind of modern electronic equipment

Data on catch

Technical interactions
Interactions with tuna longliners

Special feature

Relationship between fishing effort, fishing mortality and catch rates

GREECE

GSA 20, 22, 23 – IONIAN, AEGEAN AND CRETAN SEA

FISHERY 1 – SMALL PELAGIC PURSE SEINE

General

The purse seines fleet of Greece according to the census of the Ministry of Agriculture, consists of 316 vessels having 55,657 kW total engine power and 11,909 GT total tonnage and mean boat length 18.49 m. Purse seines are distinguished into two major types:

- operating during the day
- operating during the night using light which is the most common activity.

There are no significant differences between the two types as far as equipment and vessel construction is concerned. The most important difference is related to the mesh size of the net (14 mm for the night and 40 mm for the day, full mesh both).

According to the data of National Statistical Service of Greece, during the period 1990-2000, they fished 31% of the total catch of the Greek fishery (National Statistical Service of Greece, 1990-2000). The total catch of purse seiners for the most abundant species for the period 1990-2000 (in metric tonnes), and their percentages (in the purse seine catch), are presented in the table below. These data cannot be considered as accurate.

	1990	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**
Sardina pilchardus	9,261.5	8,895.8	13,705.6	13,115.1	11,936.8	12,736.1	13,610.3	15,072.5	12,784.4	7,998.7	9,830.3
Engraulis encrasicolus	13,967	9,997	9,392	9,849	12,461	10,947	12,700	12,481	14,313	12,623	7,769
Scomber japonicus	2,962.4	2,777.8	4,152.8	7,337.0	9,916.6	4,967.6	4,882.6	4,792.8	1,740.3	1,331.5	1,670.0
Boops boops	3,480.1	2,911.7	4,139.9	5,440.1	7,237.4	3,104.6	3,266.3	2,923.7	2,221.4	1,621.4	1,686.3
Trachurus sp.	3,545.2	3,411.8	4,251.3	4,253.1	5,687.9	3,878.8	3,897.4	3,145.4	2,248.8	1,241.2	1,500.2
Sarda sarda	396.3	393.4	275.4	458.9	788.9	1,468.7	1,419.1	1,195.3	695.2	605.9	314.8
Sardinella aurita	38,6	41.5	223.3	339.7	521.6	662.8	684.4	1,075.8	1,506.2	1,220.2	796.9
Spicara smaris	291.5	101.9	457.3	732.5	885.5	647.7	1,300.6	1,009.3	459.5	277.3	264.4
Mugil cephalus	741.3	546.9	398.7	788.1	448.0	577.4	1,181.0	429.3	192.0	258.0	154.8
Others	3,330.5	4,298.8	5,784.2	4,044.1	4,864	4,573.6	6,593.5	4,628.9	3,073.7	2,997.3	2,912.8
Sardina pilchardus	24.4	26.7	32.0	28.3	21.8	29.2	27.5	32.2	32.6	26.5	36.5
Engraulis encrasicolus	36.7	30.0	22.0	21.2	22.8	25.1	25.6	26.7	36.5	41.8	28.9
Scomber japonicus	7.8	8.3	9.7	15.8	18.1	11.4	9.9	10.3	4.4	4.4	6.2
Boops boops	9.2	8.7	9.7	11.7	13.2	7.1	6.6	6.3	5.7	5.4	6.3
Trachurus sp.	9.3	10.2	9.9	9.2	10.4	8.9	7.9	6.7	5.7	4.1	5.6
Sarda sarda	1.0	1.2	0.6	1.0	1.4	3.4	2.9	2.6	1.8	2.0	1.2
Sardinella aurita	0.1	0.1	0.5	0.7	1.0	1.5	1.4	2.3	3.8	4.0	3.0
Spicara smaris	0.8	0.3	1.1	1.6	1.6	1.5	2.6	2.2	1.2	0.9	1.0
Mugil cephalus	2.0	1.6	0.9	1.7	0.8	1.3	2.4	0.9	0.5	0.9	0.6
Others	8.8	12.9	13.5	8.7	8.9	10.5	13.3	9.9	7.8	9.9	10.8

Fleet
Referring in more details to the fleet of the main fishing areas of Greece, it can be noted, according to the official registers of the Ministry of Agriculture, that it is so structured:

Port	No.	Av.L[m]	GT	P[kW]
GSA 20 - IONIAN SEA	41	17.45	1399	7009
GSA 22 - AEGEAN SEA	264	18.72	10178	47228
GSA 23 - CRETAN SEA	11	16.67	332	1422

Fishing time over a year
The fishing period for the night purse seiners in Greece starts in 1st of March and stops in 15th of December each year and for the day purse seiners starts in 1st of September and stops in the end of June. The purse seining is highly depended on the weather conditions. Therefore, during the fishing period (one moon) the effective fishing days vary from 6 to 25. However, for six months (April-September) the effective days are more than 20.

Fishing equipment
Concerning the night purse seine which is the most common, the main body of the netting consists of 8-20 rectangular pieces of net (sections), 400 meshes wide each, joined one below the other. The mesh size of the main net body is 14 mm–28 mm (full mesh) and the twine thickness is 210/3 to 210/12 Denier. The upper and lower two sections are made of thicker twine 210/12-210/60 Denier and have usually bigger mesh size (32 mm to 90 mm full mesh). They are narrower comparing to the sections of main body, being 20 meshes wide the first and the last section and 100-200 meshes wide the second section of the top and of the bottom. The cod end consists of 4-19 sections and is placed some times in the center of the netting and other times in the side. It is made of thicker twine compared with the main net body (210/9-210/21 Denier). The length of the gear ranges from 450 m to 760 m and the depth from 80 m to 120 m; the hanging ratio of the headline to the main body netting is 5-33%. There are 60-135 rings according to the length of the gear. The headline and the lead line are usually of PA ∅10-16 mm.
A small number of recordings exist for the day purse seine. It is usually longer and less wide comparing to the night purse seine. The mesh size is bigger (40 mm full mesh) and the netting is thicker 210/12-210/15 Denier.

Deck layout and machinery involved
The most usual equipments of a purse seine involve: ***a purse winch*** usually with two drums located immediately abaft the forecastle which provide leads to ***purse blocks*** hung from the ***davit; a capstan type winch*** that is used for handling net lines; ***a power block*** or a ***power net winch,*** (which is hung from ***a crane***) from where the net is passed over and thence over a ***transporter block*** to stacking position; a ***purse ring stowage*** which is an open ended bar of sufficient length to store all purse rings.

Electronic equipment
The electronic equipment usually used from the purse seiners is: compass, VHF, Radar, echo-sounder, GPS- Plotter.

Data on catch
The main catch of purse seines consists of sardine (*Sardina pilchardus*), anchovy (*Engraulis encrasicholus*), chub mackerel (*Scomber colias japonicus*) and horse mackerel (*Trachurus spp.*). Data presented below comes from a study carried out in three Greek ports (Kavala,

Volos and Patra) in the framework of the project "The purse seine landing composition in Eastern and Central Mediterranean" (Anon., 2002).
In Kavala (North Aegean Sea), during the first year of the study (2000), sardine composed almost the 70% of the total catch and significant quantities of anchovy were landed during spring and summer. During the second year, the quantities of sardines were lower (<50%), whereas anchovy consisted a significant part of the total catch (30%-74%). In the landing port of Volos (Pagassitikos Gulf) and Patra (Patraikos Gulf), according to the analysis, about 80% of the catch was composed of sardine and anchovy in both areas, but the proportion of the two species varied. In Pagassitikos Gulf 33% of the catch was sardine and 45% anchovy and in Patraikos 71% was sardine and only 11% was anchovy.
The length distribution of the sardine catches range from 100–190 mm and the peak is observed at 140 mm. Regarding anchovy, the length distribution of the catches range from 90 to 180 mm with the peak observed at 140 mm. The catch of chub mackerel range from 130 to 280 mm and of horse mackerel from 80 to 400 mm.
Discards contribute a small proportion of the total catch (<10%) and consist mainly of gilt sardine (*Sardinella aurita*) and undersized specimens of chub and horse mackerel. In Pagassitikos Gulf there were not observed discarding practices.

Technical interaction with other fisheries
There is competition for anchovy, sardine and chub mackerel in the North Aegean Sea, for *Spicara smaris* in Ionian Sea with bottom trawl. The small-scale fishermen are complaining that the purse seiners are operating in very shallow waters and they catch demersal species. Complains are stronger against the day purse seines. However, the quantities of demersal species caught by night purse seines were found very small (almost not existing) during on board observations (Anon., 2002).

Special features
According to the legislation in force, the mesh size in the cod end must be at least 14 mm (full mesh) for the night purse seines and 40 mm (full mesh) for the day purse seines. The total length of the gear must be up to 800 m and the depth up to 120 m. Seining is forbidden inside 300 m from the coast and/or in depth less than 30 m. There is a closed season from 15th of December to the end of February of the following year for the night purse seines and from 1st of July to 31st of August for the day purse seines. Fishing with purse seine is forbidden within 500 m from the permanent fishing installations of stable fishing traps, in case they are in operation and within 1000 m from the entrance of aquaria when they are open. It is prohibited to purse seining to use the net as drift net. Purse seining is prohibited during full moon, 2 days before and 2 after, with the exception of Saronikos Gulf and the sea surrounding Crete for which this is only applied during Saturdays and the Sunday after the full moon. The intensity of the light must be up to 2000 candles per light boat when the number of lamp rafts is more than 5 and in case that the lights are not covered on top with reflector. In any case the total light intensity should not exceed 10000 candles per vessel. Apart from the above-mentioned restrictions there are many local time and place restrictions in closed gulfs and protected areas.

Relationship between fishing effort, fishing mortality and catch rates
No data available

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CAP. 3 - FIXED AND DRIFTING GEAR FISHERIES

SPAIN

There are several artisanal fisheries using a lot of gear targeting many different species of fish, crustaceans and molluscs. These kinds of fisheries are represented along the whole Spanish coast, usually very spread in all the existing ports. Additionally, some concentrations of vessels could be found in beaches.
The number of vessels involved in these fisheries is uncertain, since some boats have not any license to fish and others, officially active, only work a few days in a year. The small-scale fishery in the Spanish Mediterranean is of limited importance when compared with bottom trawl and purse seine fisheries. Nevertheless, its social and economic importance is great. Artisanal fleet exceeds 3,000 small sized (< 10 m) boats using more than 20 different gears, usually 2 or more by boat. It is characterised by the high specific diversity in catches as well as for a great geographic dispersion in landings, which make data collection difficult. An approximate number for this fleet is about 3139 vessels. All the boats are of small size, between 6-9 m length, 3-4 GRT and 30-50 HP. Many boats use an outboard engine.
Moreover there are an important drifting longline fishery targeting on blue fin tuna and swordfish., carry out by a particular segment of the fleet.

In GSA 1 the artisanal fisheries are formed of 873 boats, using many different gear. However, most of them use gillnets, trammel nets and bottom long-lines. Other gear used are beach seines, combined gillnets-trammel nets, traps and hand-lines. Target species are: *Pagellus spp., Mullus surmuletus,M. Barbatus, Octopus vulgaris* and *Sepia officinalis.*

In GSA 5 Artisanal: 473 vessels with a mean length of 7 m, fishing all year with trammel nets and bottom longlines. Target species are *S. officinalis, M. surmuletus, Pagrus pagrus, Dentex dentex,* and *Palinurus elephas*. Associated species to the fishery are *Scorpaena scrofa, S. Porcus, Lophius piscatorius* and *Mustelus mustelus*. *Palinurus elephas* is fished from April to August. The rest of species are susceptible of being fished all over the year.

In GSA 6, Set Gillnet: 1327 boats of 6 m length using both gillnets and trammel nets, fishing during all year, targeting on *Mullus surmuletus, M. barbatus and Pagellus acrane*.
Bottom longline: 230 boats of 9 m length targeting Merluccius merluccius all the year. Accessories species for this fishery are *P. acarne, P. bogaraveo, Conger conger* and scorpionfish.
Artisanal polyvalent: formed by 196 boats of 7 m mean length, using different type of gear targeting various species.

In the Alicante Gulf 12 ports with artisanal activity exist, with more than 150 boats landing daily. The port of Santa Pola concentrates more than half of the activity (57% of boats) landing more than 300 t by year.
In general the fishery appears to be more or less stable with a maximum CPUE in 1997 decreasing slowly thereafter. Selected species are fished all year round except Cuttlefish that shows a defined (January to May) fishing season
The 8 more discriminant species or species groups identified were: Mullets (*Mullus sp.*), Hake (*Merluccius merluccius*), Octopus (*Octopus spp.*), Sea Breams (*Sparidae*), Cuttlefish (*Sepia officinalis*), Conger eel (*Conger conger*), Shellfish (*Ruditapes + Donax + Chamelea*) and Mixed 1 *(Sparidae + Scorpaenidae + Labridae*).

Main characteristics of the more discriminant species identified.

Species/ Group	Gear	Nominal CPUE mean ± SD (kg/boat/day)	Standardised CPUE ± SD (kg/boat/day)	Annual Trend	Season	Maximum CPUE
Mullets	Trammel	17.69 ± 9.51	14.24 ± 1.04	Irregular Max.1997 Min.1998	All year	October-Nov.
Hake	Gillnet	62.5 ± 32.7	52.11 ± 1.18	Stable Max.2000 Min.2002	All year; since 1996	May-August
Octopus	Trammel	10.13 ± 10.15	7.32 ± 1.05	SinusoidalMax.1995 Min.2002	All Year	January-May
Sea Breams	Long Line	13.5 ± 12.22	6.51 ± 1.07	Sinusoidal Max.1997 Min.2001	All Year	April and Autumn
Conger eel	Long Line	6.61 ± 10.87	1.69 ± 1.12	Sinusoidal Max.1997 Min.1999	All year	Autumn and Winter
Cuttlefish	Trammel	17.8 ± 7.5	14.15 ± 1.12	Irregular Max.1997 Min.2002	January to May	February

FRANCE

The small-scale metiers categories gather several metiers and techniques, which can be seasonally practised, by small artisan boats all over the French coasts. These fisheries are practised exclusively by small scale fishing fleets. They are generally small boats with a L_{OA} lesser than 15 m and an engine power of 250 kW. Their daily activity is limited to coastal waters. They represent around 1300 fishing units including laguna activity for some of them.

	N	L_{OA}	GT	kW	Age
Small scale fishing	1267	7	4	57	26
Netters	303	9	5	77	25

Three types of small fishing vessels can be found in static net fishing fleet:

a) "Catalane" type, open deck small boat, made of wood, equipped with or not a mechanical net hauler and one net wheel, using small quantity of net by 1 or 2 crewmen.

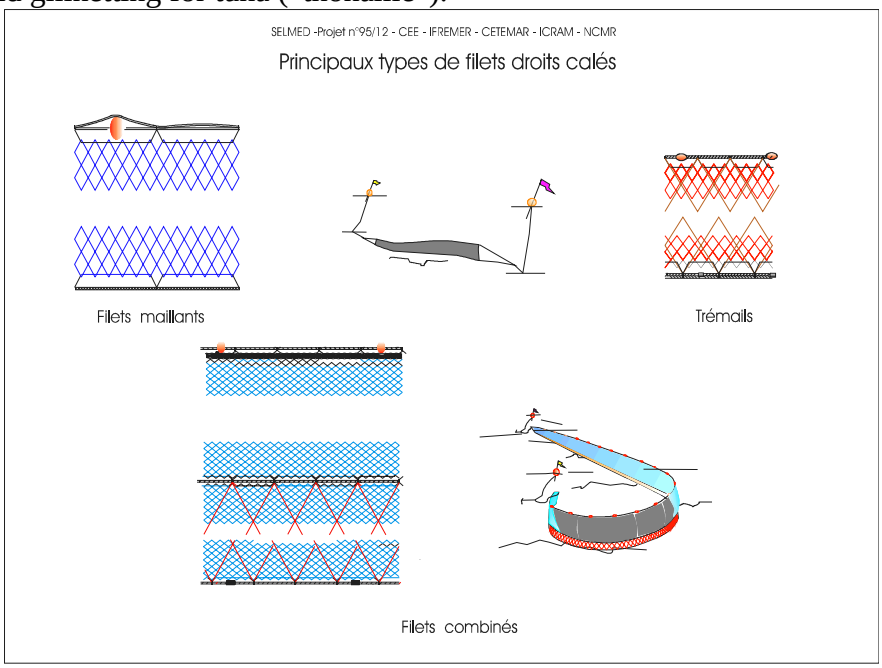
b) "Pointu" type, cover deck vessel, made of wood, with small wheelhouse, a forehead hydraulic net hauler with 1 to 3 net wheels. The biggest may have ice hold. This boat can set longer net fleets, thanks to a more important crew (3 to 5 men).

c) "Vedette" type, spider fiberglass launch, smaller than the previous one but with much more powerful engine. The smallest is equipped with outboard engines. The largest vessels have large deck and 3 to 5 crewmen. They can load long fleets of nets and target metiers of large operation range.

This fleet of small scale fisheries can practise different metiers, from shore to slope, according to the season, type of coast, fishing ground and vessel capacity. The following fisheries can be identified:

a) Coastal fisheries: they use, seasonally and indifferently from shore to shelf, active and fixed techniques as trammel, gillnet, combined nets, bottom longline.

b) Open sea fisheries: they include mainly specialized metiers as gillnet for hake, trammel for sole, and trammel for crawfish, longlining for hake, practised from shelf to slope, drift longlining and gillnetting for tuna ("thonaille").



different types of static nets used in French waters.

ITALY

General

The main set gear are:

a) Movable trap nets
b) Set nets
c) Long-lines.

The fishing boats involved in coastal fishing, are usually small-sized, use fishing gear that are placed in a specific fishing ground and left there for some time, even a few days, to wait for fish to gill or bait, depending on the gear used.

A general overview of the Italian small scale fisheries is given by the following table (*IREPA, modified*):

Small scale fishery		N	GRT /N	Length/N	HP/N	Days at sea
	LIGURIA	537	3	7	28	108453
	TUSCANY	512	3	7	32	79218
	LAZIO	471	4	8	35	70887
GSA 9		**1520**				**258558**
	CAMPANIA	1147	3	7	24	221636
	CALABRIA	821	2	7	16	106767
GSA 11	**SARDINIA**	**1118**	**3**	**7**	**30**	**149724**
	SICILY	2701	3	7	21	409236
GSA 18	**APULIA**	**1098**	**3**	**7**	**19**	**231422**
	MARCHE	509	2	6	27	124201
	ABRUZZI	405	2	5	16	69024
	EMILIA R.	467	2	7	39	90997
	TRIVENETO	989	2	7	27	168585
GSA 17		**2370**				**452807**

The analysis of data collected by some near-water fisheries in the Adriatic sea has shown that the best capacity parameter related to fishing effort is the length of the nets. This factor, which could be considered as a measure of actual capacity, is more strictly related to the overall length of the boat than to engine power or tonnage.

Therefore, the results obtained testify to the fact that the installation of powerful engines onboard small fishing boats does not directly contribute to an increase in fishing effort, but it's only a way to cut the transfer time of these fishing boats, and should be duly taken into account in terms of security.

Set nets may differ in the method used for lowering or fitting out.

As far as net hauling is concerned, a distinction is made between fixed nets (whose ends are anchored to the sea bottom), driftnets and *'ferrettare'* or nets left at the mercy of sea currents.

The difference between driftnets and *'ferrettare'* lies in mesh size. In driftnets mesh size exceeds 180-mm in length, whilst in *'ferrettare'* mesh size is below 180mm.

Finally, there is a third lowering system aimed at forming an encircling gillnet.

In relation to fitting out, set nets are classified into gillnets formed by a single netting, and trammel nets formed by three nettings, two of which having larger meshes.

All these set nets can catch the fish that remains entangled in their meshes. Four different catch methods were identified:

1) Gilling: the fish remains trapped in the mesh with its head and the yarn of the mesh penetrates into its gill covers;
2) Meshing: the fish remains trapped in the mesh with its dorsal fin and cannot move forward nor backwards;

3) Bagging: especially in trammel nets, the fish slips into the external large mesh and pushes the internal netting inside the large mesh to the opposite direction, thus forming a bag in which it remains trapped;
4) Entangling: the fish touches the netting with a body protuberance (fin, spine or others), gets entangled and rolls in the same net while trying to escape.

The hanging ratio of the Italian set nets is very changeable according to the zones. Generally speaking, higher hanging ratios could be found in deeper sea bottom. The hanging ratios range between 0.25 and 0.70 even though some set net have values out of this interval.
In the movable trap nets, the so-called *bertovelli* or netting fish traps, fyke nets, etc., fish can slip into these traps very easily, especially if attracted by baits, and is virtually impossible to escape.
There exist several types of fish traps, for example fish traps for cuttlefish, fish traps for sea snails, fish traps for depth shrimps, fish traps for lobsters, and other types of fish traps to catch several species at one blow.
If we considered the different types of fish traps separately, we would agree in defining the unit effort as each fish trap lowered for a fixed period of time, for example 24 hours. Therefore to calculate the overall fishing effort related to cuttlefish, we should add the days of lowering to the number of lowered fish traps for cuttlefish. This calculation could be acceptable as an indicator of the specific fishing effort, even if there are other elements to be considered that could impact on the final outcome.
The distance between fish traps, the effectiveness and the duration of the attraction system (spawn or feed container), the competition between different gear (trammel nets too close to fish traps, etc.), the frequency of lowering and hauling-in can be essential even between nearby fishing grounds. Suffice it to think about the catch of greater amberjacks with shading set traps, whose catch potential depends on the intensity of light and the glare from the bottom that could lead to different results in fish traps that are only 30 metres apart.
Even when the attraction of fish depends on feed, it is therefore essential to verify the fishing power of the fish trap, because sometimes small fish eats the baits and the fish trap stops working.

GREECE

The inshore fishery represents the 90% of the fleet in terms of number of vessels and contributes to the total engine power by 64 %. The 54 % of the total catch of the Greek fishery comes from inshore fishery and contribute by 58% to the total value of catches (National Statistical Service of Greece, 1999). The main fishing gears used are gillnets, trammel nets, long lines and fyke nets.

There are 18,142 vessels (430 boat seines included) and more than 30,000 fishermen involved in these activities. The fleet is dispersed around the Greek coasts. Landing is taken place in many fishing ports and the recording of the catches or of other catch statistics (e.g. effort) is extremely difficult. A significant part of the fishermen has a second job (usually in agriculture or tourism) and fishing is more or less an opportunistic activity. The inshore fisheries vessels have been reduced over the period 1991-2001 by about 10%. The number of small vessels (<12 m) showed a fast reduction from 1991 to 1993 and from 1998 to 1999, whereas the other years the reduction was much slower but constant. The number of big vessels (>12 m) decreased fast between 1991 to 1993 and 1998 to 1999, but increased between 1995 to 1998.

The inshore fisheries are targeting to a high variety of species. Almost all the vessels change métier during the year. The allocation of the effort to fishing gear used or to target species is extremely difficult. The available data on catch composition, size composition, discards etc. are very limited, sporadic and geographically restricted, whereas for some commercially important species (e.g. lobster) data are completely lacking.

The inshore fisheries are much more species targeting, than bottom trawl, and some of them can be characterised as single-species metiers (e.g. *Pagellus bogaraveo*). The gears used are selective and generally they allow small fish to escape. Contrary to the bottom trawl fishery, that operates only in proper fishing grounds, the inshore fisheries gears are not selective concerning the fishing ground operating in any kind of substrate and consequently there are not natural shelters for the target and the by catch species. The development of the artisanal sector in Greece results to significant fishing effort and fishing mortality. The most known examples of fisheries that have collapsed or are in danger in Greece are related to two single-species fisheries, *Pagellus bogaraveo* and *Polyprion americanus*. Boat seiners are included in the coastal fisheries but they operate in a complete different way. Information about this gear is given in the chapters related to special fisheries.

The average values of tonnage, power and length per GSA area, are presented in the next table.

Area	No of vessels	Length (m)	Avg GT	Avg kW
GSA 20	3,916	6.6	1.83	17.37
GSA 22	13,421	6.8	2.56	22.92
GSA 23	805	7.0	2.97	20.63

According to the data of National Statistical Service of Greece (NSSG), the total catch of coastal gears for the most abundant species for the period 1990-2000 (in metric tonnes), and their percentages, are presented in the table below.
The following data cannot be considered as accurate.

Catch per species in tons and % of the fixed and drifting gears in the Greece

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
*Mytilus galloprovincialis*s*	3,613.8	6,203.9	16,593.3	19,618.2	16,792.9	21,637.4	22,819.3	24,002.1	7,647.1	15,859.9	468.7
Sardina pilchardus	728	3,739.6	5,026.1	6,294.6	6,750.9	6,553.8	3,918	4,024	4,702.1	6,553.7	4,903.5
Boop boops	2,416.4	4,320.1	3,701.9	5,369.7	5,326.2	2,344.2	2,195.9	1,848.8	1,398.8	1,349	1,465.5
Engraulis encrasicolus **	291.7	790.8	1,302.9	3,679.2	4,036.4	2,580.3	1,939.4	1,489.2	2,716.5	3,522.6	1,523.4
Mugil cephalus	2,589.0	2,676.2	1,958.9	2,357.7	2,108.8	2,109.3	2,513.8	2,521.1	1,767.1	1,695.9	1,458.9
Octopus vulgaris	1,057.8	1,891.4	3,041.8	1,913.4	1810	1,294.9	1,566.8	2,001.1	1,186	1,377.8	1,691.8
Trachurus sp.	690.4	1,768.6	2,108.9	2,620.9	2,534.1	1,935.5	1,538.1	1,591.2	1,055.9	1,392.9	1,375.2
Sepia officinalis	1,716.8	1,418.9	1,210.5	1,355.7	2,084.4	1,762.3	1,285.8	1,887.9	1,648	2,263.1	1,132.6
*Ostrea edulis**	3,685.3	4,450.2	3,759.3	1,686.9	1,087.5	1,126	1,009.5	342.3	114.4	47.4	104.7
Others	25,503.3	31,703.4	30,173.1	34,603.3	37,805.5	28,315.5	25,138	25,593.6	21,649.3	21,963.9	21,627.2
*Mytilus galloprovincialis**	8.54	10.52	24.09	24.68	20.90	31.06	35.70	36.76	17.43	28.31	1.31
Sardina pilchardus	1.72	6.34	7.30	7.92	8.40	9.41	6.13	6.16	10.71	11.70	13.72
Boop boops	5.71	7.33	5.37	6.75	6.63	3.37	3.44	2.83	3.19	2.41	4.10
*Engraulis encrasicolus***	0.69	1.34	1.89	4.63	5.02	3.70	3.03	2.28	6.19	6.29	4.26
Mugil cephalus	6.12	4.54	2.84	2.97	2.62	3.03	3.93	3.86	4.03	3.03	4.08
Octopus vulgaris	2.50	3.21	4.42	2.41	2.25	1.86	2.45	3.06	2.70	2.46	4.73
Trachurus sp.	1.63	3.00	3.06	3.30	3.15	2.78	2.41	2.44	2.41	2.49	3.85
Sepia officinalis	4.06	2.41	1.76	1.71	2.59	2.53	2.01	2.89	3.76	4.04	3.17
*Ostrea edulis**	8.71	7.55	5.46	2.12	1.35	1.62	1.58	0.52	0.26	0.08	0.29
Others	60.30	53.77	43.81	43.53	47.06	40.65	39.32	39.19	49.33	39.20	60.49

** The production that is given from the (NSSG) comprise also the production of the cultivated mussels and oysters*

*** The production that is given from the (NSSG) comprise also the production of the lagoons*

Concerning gillnet, trammel nets and long lines, more specifications are given in the relative chapters. Regarding fyke nets some rough informations are given below.

Fyke nets of two to six chambers made of netting with hoops are used for catching eels, striped grey mullet, sea bass and sea breams when they fish near to estuaries or octopuses when they fish in open sea. The catching system consists of two fyke nets connected by a leader net 4-5 m long. The number of hoops ranges from 2-6; their circumference range between 50 and 180 cm and the netting mesh size is 2044 mm (full mesh). Lines of 2-6 pairs when they fish near estuaries or 50-100 pairs when they fish in open sea are set; the total number of fyke nets hauled per set is 300-1,000 pairs. Soaking time is 3-10 days. Concerning fyke nets the mesh size of the netting must be at least 20 mm (full mesh) when the gear is used for eels and 36 mm (full mesh) when it is used for other species.

3.1 – trammel nets

SPAIN

GSA1 – NORTHERN ALBORAN SEA

FISHERY 1 - TRAMMEL NETS

General
Several types of trammel net are used along the coast practically in all the ports of the GSA1. Usually a same boat (fisherman) practices several types of fisheries, targeting different species by different types of trammel net.

Fishing ground
The fishing grounds are always located in areas from 5 to more than 100 m depth depending on the type of the trammel-net. The trammel nets named “claros” are fixed generally besides rocky areas from 5 to 10 m depth, the “ciegos” in muddy and sandy grounds between 15 and 40 m and the “langosta” trammel net up to 200 m.

Fleet concerned
The trammel net fishery is practiced by an uncertain number of boats.

Fishing time over a year
The fishing season varies depending on the type of gear. The “claro” is used from January to May, being replaced by the “ciego” between June and September, when the recruitment of *Mullus surmuletus* occurs in the area. The “langosta” trammel net is also used in summer time.

Fishing equipment
Both the inner and the outer nets vary in mesh size depending on the target species. The “ciego” has an inner mesh size from 4 cm to 5 cm and an outer between 30-40 cm, while in the “claro” the inner mesh is usually of 7-8 cm and the outer 40-50 cm. In the langosta trammel net the inner mesh size is 10 cm and the outer 60 cm. The height of the gear also differs by types, ranging between 1.5-3.5 m.
Hanging ratio varies from 0.5 to 0.65. The maximum length is 2500 m but usually is lower than 1200 m.

Deck layout and machinery involved
Net hauler usually situated forward.

Electronic equipments
GPS, radio, only a few with echo sounder.

Data on catch
Target species are cuttlefish (*Sepia officinalis*) in the “claros”, red mullets (*Mullus* spp.) in the “ciegos”, and lobsters (*Palinurus mauritanicus*) in the “langosta”, but also a other species are fished among them are important some Sparids.

Technical interactions with other fisheries
With trawl fisheries for the area.

Special features

Relationship between fishing effort, fishing mortality and catch rates
No data.

GSA5 – BALEARIC ISLANDS

FISHERY 1 -TRAMMEL NETS

General
Practically the same types of trammel nets are used in the GSA5 than in the previous one.

Fishing ground
The fishing grounds are always located in areas from 5 to more than 100 m deep, depending on the type of trammel net. The trammel net named “claros” are fixed generally besides rocky areas 5-10 m deep, the “ciegos” in muddy and sandy grounds between 15 and 40 m and the “langosta” trammel net up to 200 m.

Fleet concerned
An unknown number of boats but probably by more than 400 boats practice the trammel net fishery.

Fishing time over a year
The “langosta” trammel net is used from March to August since there is a 6-month closure during the rest of the year.

Fishing equipment
Both the inner and the outer net vary in mesh size depending on the target species.

Deck layout and machinery involved
Net hauler usually situated forward.

Electronic equipments
GPS, radio, only a few with echo sounder.

Data on catch
Target species are cuttlefish (*Sepia officinalis*) in the “claros”, red mullets (*Mullus* spp.) in the “ciegos”, and spiny lobster (*Palinurus elephas*) in the “langosta”, but also other species are fished, among them some Sparids are important.

Species	Weight (t)
Sepia officinalis	13342
Mullus surmuletus	8194
Palinurus elephas	5608

Technical interactions with other fisheries
No interaction exists.

Special features
No quotas exist in *P. elephas* fisheries and reliable catch statistics are not available. In the Spanish Mediterranean effort controls and technical measures are used to manage fisheries. Fishing effort is regulated by an annual 6-month closure during the egg-bearing period (September to February) and there are caps on the amount of gear fished per boat (5000 m trammel nets) and on the soak time (<48 hours). The minimum mesh size of the trammel net outer and inner panels and the maximum size of the traps are also regulated. Finally, it is forbidden to land lobster smaller than 80 mm CL (about 4 years) and berried females.

Relationship between fishing effort, fishing mortality and catch rates
No data.

GSA 6– NORTHERN SPAIN

FISHERY 1 - TRAMMEL NETS

General
Same types of trammel net as those used in the other areas. Most of vessels use more than one gear simultaneously or seasonally. The trammel nets named “sepiera” and “salmonetero” are the most frequent gears and give more than 50% of the total artisanal catches.

Fishing ground

The fishing grounds are always located in areas from 5 to more than 100 m depth depending on the type of trammel net. The trammel nets named “salmonetero” are generally fixed on *Posidonia* meadows from 15 to 30 m depth, the “sepiera” in sandy grounds up to 20 m, the “langostero” on rocky bottoms deeper than 50 m, and the “lenguadera” on sandy bottoms up to 30 m.

Fleet concerned
The trammel net fishery is practiced by an uncertain number of boats.

Fishing time over a year
The fishing season varies depending on the type of used gear. The “sepiera” is used from December to June, being replaced for the “salmonetero” along all the year but especially between September and November, when more juvenile fishes are present in the area. The “langostera” trammel net is also used in summer time and the “lenguadera” from December to March.

Fishing equipment
Both the inner and the outer net vary in the mesh size depending on the target species.

Deck layout and machinery involved
Net hauler usually situated forward.

Electronic equipments
Most vessels have GPS, radio; only a few are equipped with echo sounder.

Data on catch
Target species are cuttlefish (*Sepia officinalis*) in the “sepiera”, red mullets (*Mullus surmuletus*) in the “salmonetero”, spiny lobster (*Palinurus elephas*) in the “langostera”, the common sole (*Solea solea*) in the “lenguadera”. Also other species are fished; among them, some sparids and scorpenids are important.

Technical interactions with other fisheries
No interactions.

Special features
No special features.

Relationship between fishing effort, fishing mortality and catch rates
No data.

FRANCE

GSA 7 – GULF OF LIONS AND LIGURIAN COASTS

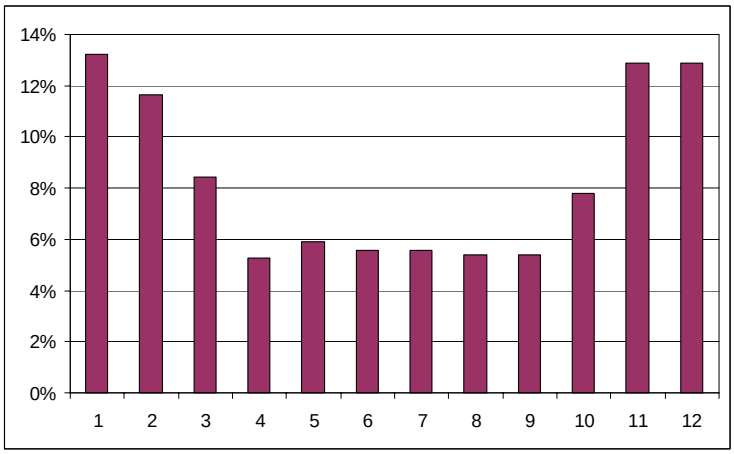
FISHERY 1 - SOLE TRAMMEL FISHERY

Fishing grounds
These techniques are mainly practised on smooth bottoms at SE of Gulf of Lions, from 60 to 100 m depth from October to April, and from 10 to 35 m depth from July to September.

Fleet
Ninty-nine fishing vessels were involved in these fisheries in 2003. They were more than 23 years old in average. Their length ranged from 5 to 9.6 m and their power from 15 to 374 kW.

	LOA (m)	GRT	GT	P (kW)
min	5	1,2	0,55	15
max	17,4	27	59	374
mean	**9,6**	**7,12**	**7**	**113**

Fishing time over the year
Soaking time is about 15 hours and this activity takes 40 days /year in winter for the offshore activity and 60 days/year for inshore activity.



fishing activity per month (%)

Fishing equipment
Trammel for sole is generally in multifilament with 70 to 110 mm inner mesh size, 300 to 500 outer mesh size and low buoyancy. The fishing height reach 1,5 m approximately. Net fleets do not exceed 5000 m.

Deck-layout
This technique needs a net hauler with single reel placed forehead and of a small wheel house. The working deck is placed generally behind the wheelhouse and its stern part is used to store the nets. The largest vessels have cover deck placed with a gangway in the middle to facilitate the passage of the nets from the net hauler to the working deck.
Two or three vessels own an automatic net hauler.

Electronic equipment
Echo-sounder
Electronic charter for the biggest vessels.

Data on catch
The target species are (*Solea solea*) and (*Solea lascaris*) whose individual sizes in landings range between 22 and 45 cm TL.
Catches are generally around 20 kg/ fishing trip.

Technical interactions
With bottom trawling.

Special features
Nothing.

Relationships between fishing effort, fishing mortality, catch
No data available.

FISHERY 2 - CUTTLEFISH TRAMMEL FISHERY

Fishing grounds

Gulf of Lions on sand bottoms, between 10 and 30 m depth.

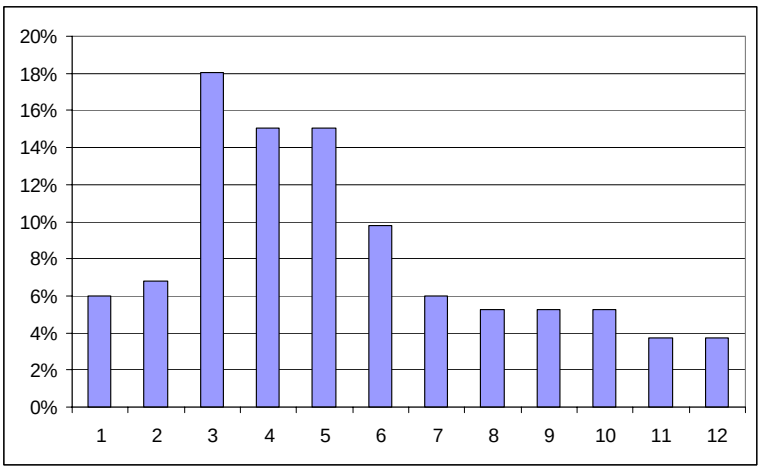
Fleet

Twenty-eight, 24-year old boats practise this technique. Their mean length is lesser than 7.6m and the mean power is 84 kW. The following table shows other characteristics.

	LOA	GRT	GT	P (kW)
min	5,32	1	1	13
max	13	10	10,5	250
mean	7,6	3,5	3	84

Fishing time

The cuttlefish fishery is mainly practised from February to April, during the spawning.



Fishing activity (%) per month

Fishing equipment

Approximately the same gear as for sole.

Deck-layout

Net hauler and open deck with small wheelhouse or full covered deck.

Electronic equipment

Echo-sounder; GPS; electronic charter.

Data on catch

Catches are mainly composed of cuttlefish (*Sepia officinalis*) and various flatfishes as sole (*Solea solea*, *Solea lascaris*).

Technical interactions

With bottom trawling

Special features
Nothing

Relationships between fishing effort, fishing mortality, catch
No data available

FISHERY 3 - BRILL AND TURBOT TRAMMEL FISHERY

Fishing grounds
Sandy grounds, at depth lower than 6 m for turbot and smooth grounds from 16 to 25 m depth for monkfish, rays and brills.

Fleet
Same characteristics as for sole. Length from 8 to 10 m and powers from 50 to 110 kW.

Fishing time over a year
Fishing season stands from October to December and from March to June for about 60 fishing days/year/boat. Soaking time does not exceed 30 hours.

Fishing equipment
Fleet of 3000 to 6000 m length of trammels in monofilament or multifilament with the inner mesh size from 120 to 200 mm. The nets do not exceed 1,8 m in stretched height.

Deck-layout
Same as for sole and cuttlefish.

Electronic equipment
Same as for sole and cuttlefish trammel.

Data on catch
No data

Technical interactions
Trawlers working on the Gulf of Lions shelf mainly fish *turbot* and *brills.*

Special features
Nothing.

Relationships between fishing effort, fishing mortality, catch
No data.

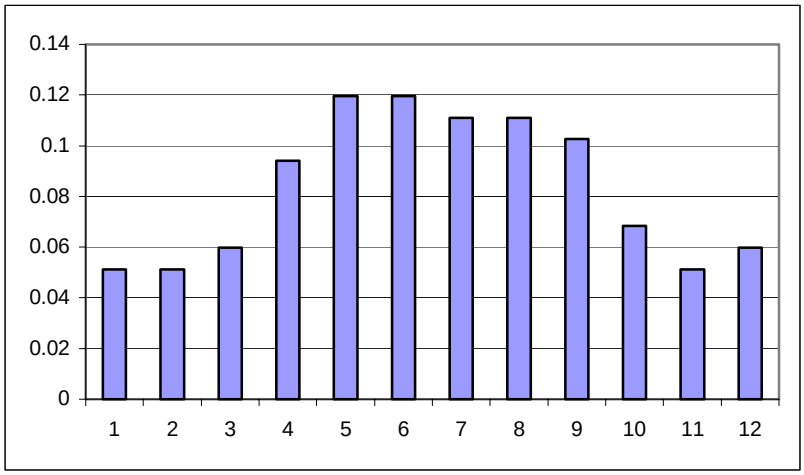
FISHERY 4 -MUREX TRAMMEL FISHERY

Fishing grounds
Shallow waters and sandy bottoms of the Gulf of Lions coasts.

Fleet
The fleet consists of 15 fishing boats, which are 27 years old. Their characteristics are given in the following table.

	LOA	GRT	GT	P(kW)
min	5	1,7	1	22
max	11,6	8,6	7,9	184
mean	8	4,2	3,6	88

Fishing time over the year



Fishing activity (%) per month

Fishing equipment
The fishing gear is similar to the sole trammel net with only a higher buoyancy. Fleets are generally made of 300 to 1000 km of trammel net having the inner mesh size ranging from 80 to 120 mm and a maximum stretched height of 1,5 m.

Deck-layout
As for small trammel vessels.

Electronic equipment
Echo-sounder and GPS.

Data on catch
No data.

Technical interactions
Nothing.

Special features
Nothing.

Relationships between fishing effort, fishing mortality, catch
No data available

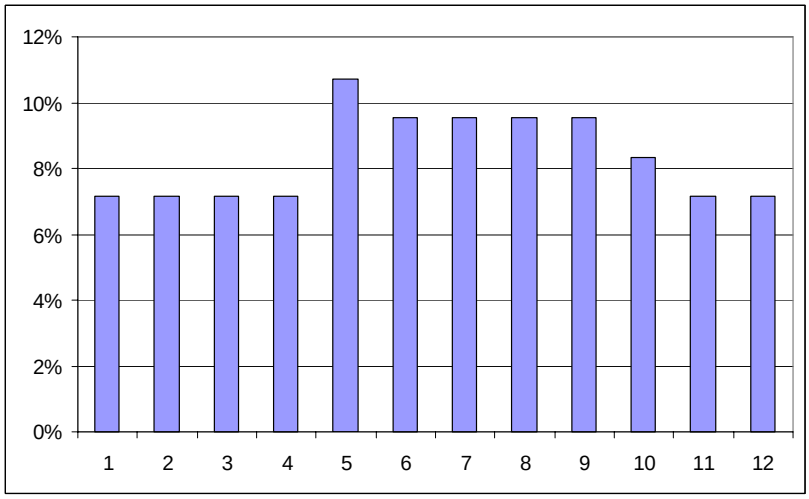
FISHERY 5 - SCORPIONFISH TRAMMEL FISHERY

Fishing grounds
These techniques are practised on coralligenous and seawed bottoms, between 10 and 40 m.

Fleet
The fishing fleet is composed of small, 33 years old vessels, 6-8 m long and 20-88 kW engine power.

	LOA	GRT	GT	P (kW)
min	5,5	2	1	13
max	9	5	3	87
mean	7,5	3,2	2,2	47

Fishing time over year
Fishing season lasts from May to July.



Fishing activity (%) per month

Fishing equipment
French fishermen use fleet of multifilament trammel net having a length < 1500 m and a mesh size ranging between 38 and 82 mm.

Deck-layout
No difference with boats working for the other trammel metier.

Electronic equipment
The same devices are employed as for the other trammel fisheries.

Data on catch
These metiers target species for fish soup and "bouillabaisse", including scorpionfish *(*mainly *Scorpaena porcus* and *S. notata)*, breams *(Diplodus et Sargus)*, "mostelles and small size species as red mullet (*Mullus surmuletus and M. barbatus*), labroids *(Symphodus)*, (*Spicara moena and S. smaris*).

Technical interactions
Interaction with coastal beam trawling.

Special features
Regional and seasonal restrictions are imposed by fishermen organisation limiting the set length and the fishing period.

Relationships between fishing effort, fishing mortality, catch
No data available.

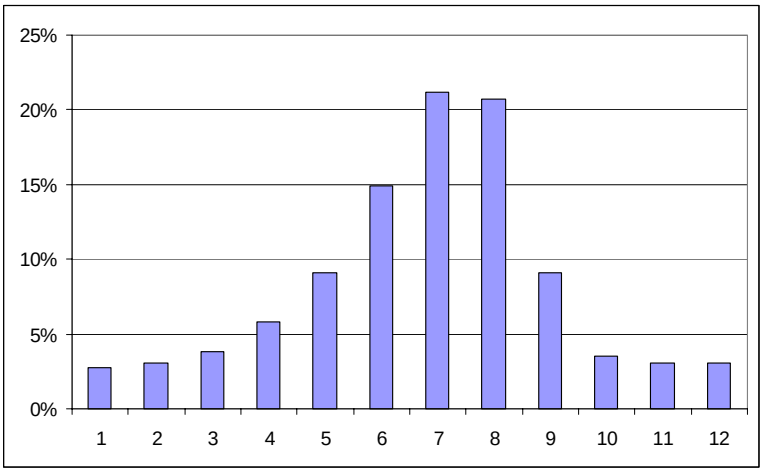
FISHERY 6 - CRAWFISH TRAMMEL FISHERY

Fishing grounds
This activity stands essentially on hard bottom of the slope of the Catalan and Liguro-Provençal coast, between 50 and 200 m depth.

Fleet
Ninety-two, 32 years old vessels having a length from 4 to 13 m and an engine power from 5 to more than 300 kW.

	LOA	GRT	GT	P(kW)
min	4	1	1	5
max	13	13	13,6	328
moy	7,6	3,8	3	57

Fishing time over the year
Fishing season lasts from March to October.
The gears are generally set for 3 - 4 days and approximately for 150 to 300 days/year/boat.



Fishing activity (%) per month

Fishing equipment
French fishermen set between 500 and 5200 m of trammel net in mono or multifilament; the inner mesh size ranges from 80 to 120 mm. The stretched height is generally less than 2 m. They are set at sea for 72-170 hours.

Deck-layout
Net hauler with 2 or 3 reels, fixed forehead. Wheelhouse often placed in the middle of the boat.

Electronic equipment
Echo-sounder; GPS; sometimes, electronic charter.

Data on catch
Two species of crawfish (*Palinurus elephas* and *P. mauritanicus*), with other highly valuable species such as monkfish (*Lophius piscatorius*), rockfish (*Scorpaena srcofa*), bream (*Pagrus pagrus*), and John Dory (*Zeus faber*).

Technical interactions
No particular interaction.

Special features
Prudhomies legislation.

Relationships between fishing effort, fishing mortality, catch
No data available.

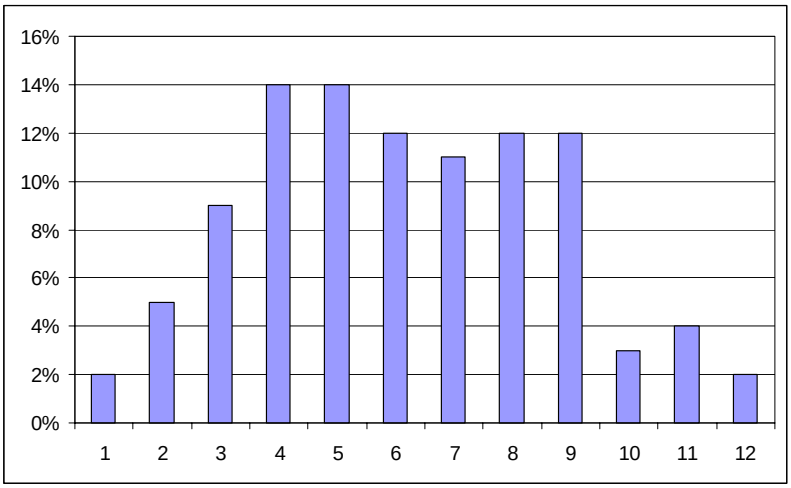
FISHERY 7 - RED MULLET TRAMMEL FISHERY

This technique concerns mainly the Eastern part of Provence and the Western part of Gulf of Lions and shallow waters lesser than 10 m depth.

Fleet
Eighteen 29-years old boats are involved in this fishery; they are 8 m long and have an average engine power of 56 kW.

	LOA	GT	GRT	P (kW)
min	6	1	1	13
max	10	10	7,5	250
mean	8	4	3	56

Fishing time
Fishing season lasts mainly from April to September for 150 to 250 days/year/boat.



Fishing activity (%) per month

Fishing equipment
Red mullet trammel nets have an inner mesh size ranging from 45 to 55 mm and the outer mesh size between 340 and 420 mm; they are made in monofilament or multifilament of 75 to 120 m/kg. Their stretched mesh varies between 1,5 and 1, 8 m and their length ranges between 100 and 2000 m. They are set at sea for 10-12 hours.

Deck-layout
As for all small boats of artisanal fishery.

Electronic equipment
Echo sounder and GPS

Data on catch
No data available

Technical interactions
Nothing

Special features
Nothing

Relationships between fishing effort, fishing mortality, catch
No data available.

OTHER TRAMMEL FISHERIES
Trammel for lobster (*Homarus gammarus*), trammel for cigale (*Scyllarus arctus*)

GSA 8 – CORSICA WEST COAST

FISHERY 1 - COASTAL TRAMMEL NET FISHERY FOR VARIOUS FISHES

This fishery is practised on bottoms from 0 to 40 meters deep and detritic grounds (rock, coral rock, sand and posidonian grass) mainly in the Western coast of Corsica.
About 200 boats with an average 8m length, 85 kW power and 5 GRT are involved in trammel net fishing.
The fishing time over a year per boat is evaluated to 1500 hours (180 fishing days/year and about 8 hours of soak time).

Fishing equipment
The coastal trammel nets are multifilament gears with 65mm inner stretched mesh size and a height of approximately 2 m. Fishermen set per day-trip a maximum of 50 nets, 50 m long.

Data on catch
This coastal trammel net fishery targets mainly bottom coastal fish as red mullet, sparidae, scorpaenidea, labridae, molluscs. The production of this activity would be estimate to about 500 Mt (100 Mt of *Mullus surmuletus*).

Special features

The legislation for minimum inner mesh size may be different from one fishing harbour to another.

FISHERY 2 - DEEP TRAMMEL NET FOR VARIOUS FISHES

Fishing areas are shared between 40 and 90 m depth on detritic and coralliferous bottoms. Both the fleet and the activity are the same as for the coastal trammel fisheries.
The setting time varies from 10 to 12 hours.
A 2500-m long trammel net is used, with an inner mesh size of 100 mm and 1.20 m height.
300 Mt are annually landed. The main species caught are *Scorpaena scrofa*, *Phycis phycis*, *Pagellus erythrinus* and *Pagrus pagrus*. Some crawfish can be caught too.

FISHERY 3 - CRAWFISH TRAMMEL NET

Fishing grounds

The same fleet and fishing grounds are concerned as for other trammel nets.
The soak time varies from 48 to 72 hours, during a period of six months (120 fishing days).

Fishing equipment

For crawfish, fishermen use a multifilament trammel net having a 166-mm inner mesh size and less of 1 meter of fishing height.
Local legislation limits the length of net fleet to 80 nets of 50 m length per boat.

Deck layout and machinery

The same for all small scale fishing vessels.

Data on catch

The species fished are: *Palinurus elephas* and *Palinurus mauritanicus* 170 MT/M year with 50 MT of by-catch of lobsters and spider crabs. Other by-catch species : monkfish (*Lophius* spp.), scorpionfish (*Scorpana scrofa* and *S. elongata)*, elasmobranches.

Technical interactions

Such fleet conflicts with small trawlers working in the same area.

Special features

Eight temporised closure areas are established since 1979 to protect *Palinurus elephas*.

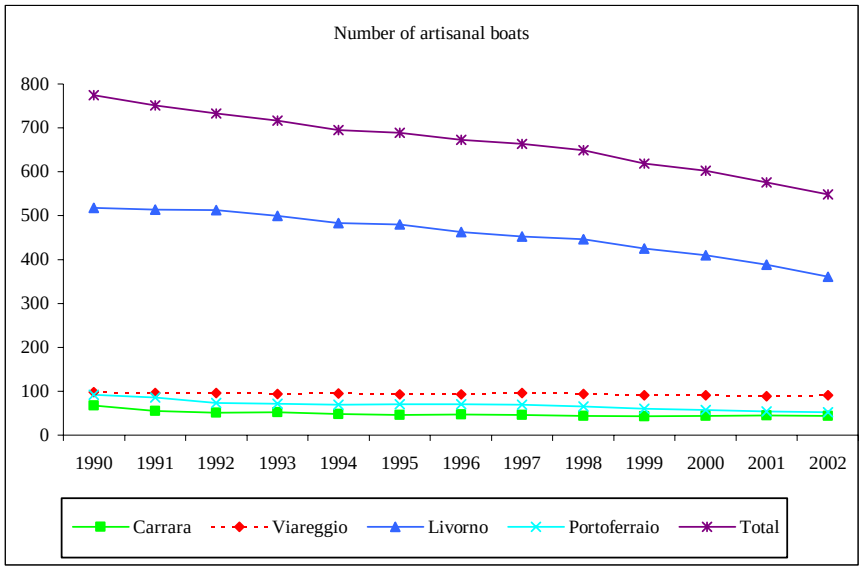
ITALY

Among the different types of set nets, trammel nets aimed at catching different species living near the bottom are quite common.
There are different types of trammel nets that differ in height, diameter of the armouring and internal fine mesh. In general, for some species, the fishing effort could be proportional to the length of the net, for example for soles or mantis shrimps, but for other species even the net height could be important, and in this case the overall area (length by height) could be referred to as a fishing effort index if related to the days of haul.
It should be noted that the trammel net can catch very different species, depending on the bottom, for example shallow coastal bottoms, detritic bottoms or deep mud, therefore the different types of trammel nets should be classified according to the target species.

GSA 9 – LIGURIAN AND TUSCANIAN SEA

General

In GSA 9, trammel net is the most utilised gear by the small-scale fleet. For example, in Tuscany (Maritime departments of Carrara, Viareggio, Livorno and Portoferraio) during 2002, 548 artisanal boats were licensed for fixed set nets and the majority of them utilise trammel nets at least in some periods of the year.



Trend of the total number of artisanal vessels in the four Maritime Departments of Tuscany **(***central part of GSA 9***)**

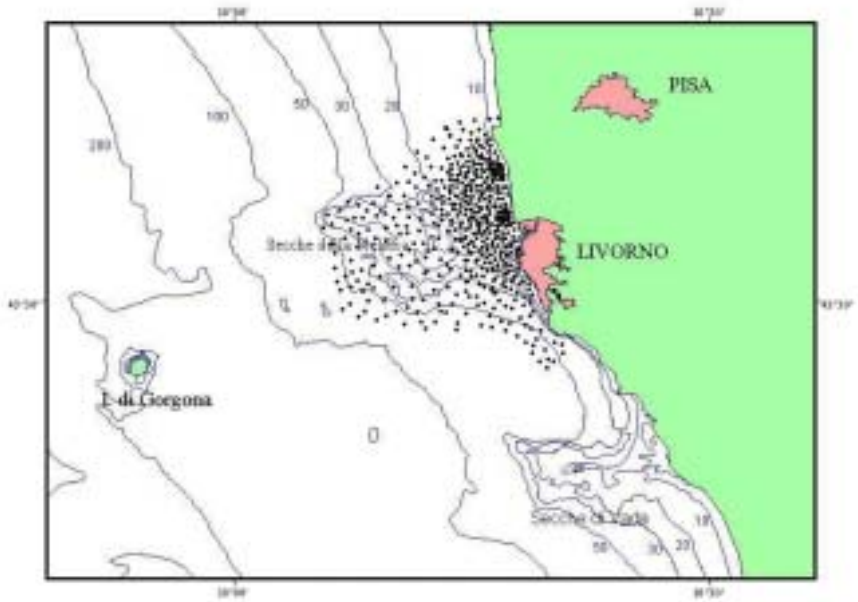
A very high number of variants in the technical characteristics of this type of net may be found; first of all this variability depends from the target species, but also the local habits (and each fisherman) may produce significant differences in the constructive characteristics of the nets. In spite of this high variability, some important fisheries with trammel net inside the GSA 9 may be identify: fishery targeting *Sepia officinalis* and "pesce bianco" ("white fishes", especially Sparidae), fishery targeting red mullets, *Mullus barbatus* and *Mullus surmuletus*, fishery targeting caramote prawn, *Penaeus kerathurus*, fishery

targeting Spiny lobster, *Palinurus elephas*. At present, there aren't available data on these two last fisheries.

FISHERY 1 - TRAMMEL NET FOR SEPIA OFFICINALIS AND "PESCE BIANCO"

Fishing grounds

The fishing grounds are generally localised in the surroundings of the ports. In the case of Livorno, most of the activity of this gear is carried out in a wide rocky bottom area, from the South of the port, to the North where sand-muddy bottoms are prevalent. This last area (5-15 m depth), largely coinciding with the fishing grounds of gillnet targeting common sole, shows the highest values of activity.



Fishing grounds of the artisanal fleet of Livorno using trammel net

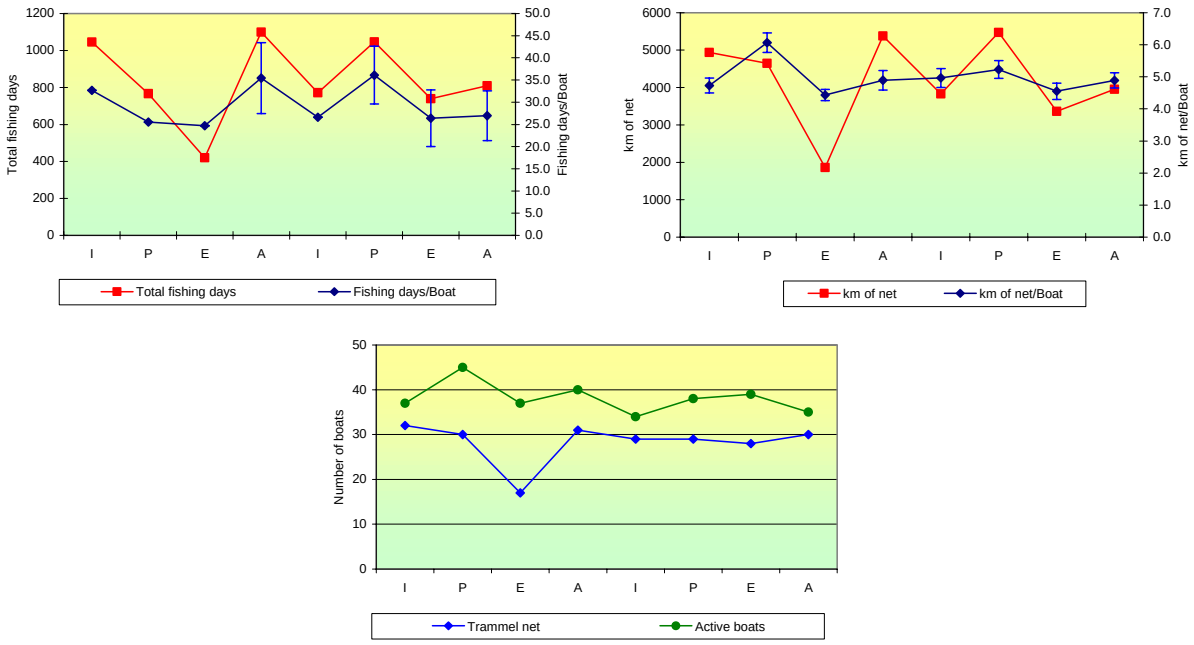
For this fishery, the target species are mostly represented by *Sepia officinalis* and white fishes such as *Lithognathus mormyrus*, *Sparus aurata*, *Solea vulgaris* etc. In some areas another important species may be *Octopus vulgaris*.
Although the majority of vessels change gear over the years according to the abundance of the target species, quite almost the boats of the artisanal fishery utilise this gear during the year.

Fleet

In Livorno, a representative port of the GSA 9 where about 60 artisanal boats are present, the percentage of the fleet using this type of trammel net ranges between 60% and 80% according to the season.

Fishing time over a year

This activity is carried out all year round, with some peak in correspondence with the maximum abundance of the target species; winter-spring for *S. officinalis*, summer for *L. mormyrus*, fall for *O. vulgaris*. In Livorno the maximum of the activity with this gear is observed in spring and the minimum one in summer. During the different seasons, the mean number of days/boat shows high fluctuations during the year, being mostly influenced by the meteo-marine conditions. It ranges between 36 days/boat in spring and 25 days/boat in summer.



Seasonal trend of the fishing activity, fishing capacity and total number of boats of the fleet of Livorno using trammel net for cuttle fish and "pesce bianco". Fishing days/boat and km of net/boat are already reported. (I = winter; P = spring; E = summer; A = autumn)

Fishing equipment

The technical characteristics of the trammel net targeting cuttlefish, used by the Livorno artisanal fleet, are resumed in the next table. Each boat utilises in average about 5000m of net during each trip.

Usually in this fishery the net is lowered into the sea at dusk and pulled in at dawn. When cuttlefish is the target species, the net frequently remains at sea for about 24 hours.

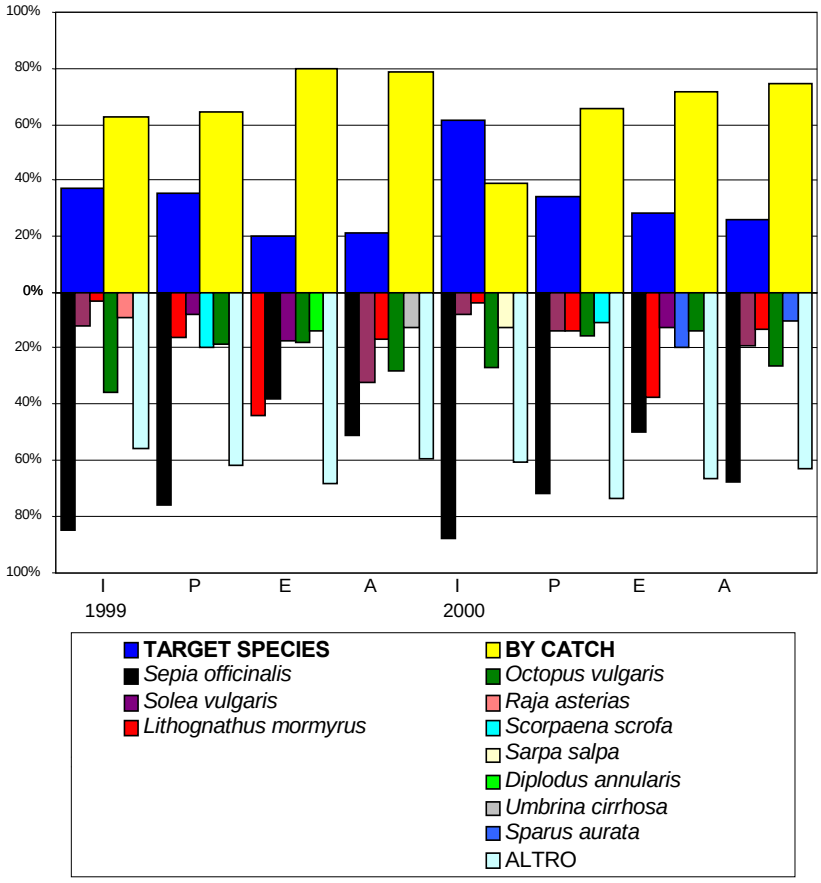
General characteristics of a trammel used in GSA 9

INNER PANEL						*Floats Number*	*HEADLINE*		*LEADLINE*
Hight (m)	*Length (m)*	*N. mesh (width)*	*Meshes*		*Hanging Ratio*		*Diam. (mm)*	*Material*	*(g/m)*
			Size (mm)	*Denier Gr/n Filament*					
3,3	*90*	*3000*	*66*	*210/6*	*0,45*	*55*	*4*	*PA*	*120*
OUTERN PANELS									
Hight (m)	*Length (m)*	*N. mesh (width)*	*Meshes*		*Hanging ratio*				
			Size (mm)	*Diameter Gr/n filament*					
1,8	*90*	*500*	*340*	*210/12*	*0,53*				

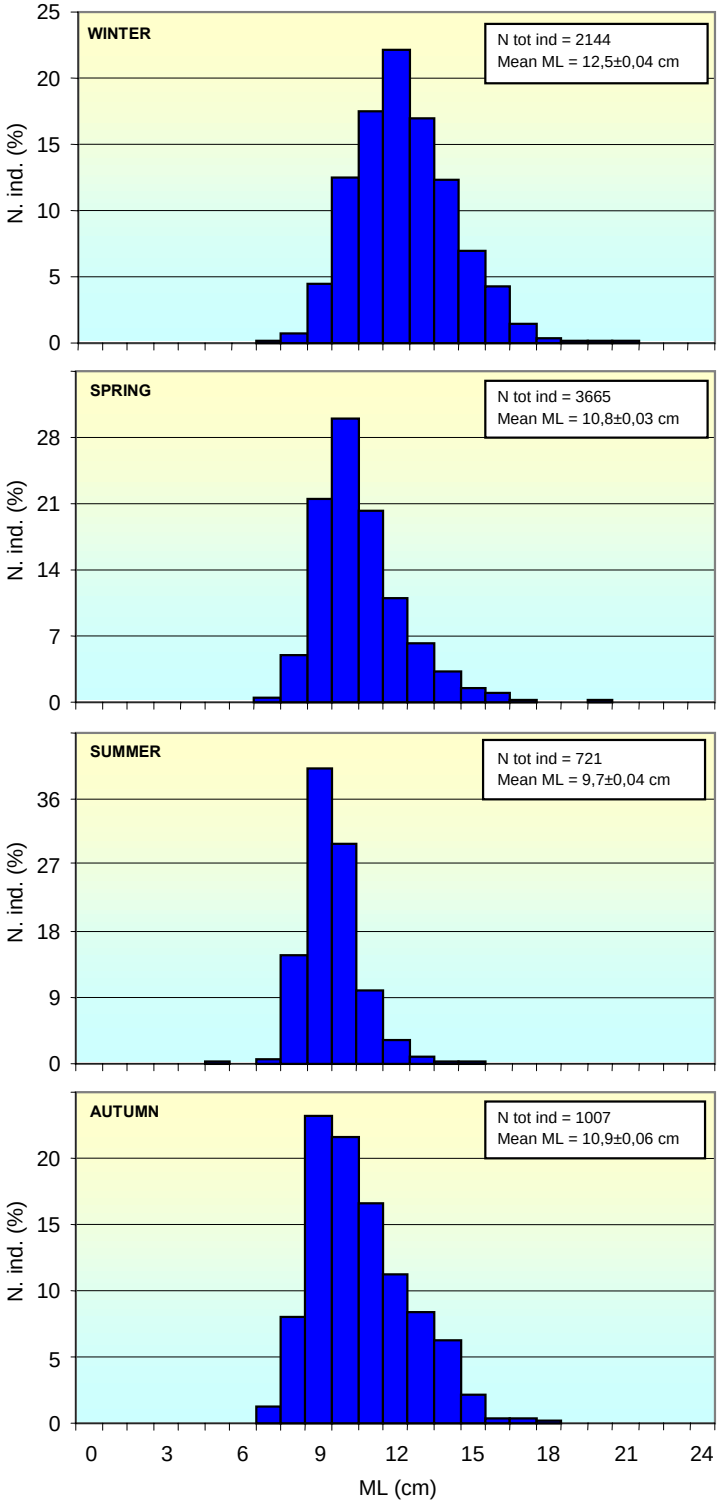
Deck layout and machinery involved
Devices are represented by a net hauler.

Electronic equipment
The electronic equipment generally consisted only by colour echosounder. Some boats may utilise GPS to reach more distant fishing grounds.

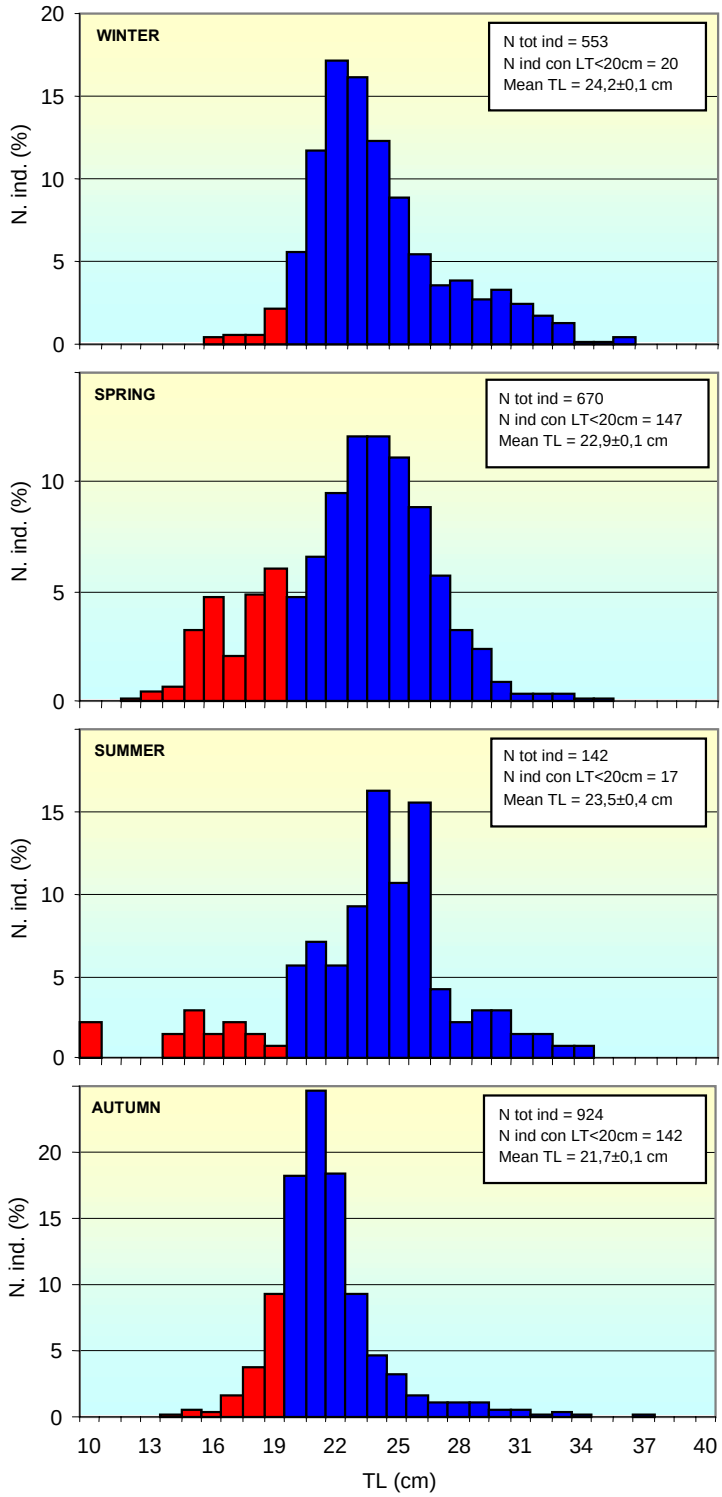
Data on catches
The landing of this fishery is constituted by a high number of species. In Livorno, in the period 1999-2000, 94 species comprehending 80 fishes, 5 cephalopods and 6 crustaceans have been landed. Target species represented in all seasons an important percentage of the total yields (from 20 to 60%).
S. officinalis represented always over 50% of the CPUE of the target species, resulting particularly important in winter-spring. *L. mormyrus* contributed to the yields of the target species in summer (9-11% of the total CPUE), while *S. vulgaris* is caught more constantly during the year, representing from 3 to 7% of the total catch of trammel net in the different seasons.
In this fishery the commercial fraction represents the majority (70-85%) of the total biomass caught. Discards is mostly due to the reject at sea of damaged specimens of by catch species; discard of the target species is usually negligible.
The length frequency distributions of the landing of *S. officinalis* with trammel net show a uni-modal structure with mean size of about 11 cm ML and size range included between 5 and 23 cm ML. In *S. vulgaris* the mean landing size is about 23 cm TL, with a wide size range in all seasons (from 10 to 37 cm TL). The catches of this gear included specimens under the minimum legal size of landing (20.0 cm TL, Reg. CE 1626/94), representing from 4% in number and 2% in weight (winter) to 22% in number and 9% in weight (spring).
The mean size of *L. mormyrus* landed by the artisanl fleet of Livorno with trammel net is about 24 cm TL, with a very broad size range included between 11 and 38 cm TL.



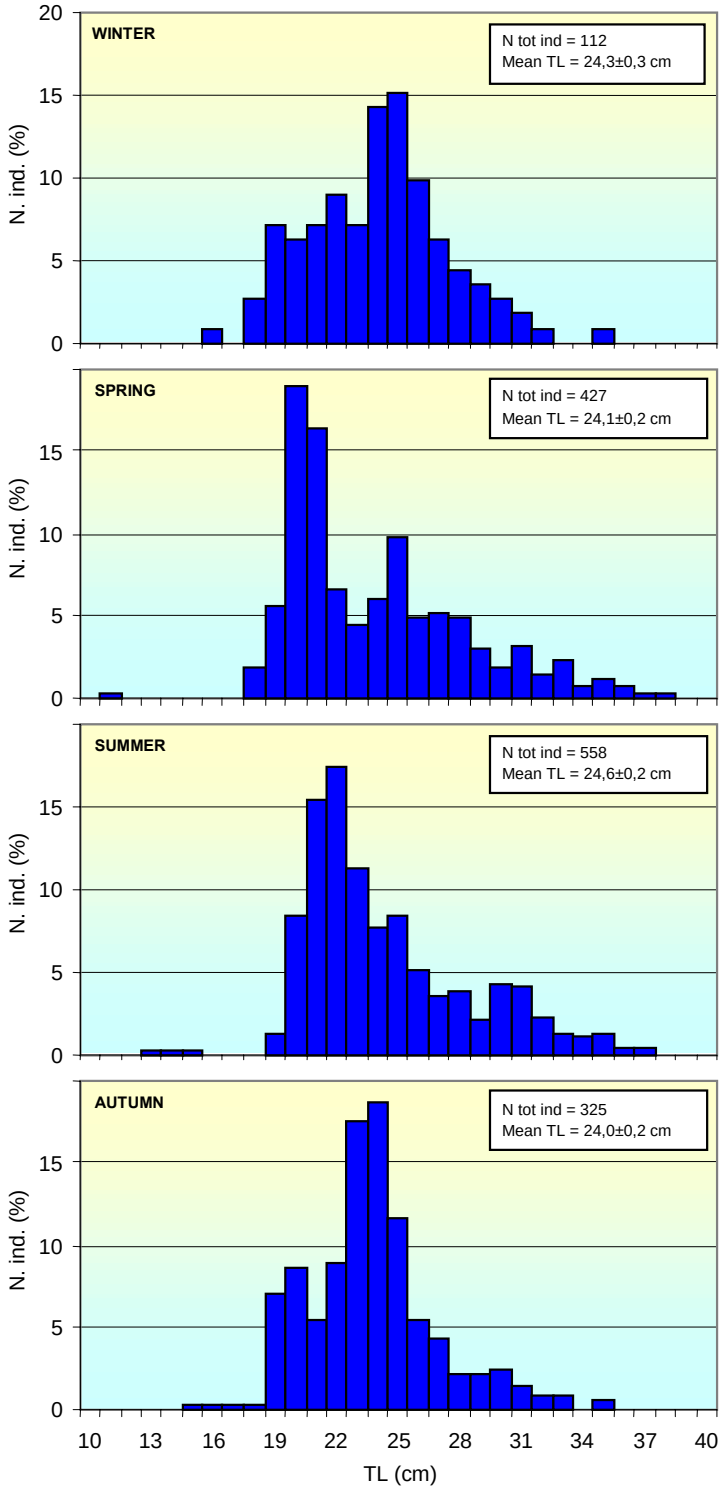
Composition (in percentage) of the catches by season obtained from the artisanal fleet of Livorno with trammel net. Blue bars: target species; yellow bars: by catch. I = winter; P = spring; E = summer; A = autumn.



Length frequency distributions of the specimens of S. officinalis caught by trammel net from the artisanal fleet of Livorno



Length frequency distributions of the specimens of S. vulgaris caught with trammel net from the artisanal fleet of Livorno. Red bars represent the specimens under the minimum legal size (TL<20 cm).



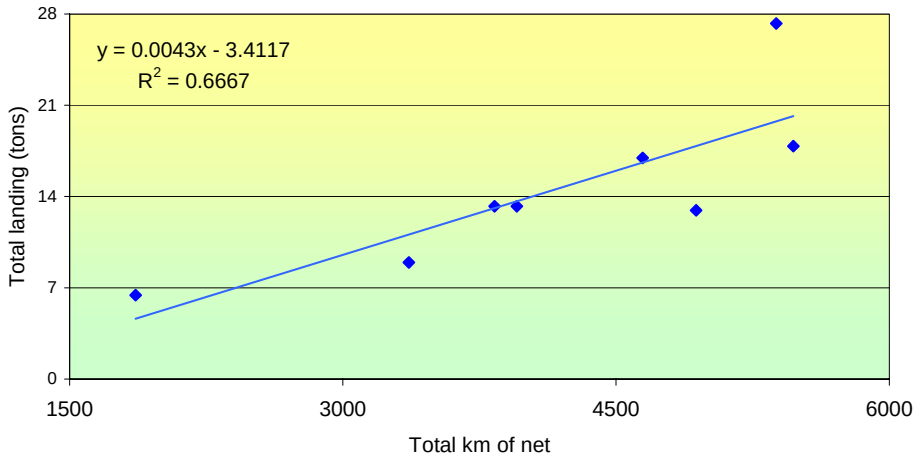
Length frequency distributions of the specimens of L. mormyrus caught by trammel net from the artisanal fleet of Livorno.

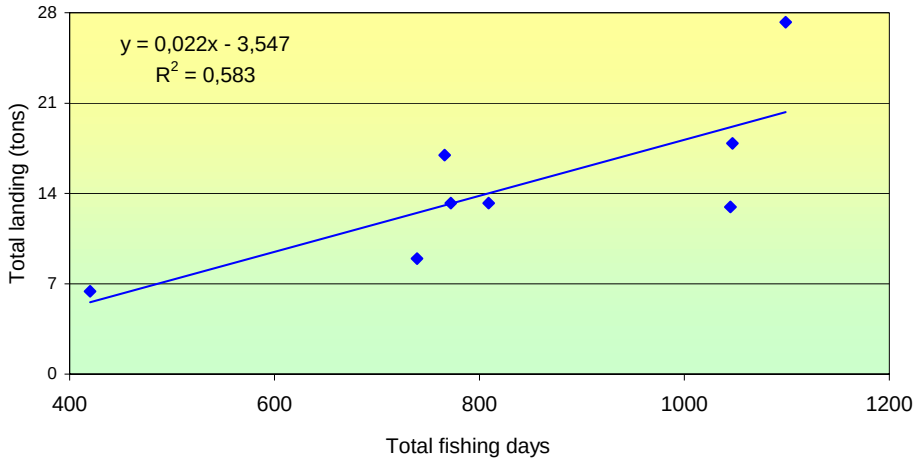
Interaction with other fisheries

This fishery is carried out exclusively in the coastal area. A spatial interaction may occur with other artisanal gears or with the illegal trawl fishery. Regarding the resource, cuttlefish is an important target species also for bottom trawl and rapido. *S. vulgaris* is a resource shared with gillnet and rapido fishery.

Relationships between fishing effort, fishing mortality and catch rates

In the artisanal fleet of Livorno, the total catches of trammel net show a correlation both with the fishing capacity (total km of net) and with the fishing activity (total number of fishing days).





Relationship between total catch and fishing capacity (above) and fishing activity (below) for the trammel net of the artisanal fleet of Livorno.

FISHERY 2: TRAMMEL NET FOR RED MULLETS

Fishing grounds

The fishing grounds are generally localised in the surroundings of the ports. In the case of Livorno, although the effort is distributed over a wide area, most of the activity of this gear is carried out in the zone extending between the harbour and the Meloria Banks, on rock-muddy bottoms. For this net the area of greatest yields of cuttlefish likewise corresponds to the zone of maximum effort; Meloria Banks and Vada Banks, where rocky bottoms prevail, are the areas with the highest CPUEs for *M. surmuletus*, while *M. barbatus* CPUEs show maximum values near the coast and on the outer part of the Meloria Banks, where muddy bottoms prevail.

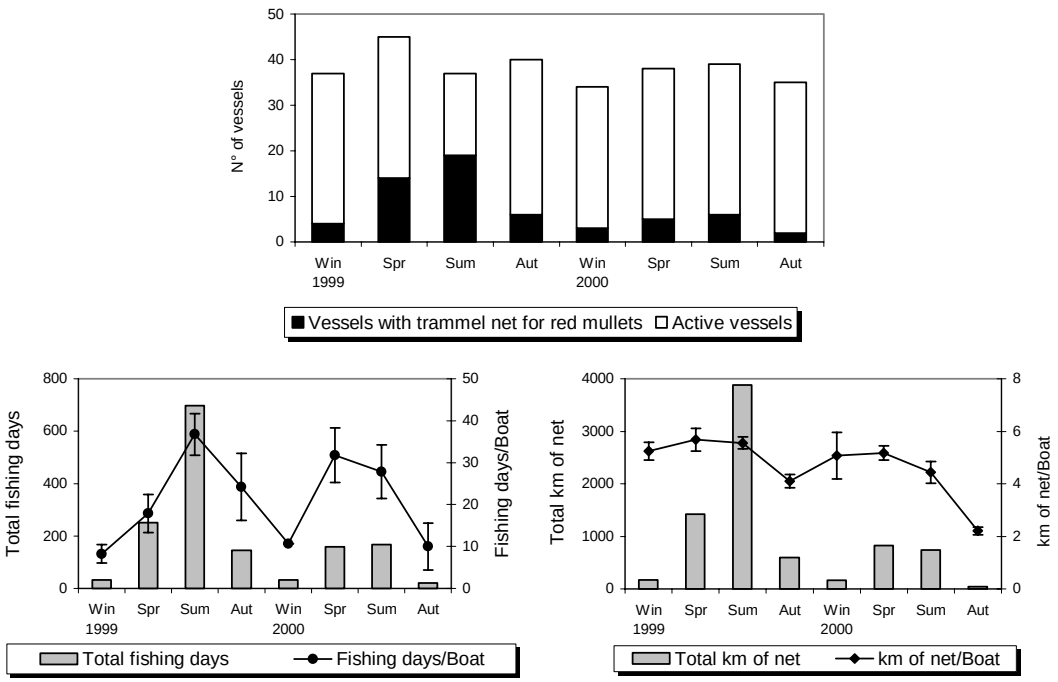
Fleet

In the GSA 9 small-scale fleet performs this fishery. The target species are mostly represented by *Mullus barbatus* and *Mullus surmuletus* but other species, such as cuttlefish, may significantly contribute to the total landing.

The total number of vessels utilising this gear is quite variable from year to year according to the abundance of the resources. For example, in Livorno a high number of vessels of the artisan fleet used this trammel net in 1999: 14 in spring (30% of the active fleet) and 19 in summer (50%). Over the following years a lower number of vessels employed this gear: 5 in spring (13% of the active fleet) and 6 in summer (15%).

Fishing time over a year

In Livorno the total fishing activity (fishing days) and the total fishing capacity (km of net used) result closely related to the number of vessels using this gear.



Seasonal trend of the number of vessels using trammel net for red mullets (above), of their fishing activity and fishing capacity (below) in Livorno artisanal fleet. Fishing days/boat (± S.E.), total km of net (± S.E.) and total number of vessels active in the sampled period are also reported.

Fishing days were concentrated in summer during 1999, while in the following year they were equally distributed between spring and summer; a similar result was obtained concerning fishing capacity. The maximum of activity was observed in summer 1999 (36.7 fishing days/boat) and in spring 2000 (31.8 fishing days/boat). This may be due to the different meteo-marine conditions in the two years. The mean length of nets utilised by each vessel in each fishing trip ranged from 2200 m in fall 2000 (when only two vessels were active) to 5700 m in spring 1999.

Fishing equipment

Technical characteristics of the trammel net targeting red mullets (M. barbatus and M. surmuletus) used by the Livorno artisanal fleet. Data are referred to a single sheet of net.

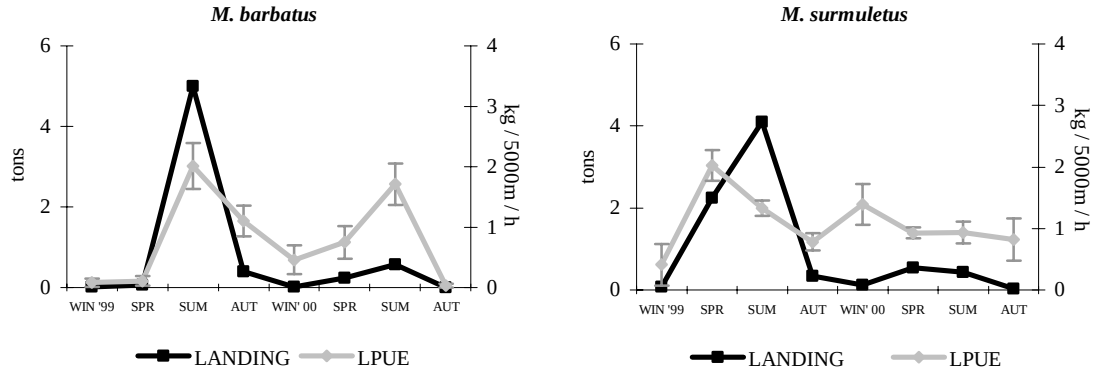
INNER PANEL						HEADLINE		LEADLINE
			Meshes					
Height (m)	Length (m)	N. mesh (width)	Size (mm)	Denier gr/n° filament	Hanging ratio	Diam. (mm)	Floats number	(g/m)
2.8	65	4000	45	210/3	0.36	5	65	120
OUTER PANELS								
			Meshes					
Height (m)	Length (m)	N. mesh (width)	Size (mm)	Denier gr/n° filament	Hanging ratio			
1.4	65	400	280	210/6	0.58			

Deck layout and machinery involved
Devices are represented by net hauler.

Electronic equipment
The electronic equipment is commonly constituted only by colour echo sounder. Some boats may utilise GPS to reach more distant fishing grounds.

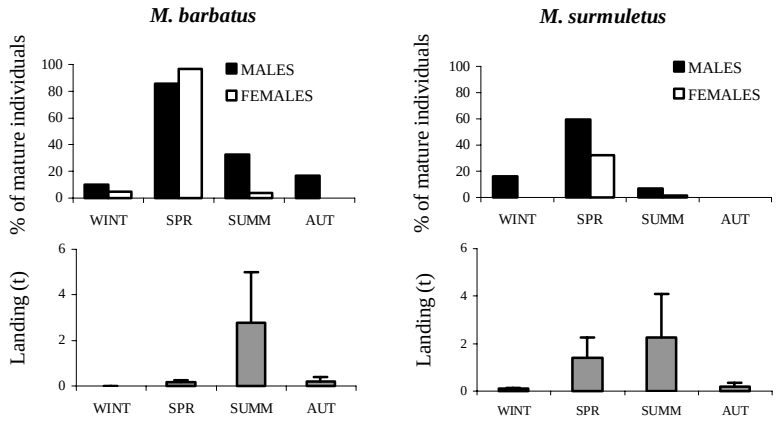
Data on catches
The seasonal trend of landing per unit effort (LPUE, kg/5000m/h) of *M. barbatus* for the Livorno fleet well fit with total landing, with maximum values in summer and minimum in winter. In *M. surmuletus* trends of LPUE and total landing are different, being the catch principally influenced by fishing effort more than the abundance of the species at sea. Commercialised biomass of both species represent a high percentage of the total catch. *M. barbatus* is totally commercialised in spring and autumn, while in winter and summer a low discard is observed (respectively 7% and 6% of the total catch). *M. surmuletus* is entirely commercialised in spring, while in the other seasons discard range between 4% in autumn and 14% in winter of the total catch. The criterion of discard doesn't show a relation with the size of the specimens, being the discarded fraction exclusively composed by damaged individuals.
Size range of *M. barbatus* catch is comprised between 11.0 and 23.5 cm of total length (TL). Except for autumn, in all the seasons the demographic structure is unimodal, with modes at

16.0 cm TL in winter and spring, and at 17.0 cm TL in summer. In autumn demographic structure is characterised by two modal peaks at 15.0 and 18.0 cm TL, due to the recruitment to the gear of juveniles and to the growth of adults.
In *M. surmuletus*, the size range of the catch is comprised between 12.0 and 28.0 cm TL. The size distributions of this species are similar in all seasons: the shape is unimodal with mode at 17.0 cm TL in summer and at 16.0 cm TL in the other seasons.

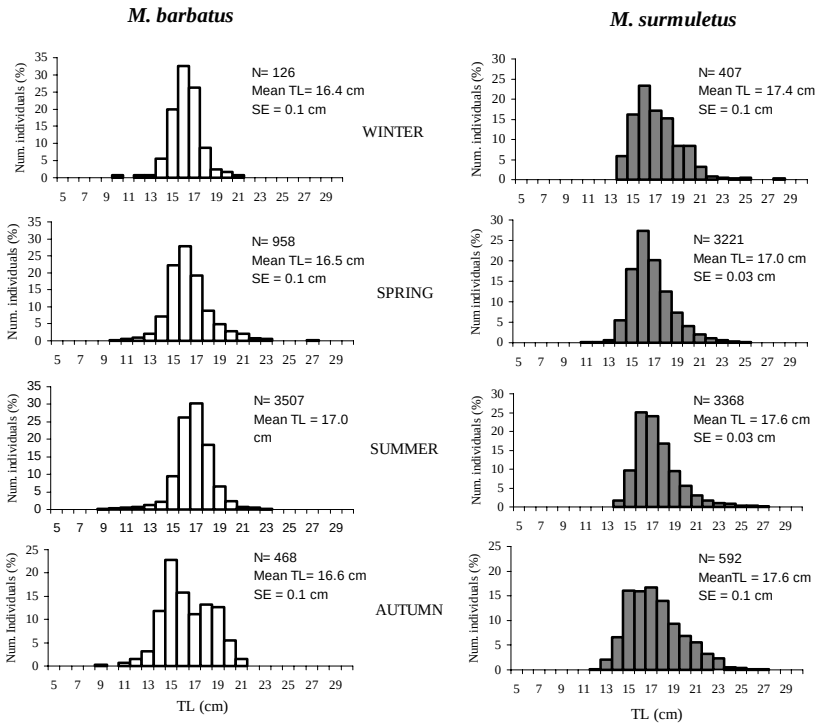


Seasonal trends of total landing and LPUE values (± standard error) for M. barbatus and M. surmuletus in Livorno

Sex ratio of the total catch is in favour of females ($p<0.05$) in both species in all seasons, except in winter for *M. surmuletus*, when the value is not statistically different from 1. The comparison between total landing and percentage of mature individuals shows that highest catches of the two species are obtained in summer, in the period subsequent to the reproductive activity; *M surmuletus* is abundantly caught also in spring, during its reproductive period.



Comparison between the percentage of mature individuals and landing of the two species



Length frequency distributions of M. barbatus and M. surmuletus catches

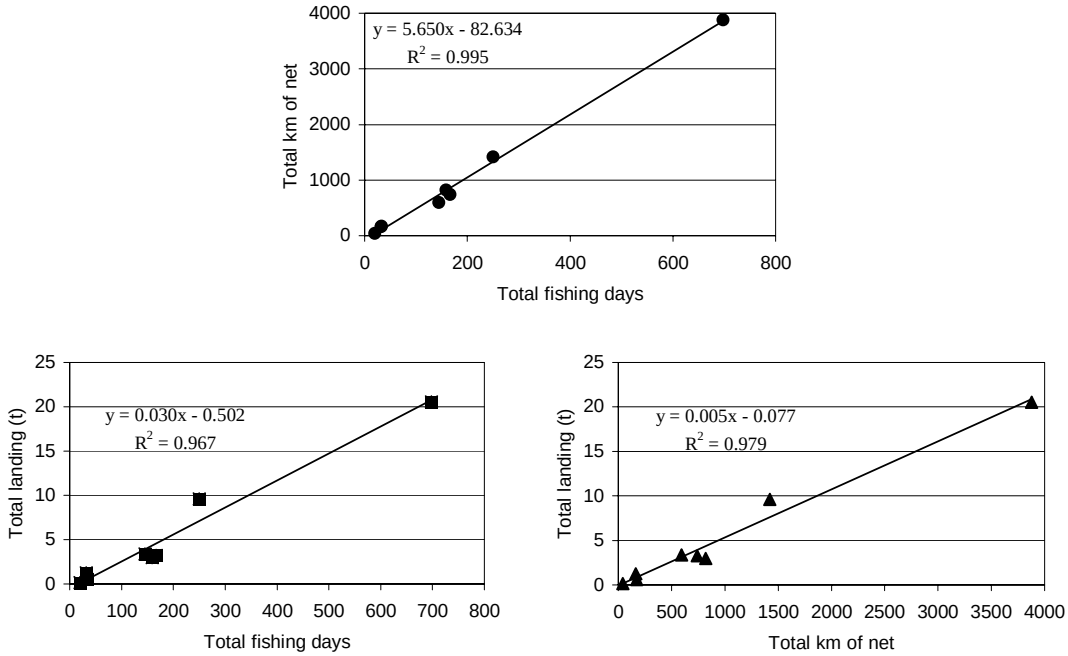
Interaction with other fisheries

This fishery is carried out exclusively in the coastal area. A spatial interaction may occur with other artisanal gears and with illegal trawl fishery. As to the resource, *M. barbatus and M. surmuletus* are two important target species also for trawl fishery operating on the continental shelf.

Relationships between fishing effort, fishing mortality and catch rates

The linear regression between fishing capacity and fishing activity is highly significant, with a positive slope. The total landing of each season is highly correlated both with the total fishing capacity and the total fishing activity.

The use of this type of trammel net seems to be adequate for the exploitation of these resources, in consideration of the low percentage of discard and of the reduced overlap between the period of highest fishing pressure from the artisanal fleet and the reproductive activity of the two species. In both species, the specimens caught with this gear showed greater size than the minimum legal landing size (TL=11.0 cm, EC Reg.1626/94) and than the size at first maturity (11-12 cm LT for *M. barbatus* females and 13.9cm LT for *M. surmuletus* females.



Livorno artisanal fleet using trammel net for red mullets. Above: fishing capacity vs fishing activity relationship. Below: total landing vs fishing capacity and total landing vs fishing activity relationships.

GSA 11 - SARDINIA

FISHERY 1 – TRAMMEL NET TARGETING PALINURUS ELEPHAS

Fleet.

Trammel net fishery targeting Palinurus *elephas* represents one of the most important activity of the artisanal fishery in Sardinia. Small boats carrying out this activity are localised all about the island.

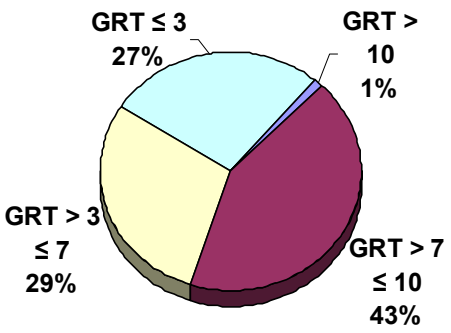
The number of vessels devoted to lobster fishery has a quota of 25% of the total small scale fishery fleet that was made up of about 1100 vessels (*Secci et al., 1995*),.

Fleet composition and boats characteristics involved in the Palinurus fishery with trammel net (*Maritime Department data*)

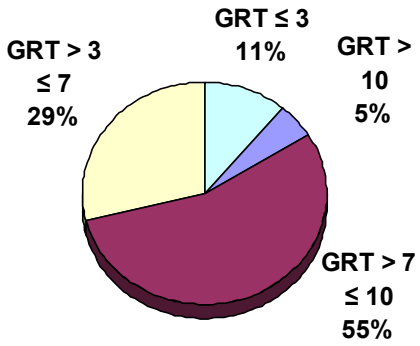
Base Port	Boats (N)	Total tonnage (GRT)	Total kW	Fishermen (N)
S. Antioco	10	95	1070	24
Carloforte	11	74	957	23
Calasetta	2	14	126	4
Marceddì	3	18	250	8
Cabras	46	310	4104	122
Su Pallosu	11	86	2391	33
Bosa	11	57	914	22
Alghero	56	246	2724	11
Stintino	12	39	421	26
Castelsardo	19	120	1585	49
Teulada	2	19	219	5
Cagliari	10	101	1222	27
Porto Corallo	5	51	562	12
Arbatax	15	99	1338	31
Calagonone	5	42	998	12
Siniscola	11	84	1220	28
Golfo Aranci	9	52	727	20
Olbia	2	12	159	4
Santa Teresa	14	112	1640	26
TOTAL	**254**	**1631**	**22627**	**587**

Regarding the set gear fishery targeting lobster, the field investigation on the Sardinian fleet has allowed to identify two subareas, belonging to Eastern and Western ports respectively, in which this fishery is particularly developed.

As regards the fleet composition of these ports no particular differences are detectable neither in terms of GRT nor in terms of length. However Western fleet is larger as to number of boats (71% of total).



Sardinia Western coast side



Sardinia Eastern coast side

Gross tonnage composition of fishery targets on Palinurus elephas in the GSA 11

Fishing grounds

The evolution of fish techniques utilized in the GSA 11 should be analysed through the years (1928-2000) from the table reported below.

Evolution of Palinurus fishery in the GSA 11

	1928	1955	1975	2000
Depth stratum of the exploited area (m)	15-100	15-100	50-200	50-200
Closing season	1 gen- 30 apr	1 feb -15 apr	1 set- 30 mar	1 set-28 feb
Minimum catch size allowed (cm)	20 cm	20 cm	26 cm	24 cm
Gears	80% pot 20% trammel	80% pot 20% trammel	5% pot 95% trammel	100% trammel
pots-pieces of net/boat	100 pot	100 pot	86 pieces of net	120 pieces of net

The activity of trammel net boats targeting *Palinurus elephas* in the 1928 was concentrated mainly on depths ranging from 15 to 100 m (till 1995) but, since 1975, fishing grounds are located between 50 and 200 m.
The available surface could be estimated in about 9.500 km^2 (Cau *et al.*, 1994).

Depth range exploited and fishing grounds available for Palinurus fishery in the GSA 11

Depth range (m)	West coast (km^2)	East coast (km^2)
50 - 100	1910	2156
100 - 200	1541	4404

Fishing time over a year
In Sardinia the fishery lasts for the winter months only. Fishing season starts at the 1st of September and generally ends on February. Therefore the effort of this fishery should be estimated in 180 days/year maximum. However this year (2003) the fishing season has been exerted until the end of March.

The fishing effort has been very variable during the fishing season., because of weather conditions. As a matter of fact the small dimensions of vessels and the distance of fishing grounds imply that fishing operations need good sea-weather conditions.

The effort of the most important lobster fishing fleet of Western coast, based on “Su Pallosu” port, vary from a minimum of 2 to 22 fishing days per month per boat. Moreover, depending on sea conditions, the hauled gear can fish from 24 to 48 hours. When the weather daily trips are usually carried out.

The fishing procedure is similar for all the crews; gill nets are lowered into the sea one-two hours before sunrise. This operation requires a minimum of one-two hours. Generally the gear is lowered in parallel to the bathymetric line in order to avoid damages to the set gears. Then the soaking time is of about 24-48 hours at depth. The operations to pull in the nets need from 1 to 2 hours to be completed.

On summer, during the closing season for lobster, the fleet change gear and targets species. Generally they fish with drifting long lines to catch sparidae (*Sparus pagrus*, *Dentex dentex*) and trammel net (targets to red mullets and sparids).

Fishing equipment
The Trammelnet used to catch lobster, locally named as "tramaglione”, is a nylon net with a thik rope of about 0.25 mm. Generally is made of 12-20 different pieces long about 100 linear meters each linked toghether to obtain a whole net. Therefore the average length of the tramaglione net is about 1.500 m.

Deck layout and machinery involved
In this fishery the mechanical devices are represented by powerful net hauler able to hauling in the net from deep bottoms.

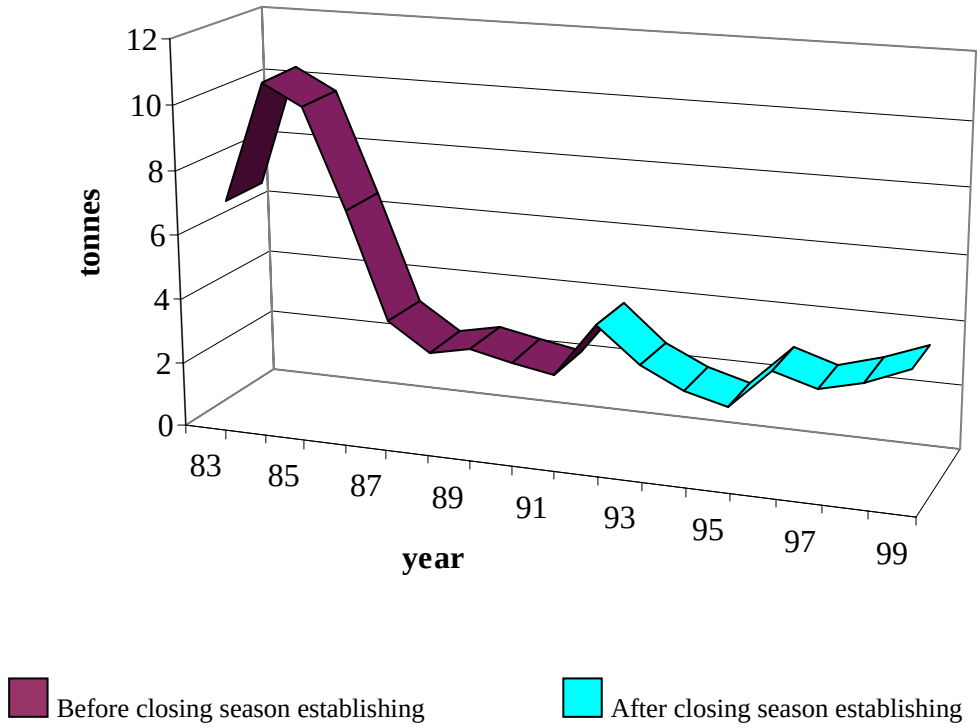
Electronic equipment
Most of boats utilise GPS, colour echo sounder and electronic geographic charts.

Data on catches
Catch landings statistics from FAO are available from 1972 to 1996 for some areas of the Mediterranean. They show the importance for this fishery in the GSA11.

Catch landings statistics from FAO (kg/year)

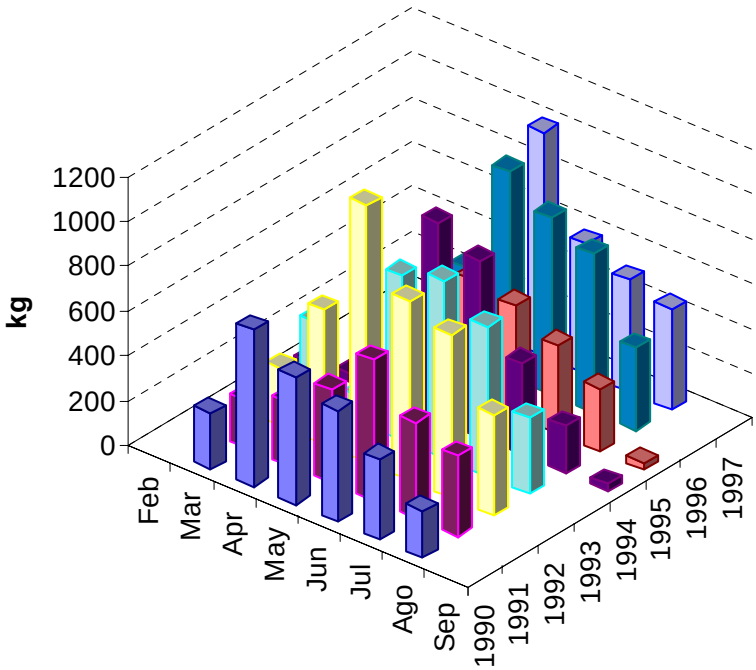
Year	Adriatic sea	Ionian sea	Sardinia	Total
1972	35	54	625	714
1973	28	503	483	1014
1974	25	241	268	534
1975	29	372	357	758
1976	49	254	484	787
1977	40	242	354	636
1978	46	510	312	868
1979	23	338	325	686
1980	62	317	229	608
1981	67	549	239	855
1982	100	268	119	487
1983	8	182	212	402
1984	54	161	433	648
1985	63	308	415	786
1986	80	210	419	709
1987	94	228	388	710
1988	717	529	836	2082
1989	47	150	293	490
1990	84	206	237	527
1991	26	132	104	262
1992	29	143	128	300
1993	25	84	102	211
1994	26	79	93	198
1995	22	69	106	197
1996	56	100	156	312
Average	**73**	**249**	**309**	**631**

Other information on historical data are available from some publications (*Santucci,1928; Manunza et al., 1955; Cottiglia et al., 1976*). They show a significant decreasing of boats, catches and mean size of catches through the years.
Considering landing from the most important ports of the west coast (Su Pallosu) the negative trend reported by FAO for the whole Island is confirmed. It is to be pointed out that after the institution in the 1991 of a regional regulation that established a closing season for that fishery, a slight increase on catches was obtained.



Landing (kg) of Palinurus elephas in a representative port *(Su Pallosu – Western Sardinia*)

Moreover trends on data landing (1990 – 1997) suggest that May and June are the most productive months.



Mean monthly commercial yields (kg) of Palinurus elephas in a representative port of GSA 11
(*Su Pallosu – Western Sardinia- years 1990-1997***)**

Interaction with other fisheries
In this fishery interactions may occur with longline or trammel nets targeting other species.

Special features
Since 1991, a regional law (DPR 22.07.91 n° 25) try to manage the fishery of this resources with a fishery closed season (45 days). Moreover a restocking area of 540 ha have been recently established (in 1998). This area is located 3 nm offshore capo Mannu, in the central-Western coast, between 50-100 m of depth.

Relationships between fishing effort, fishing mortality and catch rates
Management measures should take into account the fishing capacity and fishing effort regulation, checking the dimension of the fleet and the length of the net used per boat/day. Neverthless data about the relationships between fishing effort, fishing mortality and catch rates are not available.
Moreover regulations concerning spatio-temporal closures are useful to protect ground where important restocking aggregation is shown in some periods of the year.

GREECE

The inshore fishery represents the 90% of the fleet in terms of number of vessels and contributes to the total engine power by 64 %. The 54 % of the total catch of the Greek fishery comes from inshore fishery and contribute by 58% to the total value of catches (National Statistical Service of Greece, 1999). The main fishing gears used are gillnets, trammel nets, fyke nets and long lines.
There are about 20.000 vessels and more than 30.000 fishermen involved in these activities. The fleet is dispersed about the Greek coasts. Landing is taken place in many fishing ports and the recording of the catches or of other catch statistics (e.g. effort) is extremely difficult. A significant part of the fishermen has a second job (usually in agriculture or tourism) and fishing is more or less opportunistic activity. The inshore fisheries vessels have been reduced over the period 1991-2001 by about 10% . The small vessels (<12 m) showed a fast reduction from 1991 to 1993 and from 1998 to 1999 whereas the other years the reduction was much slower but constant. The big vessels (>12 m) were decreased fast between 1991 to 1993 and 1998 to 1999 but were increased between 1995 to 1998.
The inshore fisheries are targeting to a high variations of species. Many vessels are swift metier during one year. The allocation of the effort to fishing gear used or to target species is extremely difficult. The available data on catch composition, size composition, discards etc are very limited sporadic and restricted geographically. For important species (e.g. lobster) there are no data.
The inshore fisheries are much more species targeting, than bottom trawl, and some of them can be characterised as singlespecies metiers (e.g. *Pagellus bogaraveo*). The gears used are selective and generally the small fish can escape. However, instead of bottom trawl fishery, that operates only in proper fishing grounds, the inshore fisheries gears are not selective in the fishing ground, and they operate in any kind of substrate and consequently there are not natural shelters for the target and for the by catch species. The development of the artisanal sector in Greece is resulting to significant fishing effort and fishing mortality. The most known examples of fisheries that have been collapsed in Greece are related to two single species fisheries (*Pagellus bogaraveo* and *Polybrion americanum*).

GSA 20, 22, 23 – IONIAN, AEGEAN AND CRETAN SEA

FISHERY 1 - TRAMMEL NET FOR VARIOUS SPECIES

Trammel nets are the most important gear of the inshore fishery. This gear is used all over the year in nearly all the ports. There are different kinds of trammel nets regarding to gear characteristics, according to target species. Some métiers are dispersed almost in all the Greek seas but there are other métiers with just local interest. Target species of the trammel net métiers are: *Merluccius merluccius, Penaeus kerathurus, Solea vulgaris, Diplodus sargus, Mullus surmuletus, Mullus barbatus, Pagellus erythrinus, Dentex dentex, Sepia officinalis* and other Sparidae species.

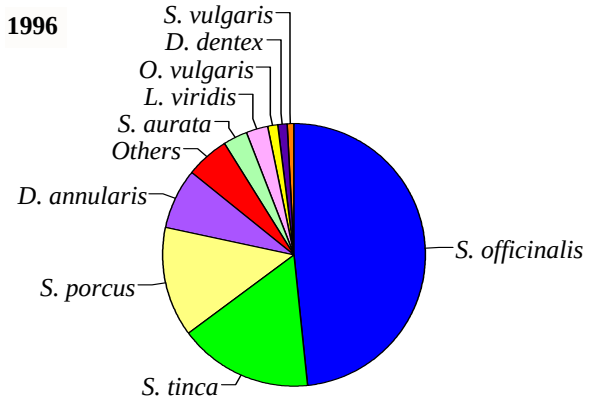
The special characteristics of the most common trammel nets used in Greece are listed below:

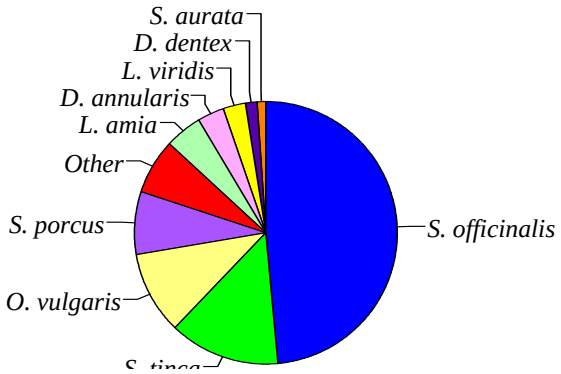
Target species	**Inner sheet**			**Outer sheets**			**Buoyancy (lt/100m)**	**Ballast (Kg/1000m)**	**Type**
	Mesh size (mm) bar length	**Hanging ratio**	**Depth (m)**	**Mesh size (mm) bar length**	**Hanging ratio**	**Depth (m)**			
Boops boops	22-26	0.6-0.73	2.6-3.1	110-130	0.6-0.73	1.3-2	6-15.6	9.6-56.3	Bottom
Dentex dentex	28-46	0.4-0.76	3.4-36.8	140-145	0.4-1	2-2.2	6.7-28.5	12.7-31	Bottom/ Floating
Homarus gammarus	22-40	0.35-0.67	2.6-4.1	70-210	0.35-0.97	1-2.7	4.4-7.6	7.8-16.8	Bottom
Mugil spp.	22-30	0.5-0.67	3.2-4.8	80-120	0.5-0.68	1.4-4.8	4.2-21.3	5.6-10	Bottom/ Floating
Mullus spp.	18-26	0.4-0.6	2.2-3.1	100-220	0.3-0.6	1.2-2.9	3.2-19.2	5.6-25.6	Bottom
Pagrus pagrus	32-40	0.6	3.4-4.8	170-200	0.53-0.6	2.2-3	4.1-5.2	10.6-13.5	Bottom
Penaeus kerathurus	20-28	0.4-0.5	2.4-4.2	90-140	0.38-0.54	1.1-2.1	1.4-6.7	5.6-17.8	Bottom
Sepia officinalis	32-42	0.34-0.6	2.6-4	130-300	0.49-0.59	1.7-3	1.9-6.6	5.1-15	Bottom
Solea spp.	28-45	0.5	2.4-9.6	110-225	0.4-0.64	1.3-2.9	1.3-12.2	5.1-33.5	Bottom

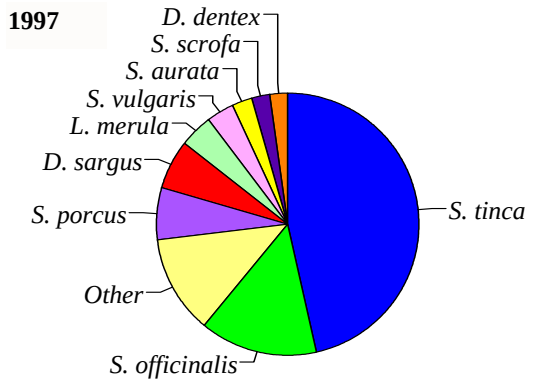
The cuttlefish (*Sepia officinalis*) and sole (*Solea vulgaris*) métiers have been studied by sending observers on professional vessels during 1996-1997 (Anon., 1998). The trammel net catch contributes about 60% and 80% to the total catch of cuttlefish and sole in Greece, respectively (NSSG). The results of the study are summarized below.

	Cuttlefish	Sole
Depth	2-12 m	18-34 m
Fishing period	March to April	December to March
Total CPUE	8.4 Kg/1000 m of net	18.1 Kg/1000 m of net
Target species CPUE	4.5 Kg/1000 m of net	5.7 Kg/1000 m of net
Total landings CPUE	6.9 Kg/1000 m of net	8.9 Kg/1000 m of net
Total discards CPUE	1.5 Kg/1000 m of net	9.4 Kg/1000 m of net
Landings/Total catch	0.83	0.48
Main by catch species	*Scorpaena porcus*	*Trigla lucerna*
Main discard species	*Symphodus tinca*	*Dasyatis pastinaca*
CPUE Main by catch species	0.8 Kg/1000 m net	1.4 Kg/1000 m of net
CPUE Main discard species	1.0 Kg per 1000 m net	6.2 Kg/1000 m of net

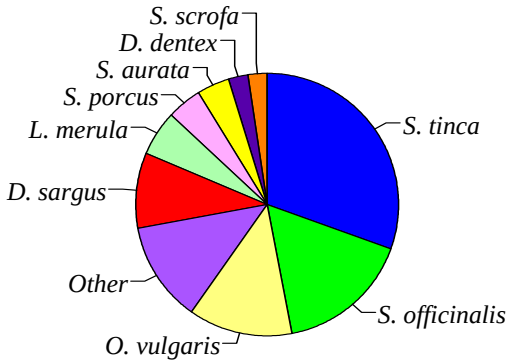
The combined catch compositions by number and by weight of the cuttlefish métier are the following.





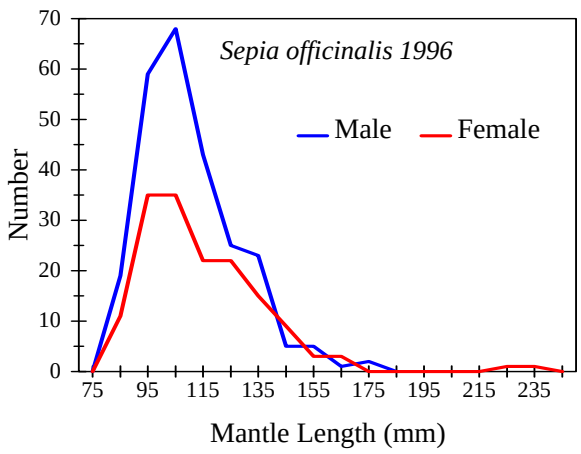


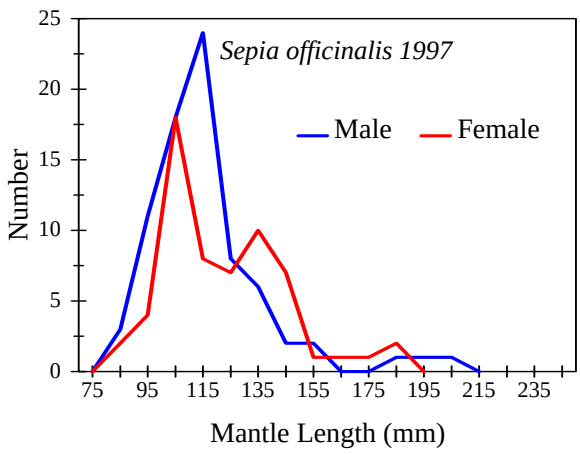
Combined catch composition by number



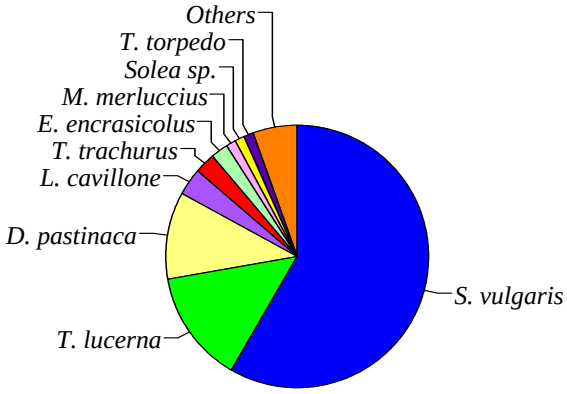
Combined catch composition by weight

The length distributions of cuttlefish per sex, for the two years of sampling are presented below.

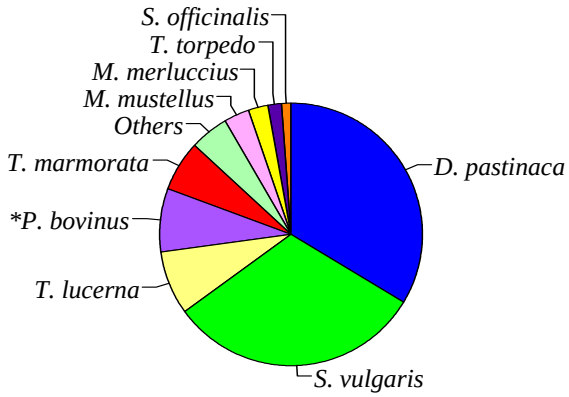




The catch compositions by number and by weight of the common sole metier are the following.

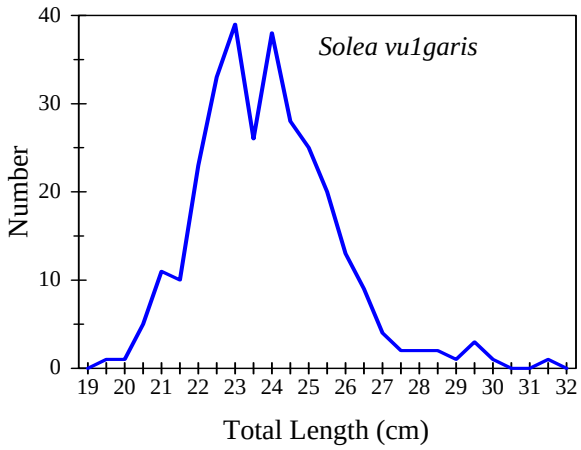


Combined catch composition by number



Combined catch composition by weight

The length distribution of common sole is presented below.



Length distribution of solea vulgaris

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3.2 – Gillnet fisheries

SPAIN

GSA 1,5,6 – ALBORAN SEA, BALEARIC ISLANDS, CATALAN COAST

Fishing ground
These gears are used along the entire Spanish coast.
The grounds are very different depending on the target species, but they are usually located close to rocky bottoms, except when the target species is hake that is caught in any type of bottom.

Fleet concerned
Gillnets are used by the artisanal fleet but the number of vessels using this kind of gear is uncertain.

Fishing time over a year
Since the number of target species is high, gillnets are used all the year round. The "bonitolera" is used seasonally from August to November coinciding with the migrational movements of the species.

Fishing equipment
The generic name given to gillnet in the Spanish Mediterranean is "solta". There are many modifications to the basic gear in function of the target species, which can be very different in size or behaviour.
Other two gillnets quite widespread along the coast are that targeting hake and the "bonitolera" targeting small tuna fish. The mesh size ranges from 4 to 8 cm.

Deck layout and machinery involved
Net hauler.

Electronic equipments
A part of the fleet does not use any electronic equipment.

Data on catch
The main species for traditional "soltas" are those belonging to the family Sparidae and the two species of the genus *Mullus*.
The gillnets targeting hake are frequent in GSA6 and a high portion of the catch is hake. As an example, in the Santa Pola port the "plastiquera" (local name for this type of gillnet) caught in the year 2000, 109 t, 47% of which corresponded to hake. Also in this port the "bonitoleras" caught 2.2 t being mainly *Sarda sarda*.

Technical interactions with other fisheries
With trawl fisheries in some places and with other artisanal fisheries.

Special features
Information not available

Relationship between fishing effort, fishing mortality and catch rates

In a study on the artisanal fishery in the Gulf of Alicante (GSA5) were obtained standardized abundance index; the main results for gillnet fishery for hake was as follow:

Species/ Group	Gear	Nominal CPUE mean ± SD (kg/boat/day)	Standardised CPUE ± SD (kg/boat/day)	Deviance % Explained GLM	Annual Trend	Season	Maximum CPUE
Hake	Gillnet	62.5 ± 32.7	52.11 ± 1.18	65.74	Stable Max.2000 Min.2002	All year; since 1996	May-August

FRANCE

GSA 7 – GULF OF LIONS

General

Gillnetting concerns several metiers, which target different species from the coast to the continental slope. However, most of them are restricted to inshore waters of less than 50 m depth and only hake and John Dory gillnetting are practised on slope. The fleet is composed of small boats, the length of which ranges between 4.5 and 17.4 m with an average power of 67 kW.

	LOA	GRT	GT	P (kW)
min	4,5	1	1	2
max	17,4	64	64	264
mean	7	3,8	3	67

FISHERY 1 - HAKE GILLNET FISHERY

Fishing grounds

When gillnetters are targeting hake, they set their nets between the edge and the slope of the continental shelf between 80 and 400 m. Their activity is mainly concentrated on the Eastern part of Gulf of Lions.

Fleet

The fleet consists of 116, 27-years old fishing boats. They are 9 m long and powered with 97 kW in average.

	LOA	GT	P (kW)
min	4	1	10
max	15	20	374
mean	9	5,5	97

Fishing time over

Gillnetters share their activity between hake fishing on bottoms of more than100 m depth during Winter and sparidae for the small boats and “thonnaille” for the biggest ones in Spring and Summer.
Soaking time does not exceed 12 hours with sometime daily setting to avoid predation by small scavangers (isopodes).

Fishing equipment

Hake gillnets are made of a net panel in PA monofilament of a diameter of 0,25 - 0,37mm and a mesh size of 80 mm. These nets reach 4-7 m in height and have a length ranging between 3000 and 5000 m.

Deck-layout

Mechanical net hauler with 2 or 3 reels set forehead. Open deck for the smaller boats and covered deck with a central gangway to make easier the passage of nets from the net hauler to the stern part of the working deck.

Electronic equipment

Echo sounder, GPS and electronic plotter.

Data on catch

Annual catches are estimated to be 300 MT, representing 15-16% of the French production. These catches are essentially composed of adults of 30-45 cm length.

Technical interactions

Interactions among trawlers, gillnetters and longliners have been largely described by French and Spanish scientists (*Aldebert and al*.).

Special features

Nothing to remark.

Relationships between fishing effort, fishing mortality, catch

No data valuable.

FISHERY 2 - RED MULLET GILLNET FISHERY

Fishing grounds

This fishery concerns all the littoral of the French Mediterranean coast. The target species are either *Mullus surmuletus* or *Mullus barbatus*. The fishing areas for *Mullus surmuletus* are bottoms enclosed between rocks and seagrass meadows, between 8 and 25 m depths. The biggest individuals which are scattered on deeper bottoms of continental shelf are less vulnerable to gillnetting.
Mullus barbatus are caugth mostly on seagrass meadows and muddy and sandy bottoms from 5 to 30 m depth.

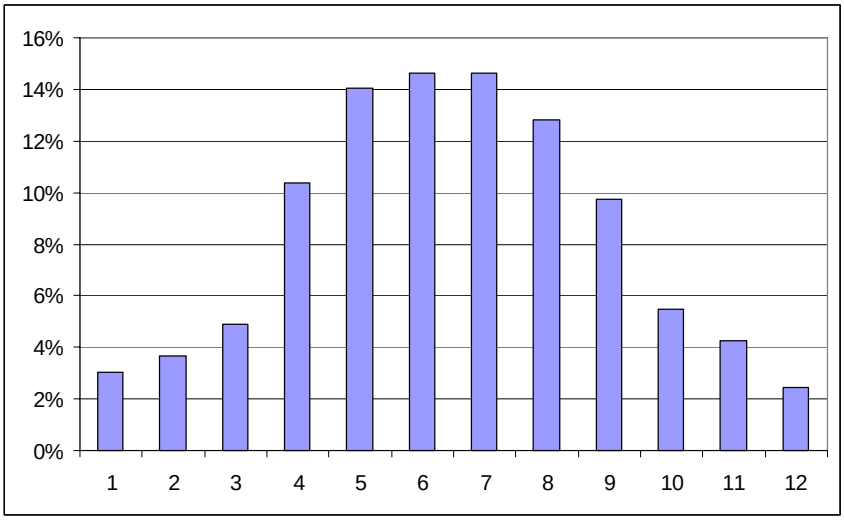
Fleet

The fleet consists of 191, 22-years old fishing boats. Their mean values are: 7.5m (length) and 75 kW (power).

	LOA (m)	GT	P (kW)
min	5	65	8
max	11	896	166
mean	7.5	278	75

Fishing time

The main fishing season lasts from April to end of September. These nets are set either before sunrise or before sunset for no more than 2 to 3 hours of soak time according to the delicacy of the fish.



Fishing activity (%) per month

Fishing equipment

The fishermen set generally between 200 and 2000 m of gillnet in PA monofilament of 0.18 to 0.25 mm. Mesh size ranges between 34 and 56 mm.

Deck-layout

Open deck with sometimes a small wheelhouse.

Electronic equipment

Echo sounder and GPS.

Data on catch

By-catch is mainly composed of labridae (*Symphodus* spp.*)*, small scorpionfish (*Scorpoena notata*) and small sparidae (*Diplodus* sp. and *Pagellus* sp.).

Technical interactions

Mainly with small inshore beam-trawlers or bottom otter trawlers targeting red mullet (mainly *Mullus barbatus*) in September on grounds between 20 and 30 m and in October on bottoms between 50 and 80 m.

Special features

Independently of the National regulation which establishes at 11 cm the legal size for *Mullus* sp., most of Prud'homies impose a minimum size of 22 cm.

Relationships between fishing effort, fishing mortality, catch

No data.

FISHERY 3 - SEA BREAM AND OTHER SPARIDAE FISHERY

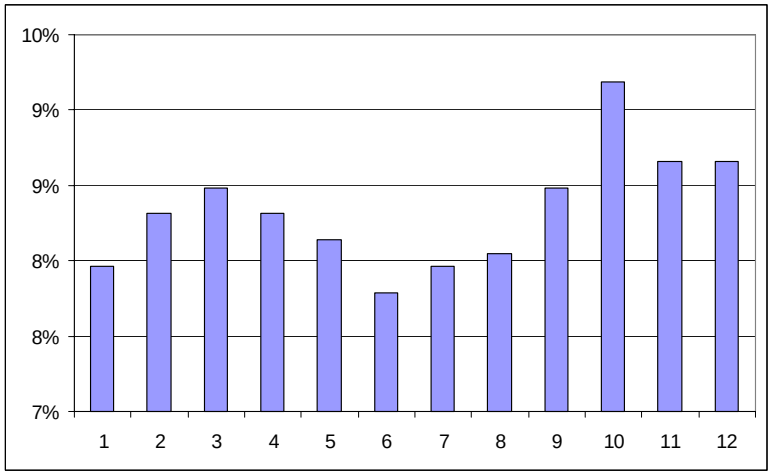
Fishing grounds
Fishing grounds are generally located between 5 and 40 m depth.

Fleet

From 95 to 128 fishing boats of the French small scale fishing fleet are seasonally involved in this technique. They are 25 years old, 7.5 m long and 85 kW in average.

	LOA (m)	GT	P (kW)
min	3,5	1	10
max	13,5	15,6	250
mean	7,5	3	85

Fishing time over
Fishing season stands generally from March to June and from September to December for sea bream (*Sparus aurata*), from May to June for porgies (*Pagellus* sp.) and from June to September (*Lithognathus mormyrus*). The best catches occur after heavy sea from Eastern or Northern winds.



Fishing activity (%) per month

Fishing equipment

Fishing gears are gillnets in monofilament of nylon of 28 to 35/100, with large development in height (from 4 to 25 m of stretched height). The stretched mesh, sized to the targeted species, goes from 62 mm to125 mm. The fleet lengths are often lesser than 2 km.

Deck-layout
As for small gillnetters.

Electronic equipment
GPS and echo sounder.

Data on catch
Main targeted species are: *Pagellus acarne, Sparus aurata, Lithognathus mormyrus*. Besides main marketable by-catch species that are: *Sarpa salpa, Oblada melanura Diplodus sargus,*

catches of less valuable species, as the shads (*Alosa* sp.), sardinelle (*Sardinella aurita*) or *Trachurus* sp. are sometimes in large quantities and may constitute an inconvenient feature for the fish removal.

Technical interactions
Technical interactions concern the fishery in the different lagoons of the Gulf of Lions.

Special features

Since 1451, this technique is submitted to a professional legislation, limiting mesh size, length and period of activity.

Relationships between fishing effort, fishing mortality, catch
No data

FISHERY 4 - SEABASS GILLNET FISHERY

Fishing grounds
Main fishing grounds are in coastal waters above bottoms between 5 and 30 m deep, within 3 nautical miles from the shore.

Fleet
Seventeen 23-years old fishing boats are identified to be regularly involved in this technique. The typical fishing boat for sea bass gillnet is a 7.5 m long vessel of about 74 kW involved in several other small scale fishing techniques (set nets, longlines, traps, dredge,…).

	LOA (m)	GT	P (kW)
min	5	6.5	18
max	10	5	250
mean	7.5	2.2	74

Fishing time over
This fishery is mainly practised in wintertime, from November to January at the rate of 20 to 80 days per year.

Fishing equipment
Gillnet for sea bass has a mesh size ranging from 80 to 100 mm, made of Pa monofilament of 58-90 Rtex; its stretched height is less than 4 m. Fishermen set about 500 m for 15 hours of soak time.

Deck-layout
Same as for other small gillnetters

Electronic equipment
GPS and echo sounder

Data on catch
No data

Technical interactions
With bottom trawling

Special features
Nothing

Relationships between fishing effort, fishing mortality, catch
No data

FISHERY 5 -MULLET GILLNET FISHERY

fishing grounds
The gillnet fishery for mullet is mostly a lagoon fishing activity, but it can be also practised in coastal waters, from 5 to 15 m depth within the 3 nautical miles. It is less common than in the past according to the low price of mullet.

fleet
Forty 27-years old fishing boats from 3,3 to 13,8 m long and with 50kW in average are generally involved in this technique for 30 - 100 days per year and per boat.

	LOA (m)	GT	P (kW)
min	3,3	1	2
max	13,8	21	294
mean	6,6	2,2	82

fishing time over a year
The main fishing season lasts from June to July.

fishing equipment
Fishing gear is mostly gillnet having a mesh size from 80 to 100 mm which can set in small fleets from 300 to 2000 m long.

deck-layout
The same as small gillnetters.

electronic equipment
Echo sounder and GPS

data on catch
No data
technical interactions
Nothing

special features
Nothing

relationships between fishing effort, fishing mortality, catch
No data.

FISHERY 6 - JOHN DORY GILLNET FISHERY

Fishing grounds
Fishing grounds are essentially located on the eastern part of the French Ligurian coast and on coralliferous bottom of the slope, from 180 to 250 m depth.

Fleet
From 5 to 10 fishing boats with a length of 6-10 m and a power of 20-80 kW.

Fishing time over the year
From March to June; for 80 days/year/boat.

Fishing equipment
Gillnets are in PA monofilament with a stretched height ranging from 8 to 12 m and a mesh size from 100 to 140 mm. These nets are set by fleet of about 1000 m length for 10- 48 h.

Deck-layout
Same as other small gillnetters

Electronic equipment
GPS and echo sounder

Data on catch
By-catch are generally low and composed of crawfish (*Palinurus* sp.), scorpionfish (*Scorpaena srcofa*) and monkfish (*Lophius* sp.).

Technical interactions
With crawfish trammel fishery

Special features
Nothing

Relationships between fishing effort, fishing mortality, catch
No data

OTHER GILLNET FISHERIES

Lithognathus mormyrus gillnet fishery involves 7 fishing boats and is carried out between 7 and 15 m depth from April to October.

ITALY

The gillnets can be rigged with monofilament yarns or multifilament yarns of polyammide fiber. Monofilament gillnets, called “barracuda” are frequently used.
It is essential to select the most appropriate mesh for the size and length of target species.
For this type of nets, given the variability in height, fishing effort can be measured based on the net surface (length by height) that is hauled for each day of haul.

GSA 9 – LIGURIAN AND TUSCANIAN COAST

General description

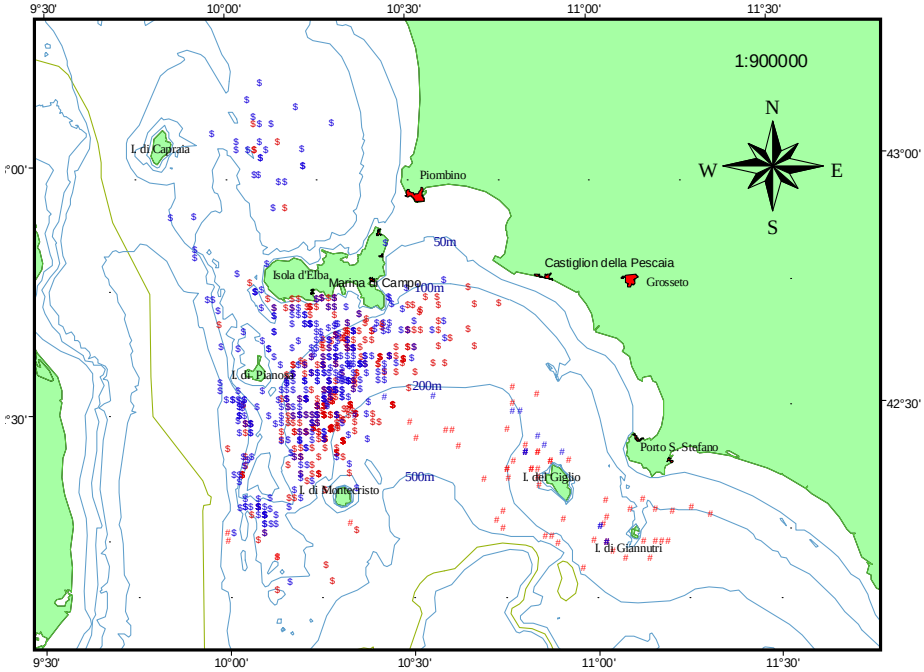
In the GSA 9, gillnet fisheries are well developed, particularly along the coasts of Tuscany and Latium (central and southern portions). This kind of gear is utilised by fisheries with a high level of differentiation among them. Significant differences are observed comparing the characteristics of the fleets, the main features of the gear, the target species and the composition of the landing.
Three main fisheries utilising gillnet may be identify in the GSA 9. The first one is the fishery targeting hake; due to the distance from the coast of the fishing grounds, this activity is generally carried out by larger boats of the artisanal fleet, using nets characterised by heavy structure, able to fish on deep bottoms. Other fisheries using gillnet are localised in the coastal area. The first one is the gillnet fishery targeting common sole, *Solea vulgaris*, carried out on shallow sand-muddy bottoms along the coast. The constructive features of this net determine its partial lying on the bottom, in order to increase the efficiency towards flat fishes. The third type of gillnet is utilised by the artisanal fleets to catch white fishes, mainly Sparidae, Scienidae and Moronidae. Frequently this net is used in association with trammel nets.

All three types of gillnet show variations in the constructive characteristics among ports according to local traditions, geo-morphological characteristics of the coast and bottoms and abundance of the species.

FISHERY 1 - GILLNET TARGETING HAKE

Fishing grounds

The fishing activity of gillnet boats targeting hake of Marina di Campo and Porto Santo Stefano is concentrated principally on bottoms ranging from 100 to 200 m depth; the first fleet operates on fishing grounds localised among the southern coast of Elba, Pianosa and Montecristo; occasionally, only during the summer, some vessels work to the North of Elba Island. The second one fishes about the Giglio and Giannutri Isles.
Terracina gillnet fishery work from the coast to 100-120 m depth, especially in the area between Sperlonga and Circeo Cape, on sand-muddy bottoms often close to rocky formations.
Ponzas fishermen mainly exploit two large fishing grounds. In spring and summer, and in bad weather and marine conditions, vessels fish inshore (up to 200 m depth) close to the islands of Ponza and Palmarola, between Ponza and Ventotene Islands or between the islands and the continental coast. In winter time they fish in deeper waters, beyond 200m depth, on the north side of Palmarola Island up to Anzio, or between Ponza and Ventotene Islands.



Fishing grounds of the vessels targeting hake with gillnet. Blue symbols: Marina di Campo fleet. Red symbols: Porto Santo Stefano fleet. Fishing grounds of the vessels targeting hake with gillnet. Blue symbols: Marina di Campo fleet. Red symbols: Porto Santo Stefano fleet.

Fleet

In the GSA 9, gillnet fishery targeting hake, *Merluccius merluccius*, is an important activity particularly in the northern and central Tyrrhenian Sea. In the Ligurian Sea (northern part of GSA 9) small boats carrying out this activity are localised at Viareggio.

Regarding the set gear fishery targeting hake, the investigation on the Tuscany fleet has allowed to identify two ports of greater interest in the Northern Tyrrhenian Sea: Marina di Campo (Elba Island) and Porto Santo Stefano.

The hake fleet of Marina di Campo is composed by 15 boats using gill nets, while that of Porto Santo Stefano by 5 boats. Historical trends on the consistency of the fleet and data on the characteristics of the boats fishing hake with gill net are not available; in the last years the number of boats in both ports resulted stable.

In the central Tyrrhenian Sea, Terracina and Ponza are other two important ports where this kind of fishery is carried out during the year. At Terracina the small scale fishery fleet is made up of about 80 vessels, being about 15 the vessels regularly devoted to targeting hake with gillnet.
The smaller vessels (3-6 tons, 29 kW engine power and 7 m length) fished with gillnets very close to the coast, while the larger ones (7-8 tons, 92 kW and 11 m length) operate a little further from the coast.
The Ponza hake fishing fleet is made up of 11 small scale fishery vessels divided as follows: 1 vessel with more than 20 GRT working mainly in the waters of the Tuscan Archipelago, 6 vessels with GRT ranging from 5 to 10 and 1 vessel with GRT less than 5.

Characteristics of the boats with gillnet in the period 1998-1999 (*Maritime Department data*)

	VIAREGGIO	MARINA DI CAMPO	PORTO S.STEFANO	TERRACINA	PONZA
Number of boats		15	5	81(15)*	11
Total kW		1855	627	4154.5	1337
kW/boat		123.7	125.4	51.3	121.5
SD		33.7	24.57	30.8	
Minimum		83	86	7.3	17.6
Maximum		179	150	161.2	219.2
Total TSL		162.7	61.8	383.8	151.4
Tons/boat		10.84	12.36	4.7	13.8
SD		4.5	4.93	1.8	
Minimum		4.6	7.9	1.7	3.8
Maximum		23.5	20.1	9.9	27.5
Length/boat		11.66	12.20		
SD		1.79	1.04		
Minimum		7.9	11.1	7.0	
Maximum		16.0	12.9	11.0	
Local 6 M		9	2		
'Ravvicinata'		6	3		

* 15 vessels of the artisanal fishery target hake with gillnet.

Fishing time over a year

The hake fishing season by gillnets starts usually in October-November at Porto Santo Stefano and in January at Marina di Campo. It ends in May-June in both ports, even if some boats can extend their activity for the whole year. The vessels suspending the hake fishery in summer generally change gillnets with drifting longlines to catch swordfish (*Xiphias gladius*). Depending on the availability of the latter species, this fishery can be exerted until October-November. At Marina di Campo some boats use trammel nets during the summer and hand lines from February to April.

Alternation during the year of set gears by hake fleet in Marina di Campo and Porto S. Stefano

GEAR	TARGET SPECIES	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Gill nets	*Merluccius, Mullus,Trigla*	■	■	■	■	■	▨	▨	▨	▨	▨	▒	▒
Hand lines*	*Pagellus*		▒	▒	▒								
Long lines	*Xiphias*						■	■	■	■	▒		
Trammel nets*	*Dentex, Maya, Palinurus, Mullus*				▒	▒	■	■	■	▒			

* = **Only at Marina di Campo**

■	Very intensive use	▒	Low use
▨	Intermediate use		Very low or no use

The fishing activity is very variable during the fishing season. In fact, due both to the small

dimensions of the vessels and the distance of the fishing grounds, fishing operations need good meteorological conditions.
The hake fishing fleet of Marina di Campo carries out on the average from a minimum of 2, to a maximum of 16 fishing days per month per boat, with an annual average per boat of 9 days per month. In Porto Santo Stefano the hake fishing fleet employs from a minimum of 2 to a maximum of 17 fishing days per month per boat, with an annual average per boat of 10 days per month.
At Marina di Campo and Porto Santo Stefano, the vessels fishing hake make usually daily trips, leaving the port at about 2:00-3:00 a.m. and returning in the afternoon, at about 3:00 p.m. to 6:00 p.m., in relation to the seasons and the distance of the fishing grounds. In fact up to 3-4 hours of navigation are necessary to arrive at these areas. In particularly favourable meteorological conditions the vessels may perform trips of 2 or 3 days, spending the overnight close to the islands of the Tuscany Archipelago. The fishing procedure is similar for all the crews; gillnets are set one-two hours before sunrise and this operation requires one-two hours, depending on weather conditions and length of the net. Generally the gear is set in parallel to the bathymetric line, also to allow bottom trawlers to operate on the same fishing grounds and avoiding damages to the set gears. Then the soaking time is about 4-5 hours at depth, the operations to pull in the nets need from 4 to 9 hours.
In Terracina the hake fishing fleet carried out, on the average, from a minimum of 10.5 to a maximum of 26 fishing days per month per boat, with an annual average per boat of 17.8 days per month. Fishermen drop the nets at about 5.00-6.00 a.m. and start the setting out at about 9.00 a.m., recovering fish and nets, then going back to the harbour at 12.00.
Ponza fishing days range from a minimum of 2 days in October and November to a maximum of 22 days in May, with an annual average of 18 days per month. As in Marina di Campo, in the Ponza Island marine and weather conditions strongly affect fishing activity, so that in October-December, due to the lower presence of hake, fishermen prefer to land their vessels to proceed to the normal maintenance works. From April to May until summer time, part of the fleet that catch hake switch to the sword-fishing activity.

Number of boats and monthly fishing activity

	MARINA DI CAMPO			PORTO SANTO STEFANO			TERRACINA			PONZA		
Month	N° boats	Total days	Days/boat /month	N° boats	Total days	Days/boat /month	N° boats	Total days	Days/boat /month	N° boats	Total days	Days/boat /month
February	14	202	14.4									
March	13	166	12.8							12	132	11.0
April	11	61	5.5							8	96	12.0
May	8	107	13.4							8	176	22.0
June	7	70	10.0							4	56	14.0
July	2	32	16.0							6	48	8.0
August	3	27	9.0	1	2	2.0	16	288	18.0	3	48	16.0
September	4	20	5.0	4	20	5.0	16	336	21.0	2	30	15.0
October	4	17	4.3	3	51	17.0	14	252	18.0	2	4	2.0
November	2	0	0.0	3	45	15.0	14	168	12.0	2	4	2.0
December	3	6	2.0	3	48	16.0	14	154	11.0	6	60	10.0
January	11	110	10.0	4	44	11.0	7	112	16.0	6	102	17.0
February	10	88	8.8	4	40	10.0	2	38	19.0	6	84	14.0
March	11	81	7.4	4	47	11.8	11	121	11.0	6	48	8.0
April	9	66	7.3	4	36	9.0	11	187	17.0			
May	13	156	12.0	4-1*	21	10.5	13	273	10.5			
June	10	69	6.9	1	14	14.0	9	171	19.0			
July	7	85	12.1	1	4	4.0	8	208	26.0			
August	8	75	9.4	1-4*	32	10.7	9	162	10.7			
September	5	34	6.8	4	42	10.5	7	147	21.0			
October	6	56	9.3	4	30	7.5	5	90	18.0			
November				4	30	7.5	9	108	12.0			

When the vessels of Ponza fish at low depth, they leave the harbour at night (01.00-02.00) and start dropping the net (about 04.00 a.m.). At 07.30 they start the setting out of the net. When the nets work in deep waters, they are set for fishing from 04.00-04.30, set out stars at 09.00 and ends at about 14.00-14.30. The nets can be primed with sardines (*Sardina pilchardus*). A row of hunks, at a distance of 3-5 m one from the other, with some sardines hung on, is set on the rope of the floating to draw the fish to the net.

Fishing equipment

In the GSA 9, landings of large sized hakes come mainly from gillnet fishery; bottom longlines fishery is practically disappeared. Longlines were used until twenty years ago; from the interviews with the local fishermen it appears that each vessel lowered 6-8 miles of longlines with 300-350 hooks per mile. The crew was composed of 3-4 fishermen and the fishing ground was the same of the present fleet operating gillnets. The abandon of the longlines fishery was due to many reasons: high investment in manpower, excessive cost for baiting the hooks, lower efficiency in catching hake in respect to set nets.

In Marina di Campo and Porto Santo Stefano the commercial gillnets are principally made of nylon monofilament with usually a diameter of 0.25 mm. During the winter some boats also utilise panels of nylon multifilament (0.30 mm of diameter) to fish in deeper waters (depth>200 m). The stretched mesh size ranges from 50 to 58 mm, but the mesh more frequently utilised is 53 mm. The length of each panel is about 200-220 m, the height of the nets is 4 m and the hanging ratio is generally about 50%. The overall length of the net used by a boat (mean values 7000 m in Marina di Campo and 10000 in Porto Santo Stefano) is mainly correlated with the dimension of the vessel and number of fishermen on board. Other factors determining the length of net used at any fishing operation are meteorological conditions, season, fishing grounds, bottom depth etc.

The boats of Terracina and Ponza utilise a gillnet called "barracuda” to catch hake. These gears are made of a nylon monofilament which usually has a diameter of 0.25 mm. The fishermen utilise nets with stretched mesh sizes of 52, 56 and 64 mm; they often use, at the same time, nets with different measures of mesh. The hanging ratio varies between. 0.5 and 0.62 for the float-line, and between 0.52-0.59 for the foot-rope. Many fishermen use low values (0.5-0.6) which reduces the net selectivity, increasing the range of sizes to be captured. The leading of this kind of gear is about 120 g/m. Regarding the overall length of the net, Terracina fleet uses 40-100 pieces of net (a piece is equal to 70 linear meters); the length of the nets ranges from 4,000 to 7,000 m, with a mean length of 5.000 m. Ponza fleet net length ranges from 3,000 m for small vessels to 15,000 m for the largest ones, with an average of 7,500 m. Mean height of the nets is 4.0 m.

General characteristics of commercial gill nets for hake in Tuscany

	Marina di Campo		Porto Santo Stefano
	Monofilament	Multifilament	Monofilament
NET YARN			
Material	nylon	nylon	nylon
Diameter (mm)	0.25	0.3	
Stretched mesh size (mm)	50-55	55	54-58
Net height (N° of meshes)	60-85	100	65-80
Length of net (N° of meshes)	4000	4000	4000
Length of set net panel (m)	200-220	220	220-230
FLOAT ROPE			
Length of rope (m)	100-110	110	100-110
Material	Braided	Braided	Braided
Diameter (mm)	7-8	8-10	5-7
LEAD ROPE			
Length of rope (m)	100-110	110	100-110
Material	Braided	Braided	Braided
Diameter (mm)	7-8	8-10	7
HANGING RATIO	50%	50%	50%
NET/ROPE ATTACHMENT LINE (UPPER AND LOWER)			
Material	nylon rope	nylon rope	nylon rope
Diameter (type)	22-24	28	
Length bolsh (m)	0.22-0.28	0.27	0.23-0.27
N° of meshes (in/out)	8/2 - 10/1	8/2	8/2 -9/1
FLOATS			
N° (free/occupied) bridges	3free/1occ	2free/1occ	3fr/ 1occ-2fr/1occ
Weight rope (g/m)	150	150	100-120

Deck layout and machinery involved

In this fishery the devices are represented by powerful net hauler able to recover the net from deep bottoms.

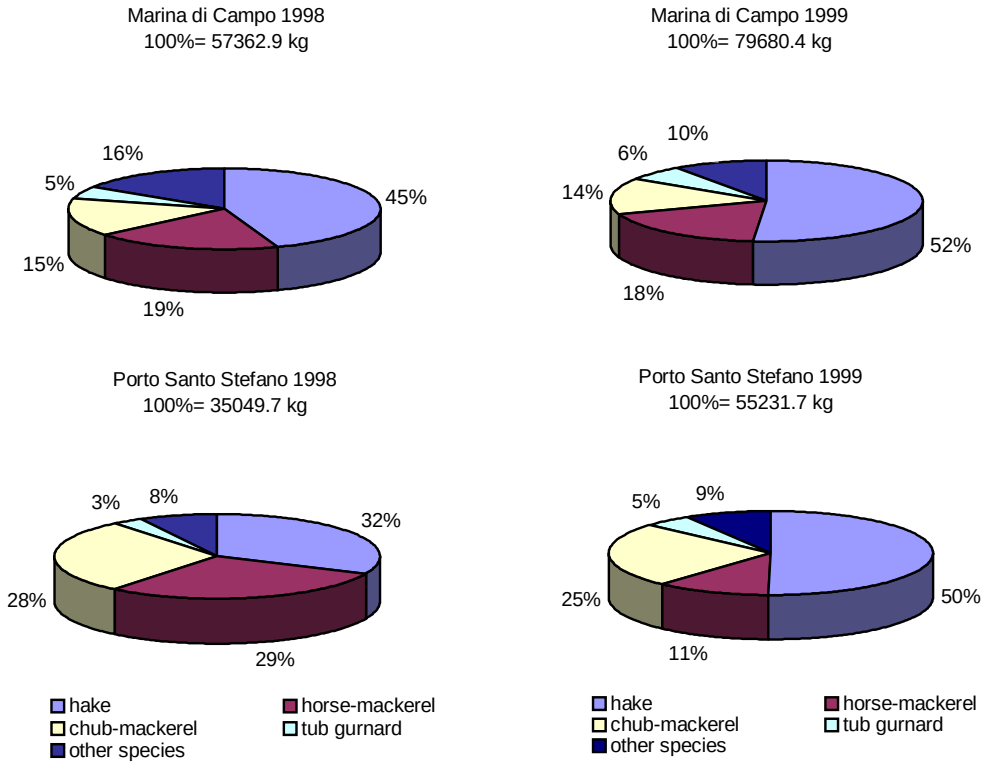
Electronic equipment

The majority of the largest boats utilise GPS, colour echo-sounder and geographic charts.

Data on catches

The total landing of gillnets fishery in Marina di Campo e Porto Santo Stefano is characterised by a high species diversity; nevertheless, few species are predominant in the total catch: hake, horse-mackerel, *Trachurus trachurus*, tub gurnard, *Trigla lucerna* and chub-mackerel, *Scomber japonicus*. Hake was always the most abundant species, contributing from 32 to 52% in biomass of the total landing. The other three important species represented from 38 to 60% of total landing, however these latter high percentages were due essentially to the catch of horse-mackerel and chub-mackerel.

Tub gurnard has a low percentage both in terms of weight and numbers in landings, nevertheless its great mean size and the high commercial value, make of *T. lucerna* an important by-catch species of the hake gillnet fishery. *Mullidae*, *Sparidae*, *Scyliorhinidae* and *Rajidae* essentially composed the group 'other species'; crustaceans and cephalopods were scarcely represented in catches.



Catch per unit of effort standardised to 5000 m of gillnet (*Marina di Campo and Porto S.Stefano*).

		Weight			Number		
Species	**Common name**	mean	SD	%	mean	SD	%
Trachurus trachurus	Horse-mackerel	26.79	39.66	35.35	79.35	116.88	31.85
Merluccius merluccius	Hake	28.72	28.93	37.90	84.78	92.37	34.03
Scomber japonicus	Chub-mackerel	3.89	8.71	5.13	8.52	16.37	3.42
Trigla lucerna	Tub gurnard	2.69	3.00	3.55	3.68	5.52	1.48
Scomber scombrus	Atlantic-mackerel	1.09	3.10	1.44	4.45	19.32	1.79
Scyliorhinus canicula	Small-spotted-dogfish	1.28	3.26	1.69	6.27	19.27	2.52
Mullus surmuletus	Striped red mullet	1.15	2.28	1.52	7.56	15.09	3.03
Mullus barbatus	Red mullet	0.86	1.18	1.13	7.66	12.15	3.07
Pagellus erythrinus	Common pandora	0.87	3.16	1.15	11.58	40.07	4.65
Trachurus picturatus	Blue jack mackerel	0.71	2.18	0.94	1.96	5.05	0.79
Trisopterus minutus capelanus	Poor-cod	0.36	0.67	0.48	3.27	5.83	1.31
Scomber spp.	Mackerel	0.23	1.66	0.30	0.00	0.00	0.00
Trigla lyra	Piper gurnard	1.29	7.05	1.70	4.40	24.21	1.77
Boops boops	Bogue	0.45	1.22	0.59	2.81	7.09	1.13
Raja sp.	Rays	0.66	2.77	0.87	0.50	1.86	0.20
Trachurus m. mediterraneus	Mediterranean horse-mackerel	0.27	1.48	0.36	0.30	1.50	0.12
Lepidopus caudatus	Silver-scabbardfish	0.30	0.70	0.40	0.18	0.49	0.07
Illex coindetii	Broadtail-shortfin-squid	0.23	0.32	0.30	1.58	2.29	0.63
Squalus acanthias	Spurdog	0.40	2.86	0.53	0.03	0.19	0.01
Sarda sarda	Atlantic bonito	0.18	0.49	0.24	0.09	0.24	0.04
Pagellus acarne	Axillary sea bream	0.20	0.59	0.26	1.77	4.85	0.71
Phycis blennoides	Greater-fork-beard	0.24	1.34	0.32	0.61	3.69	0.24
Citharus linguatula	Spotted flounder	0.14	0.26	0.18	2.57	4.21	1.03
Nephrops norvegicus	Norway-lobster	0.19	0.95	0.25	2.21	9.48	0.89
Galeus melastomus	Blackmounth-catshark	0.21	1.50	0.28	0.63	4.47	0.25
Pagellus bogaraveo	Red sea bream	0.21	0.97	0.28	1.13	3.66	0.45
Zeus faber	John Dory	0.11	0.24	0.15	0.21	0.47	0.08
Maja squinado	Sea spides	0.17	0.53	0.22	0.15	0.45	0.06
Octopus vulgaris	Common octopus	0.10	0.24	0.13	0.17	0.45	0.07
Lophius budegassa	Black-bellied angler	0.09	0.36	0.12	0.07	0.29	0.03
Raja miraletus	Brown ray	0.14	0.59	0.18	0.31	0.97	0.12
Lophius sp.	Anglerfish	0.09	0.39	0.12	0.08	0.30	0.03
Auxis rochej	Frigate mackerel	0.05	0.38	0.07	0.00	0.00	0.00

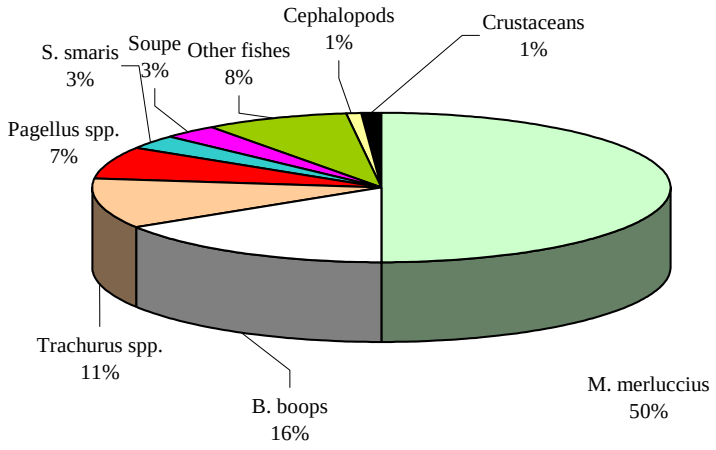
continues

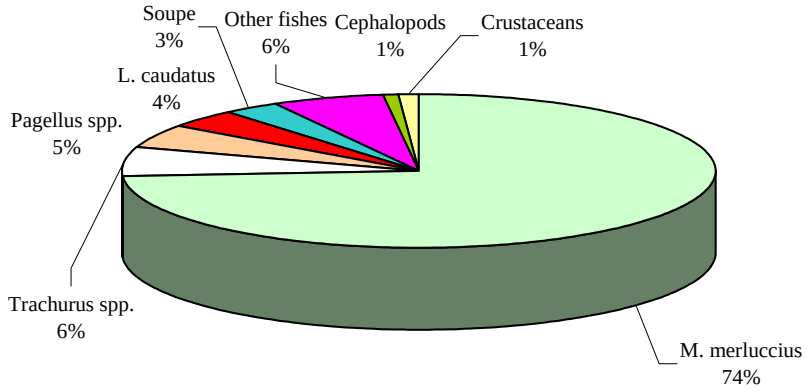
		Weight			Number		
Species	**Common name**	mean	SD	%	mean	SD	%
Scyliorhinus stellaris	Nursehound	0.27	1.72	0.36	0.14	0.53	0.06
Micromesistius poutassou	Blue-whiting	0.12	0.41	0.16	1.40	3.87	0.56
Lepidorhombus boscii	Four spot megrim	0.01	0.03	0.01	0.04	0.20	0.02
Scyliorhinus sp.	Catsharks	0.13	0.86	0.17	0.04	0.20	0.02
Spicara flexuosa	Garizzo	0.08	0.40	0.11	1.22	5.57	0.49
Aspitrigla cuculus	Red gurnard	0.05	0.17	0.07	0.55	1.99	0.22
Serranus cabrilla	Comber	0.09	0.34	0.12	1.06	3.98	0.43
Phycis phycis	Mediterranean fork-beard	0.12	0.86	0.16	0.30	2.10	0.12
Polyprion americanus	Wreckfish	0.07	0.33	0.09	0.03	0.16	0.01
Todaropsis eblanae	Lesser-flying-squid	0.06	0.26	0.08	0.45	1.95	0.18
Scorpaena scrofa	Red scorpionfish	0.06	0.24	0.08	0.12	0.46	0.05
Raja clavata	Thornback-ray	0.03	0.19	0.04	0.01	0.10	0.00
Lepidotrigla cavillone	Large-scaled gurnard	0.05	0.19	0.07	0.57	1.67	0.23
Uranoscopus scaber	Stargaza	0.03	0.10	0.04	0.20	0.50	0.08
Spicara sp.	Picarels	0.03	0.16	0.04	0.44	2.25	0.18
Parapenaeus longirostris	Deep water pink shrimp	0.02	0.11	0.03	1.44	9.54	0.58
Aspitrigla obscura	Long-finned gurnard	0.02	0.07	0.03	0.24	1.18	0.10
Eledone cirrhosa	Horned octopus	0.02	0.08	0.03	0.10	0.42	0.04
Muraena helena	Mediterranean moray	0.04	0.25	0.05	0.03	0.19	0.01
Engraulis encrasicholus	European anchovy	0.02	0.11	0.03	0.77	3.85	0.31
Octopus salutii	Spider octopus	0.02	0.13	0.03	0.05	0.27	0.02
Helicolenus d. dactylopterus	Blackbrlly-rosefish	0.01	0.06	0.01	0.05	0.20	0.02
Trachinus araneus	Spotted weever	0.01	0.05	0.01	0.03	0.13	0.01
Spicara maena	Blotched picarel	0.01	0.05	0.01	0.16	0.75	0.06
Eutrigla gurnardus gurnardus	Grey gurnard	0.01	0.03	0.01	0.08	0.40	0.03
Argentina sphyraena	Lesser silver smelt	0.01	0.02	0.01	0.25	0.83	0.10
Medorippe lanata	Shaggy crab	0.01	0.04	0.01	0.03	0.22	0.01
Lepidotrigla dieuzeidei	Spiny gurnard	0.00	0.02	0.00	0.04	0.16	0.02
Lepidorhombus whiffiagonis	Megrim	0.01	0.02	0.01	0.04	0.22	0.02
Etmopterus spinax	Velvet-belly	0.00	0.02	0.00	0.03	0.13	0.01
Raja asterias	Mediterranean starry ray	0.01	0.04	0.01	0.02	0.13	0.01
Sardinella aurita	Round sardinella	0.00	0.02	0.00	0.10	0.56	0.04
Spondyliosoma cantharus	Black sea bream	0.00	0.02	0.00	0.02	0.13	0.01
Calappa granulata	Shamefaced crab	0.00	0.02	0.00	0.02	0.11	0.01
Trachinus draco	Greater weever	0.00	0.01	0.00	0.06	0.35	0.02
Sardina pilchardus	Sardine	0.00	0.01	0.00	0.06	0.35	0.02
Pagrus pagrus	Common seabream	0.00	0.01	0.00	0.02	0.11	0.01
Deltentosteus colonianus	Toothed goby	0.00	0.01	0.00	0.01	0.10	0.00
Capros aper	Boarfish	0.00	0.00	0.00	0.01	0.05	0.00

In Terracina and Ponza catches with gillnet pointed out the presence of 30 species, all of them of commercial value.

Argentina sphyraena	*Illex coindetii*	*Pagellus erythrinus*	*Spicara smaris*
Aspitrigla cuculus	*Lepidopus caudatus*	*Phycis blennoides*	*Trachurus mediterraneus*
Boops boops	*Merluccius merluccius*	*Sardina pilchardus*	*Trachurus trachurus*
Citharus linguatula	*Mullus barbatus*	*Scomber scombrus*	*Trigla lucerna*
Diplodus annularis	*Mullus surmuletus*	*Scorpaena sp.*	*Trigla lyra*
Engraulis encrasicholus	*Pagellus acarne*	*Serranus cabrilla*	*Trisopterus minutus*
Gobius niger	*Pagellus bogaraveo*	*Spicara flexuosa*	*Uranoscopus scaber*

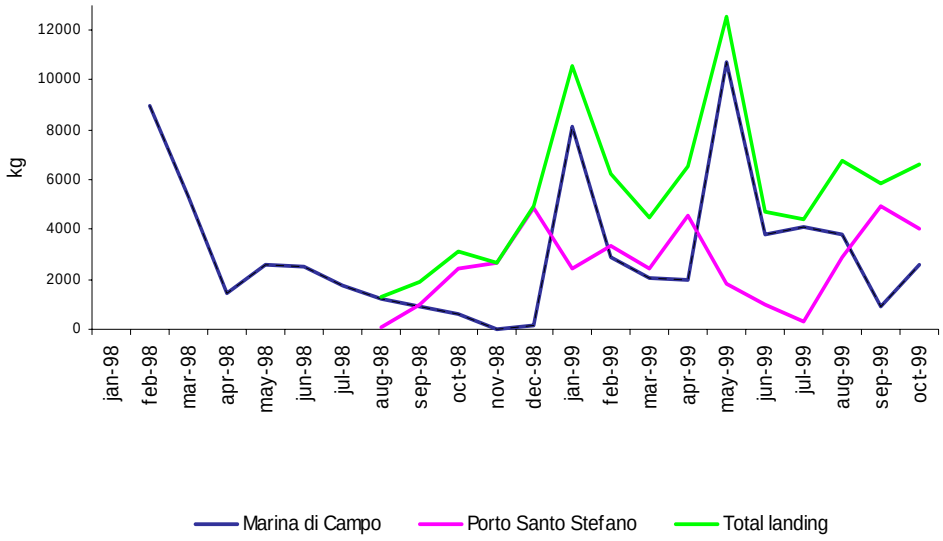
In Ponza, hake represents from 50 to 74% of total catch. In summer, *B. boops* (16%), *Trachurus* sp. (11%) and *Pagellus* spp. (7%) are important by-catch species. In winter time, as hake increases and the precedent species decrease, *Lepidopus caudatus* significantly appears in the catch (4%).



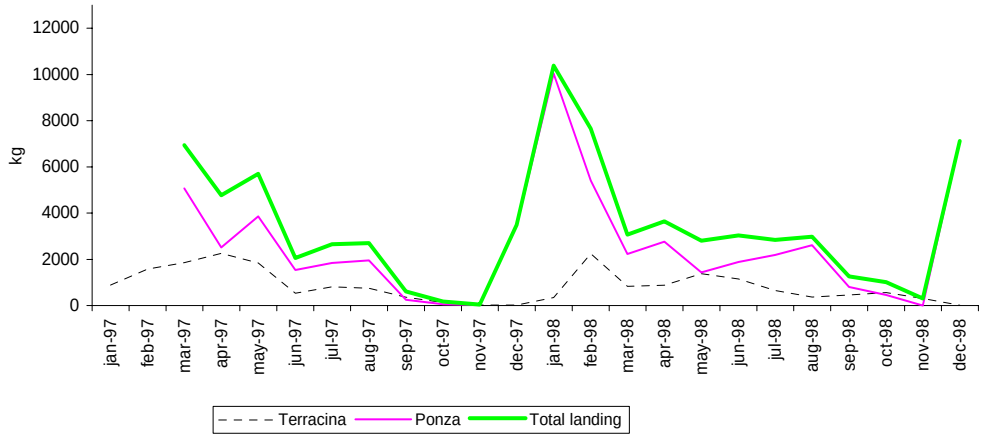


In Marina di Campo, hake is landed mostly from January to June, with a peak in January-February and another one in May. In Porto Santo Stefano hake is landed principally from October to May; in this last port the same two peaks appeared, but shifted one month before than in Marina di Campo. The lower values in both ports were recorded during Summer. This falling is a consequence of a change in fishing activity, because most of vessels carried out the sword-fish fishery with long lines.

In Terracina the small scale fishery fleet catches show a period of greater landings from February to May, with a peak in April, lower catches from September to December. In Ponza the trend of hake catches shows a decrease from March to September. After a standstill of catches in October-November, catches start again with good yields.



Hake monthly landing of Tuscany gill net fleet during 1998-1999
(*until July 1998 data not available in Porto Santo Stefano*).



Hake monthly landing of Latium gill net fleet during 1997-1998
(*until February 1997 data not available in Ponza).*

In Marina di Campo the yields ranged on average from 15.17 to 32.48 kg/5000 m in 1998 and from 21.9 to 48.24 kg/5000 m in 1999. The highest values are registered in the first months of the year. In Porto Santo Stefano the monthly CPUEs ranged from a minimum of 20.83 to a maximum of 46.54 kg/5000 m in 1998 and from 26.77 to 67.95 kg/5000 m in 1999. In both ports the maximum values of CPUE coincided with the peaks observed in the hake landing.

Mean monthly commercial yields (Kg/ 5000 m) and standard deviation (SD)

		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	TOTAL
Marina di Campo	Mean	na	32.48	20.88	15.89	16.28	17.16	24.27	20.68	20.59	19.75	0.0	15.17	21.56
1998	SD	na	31.92	18.62	9.17	9.21	6.15	7.98	16.64	0.00	13.40	0.0	2.38	20.03
	N samples	na	78	109	45	82	20	10	10	1	4	--	2	361
Marina di Campo	Mean	45.06	24.95	19.29	21.90	48.24	36.71	34.49	42.15	28.33	41.28	na	na	33.36
1999	SD	37.47	17.32	14.59	12.80	24.64	18.21	18.84	62.59	20.04	47.47	na	na	32.87
	N samples	21	43	44	24	37	18	17	34	9	17	na	na	256
Porto Santo Stefano	Mean	na	na	na	na	na	na	na	20.83	29.95	21.54	24.38	46.54	34.03
1998	SD	na	na	na	na	na	na	na	0.00	7.98	5.62	6.92	27.74	21.21
	N samples	na	na	na	na	na	na	na	1	3	6	7	12	29
Porto Santo Stefano	Mean	26.77	51.13	27.15	67.95	37.89	36.99	41.62	47.39	57.53	54.22	na	na	43.13
1999	SD	9.17	27.72	13.24	29.50	19.12	18.43	16.34	19.75	32.54	42.68	na	na	25.45
	N samples	11	15	19	11	12	11	4	12	8	7	na	na	110

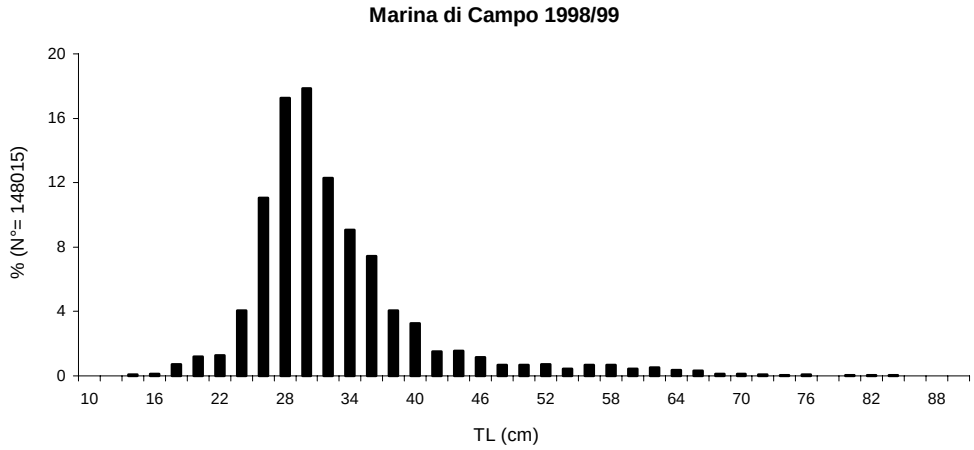
na: data not available

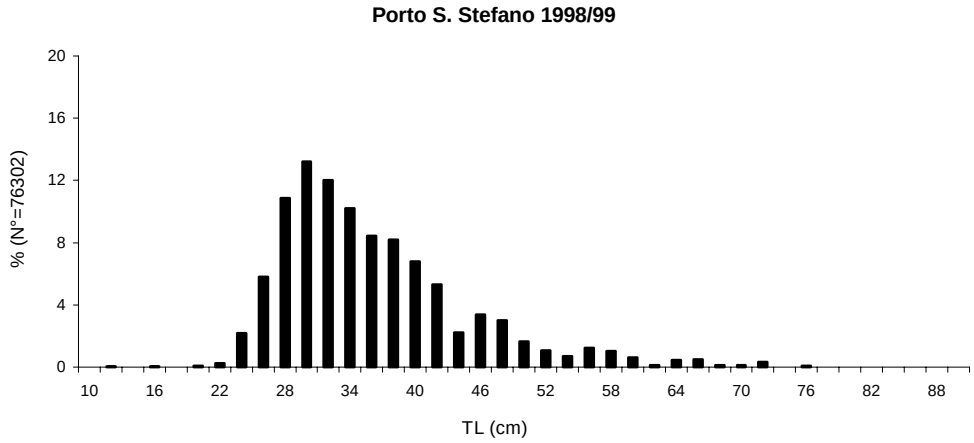
In Terracina hake yields range from 6.5 kg/day/vessel in January to 12.1 kg/day/vessel in April. They decrease constantly until September-October, and decrease again in December. At Ponza yields show a decrease from March (38 kg/days/vessel) to May (21 kg/days/vessel), than they increase until August (39 kg/days/vessel) and finally they decrease constantly in October (5 kg/days/vessel). From winter times yield values start to be conspicuous again (57 kg/days/vessel in December), reaching 91 kg/days/vessel in January.

The demographic structures of gillnet landings show a similar size composition for Marina di Campo and Porto Santo Stefano; in both cases the modal class is always about 30 cm TL. The size of specimens ranges between 14 and 84 cm TL in Marina di Campo and between 20 and 76 cm TL in Porto Santo Stefano, but in both ports the sizes of the majority of individuals is between 24 and 40 cm TL. The biggest specimens (TL> 50 cm) are caught throughout the year, but resulted more abundant in winter.

The monthly length-frequency distributions of hake caught by the gillnet fishing fleet of Terracina range between 22 and 68 cm TL. Individuals between 20 and 38 cm TL mainly composed the landings, few specimens are larger (between 40-68 cm TL). In the summer period is observed an increase of the main modal length, due to the change in the exploited fishing area: for the better weather conditions, fishing activities are concentrated on deeper bottoms.

Fish landed in Ponza generally ranges between 20 and 86 cm TL. Therefore, the capture of small scale fishery is concentrated on hake of large size. During winter-spring period (January-April), individuals between 28 and 46 cm TL (modal class at 28-32 cm TL) mainly constitute the huge part of the landings. Length ranges between 18 and 87 cm TL. In the summer period an increase of the main modal length (38-40 cm TL, length ranges between 28 and 86 cm TL) is observed. Big hakes (TL>50 cm TL) are recorded throughout the year.



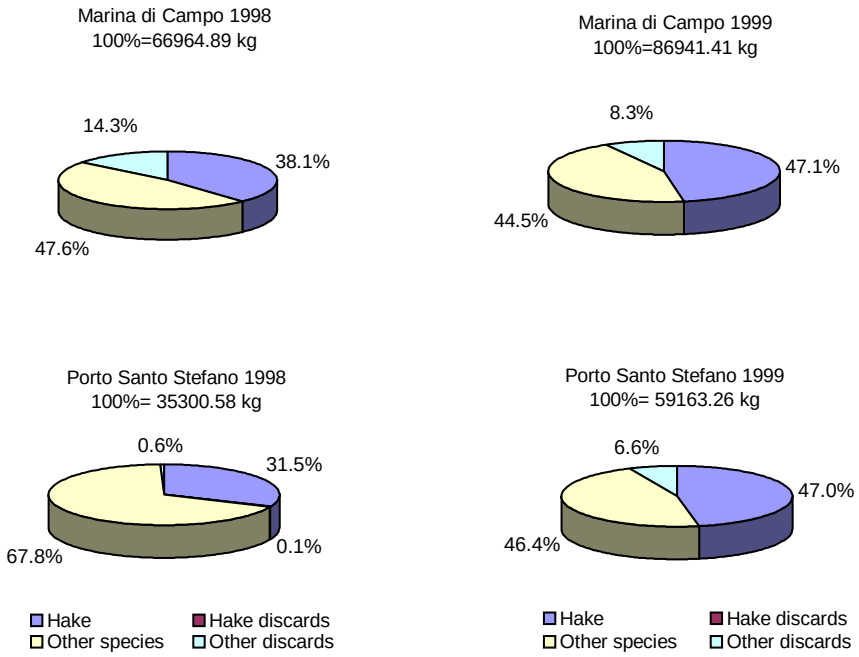


Length frequency distributions of hake landed in Marina di Campo and Porto S. Stefano

An important aspect, from a management point of view, is the different impact that mesh sizes have on each sex. In fact, hake is a species characterised by a very different growth between the two sexes: generally in Italian waters males reach a maximum of 40-50 cm TL. Over certain sizes the population is exclusively constituted by females. In the gillnets (53 mm mesh size) used by the fleets of Marina di Campo and Porto Santo Stefano, males are significantly more abundant than females. This latter feature could be due to the interplay of two different factors: on one hand there is the goal of fishermen to catch medium sized specimens (25-35 cm TL, more frequently males) with a higher commercial value; on the other hand there is a certain degree of differential distribution of sexes, being the males more abundant on the bottoms exploited by the fishery ranging from 100 to 120 m depth.

From the analysis of commercial fishery, it is clearly evident that hake is not discarded and, practically, the whole catch of this species, are landed for sale with the only exclusion of some damaged specimens.

Discards are mainly horse mackerel, especially in Marina di Campo; the very low commercial price of this species, the risk that big amounts of landing will cut also the price of the target species, were the reasons of its discard. From the trips on board resulted that the sizes of the rejected fraction were not different from those landed for sale. In general discard rates are far less than 15% in biomass.



Commercial and discard components in weight in Tuscany gill net fishery targeting hake

Interaction with other fisheries

In this fishery interactions may occur with bottom trawlers fishing in the same areas, in particular on bottoms ranging from 80 to 200m. As regards the competition for the same resource, this type of interaction is found between gillnet and bottom trawlers exerting deep water fishery. As a matter of fact, in winter, the large specimens of hake assume importance also in the catches of trawlers.

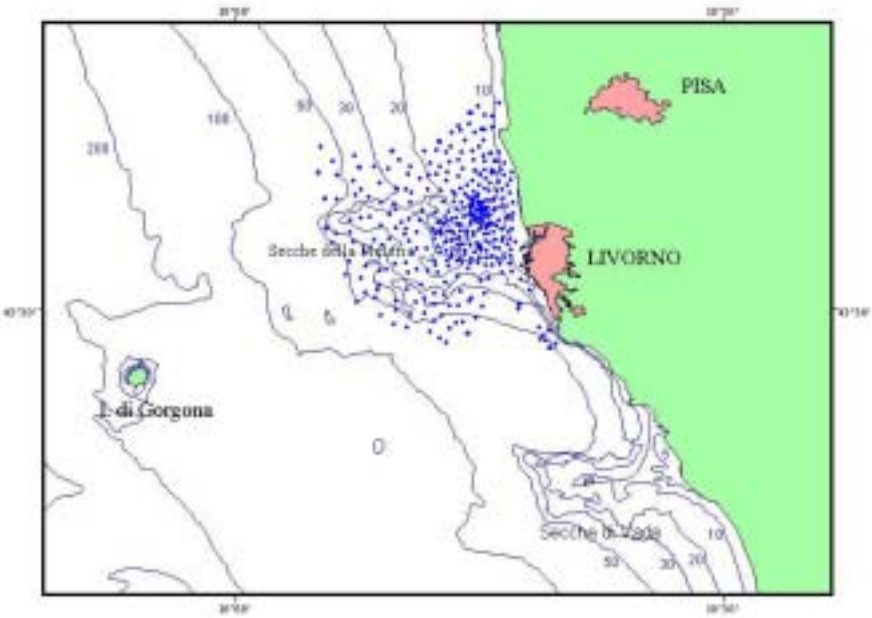
Relationships between fishing effort, fishing mortality and catch rates

Management measures should take into account the fishing capacity and fishing effort regulation, controlling the dimension of the fleet and the length of the net per boat/day. Although the number of boats is not high, they exert an important fishing mortality on the adult fraction of hake population. Regulations concerning spatio-temporal closures might be envisaged where an important reproductive aggregation is shown in some periods of the year. All things considered, in order to realise a reduction of gillnet fishing effort and a better exploitation of this resource, it should be encourage again a re-conversion of the fleet to use longline.

FISHERY 2 - GILLNET TARGETING COMMON SOLE

Fishing grounds

The fishing grounds are in general localised in the surroundings of the ports. In the case of Livorno, the fishing grounds extend from the harbour to the mouth of the Arno river, on sand-muddy bottoms. The nets, placed between 4 and 40 m depth, were lowered into the sea at dusk and pulled in at dawn.



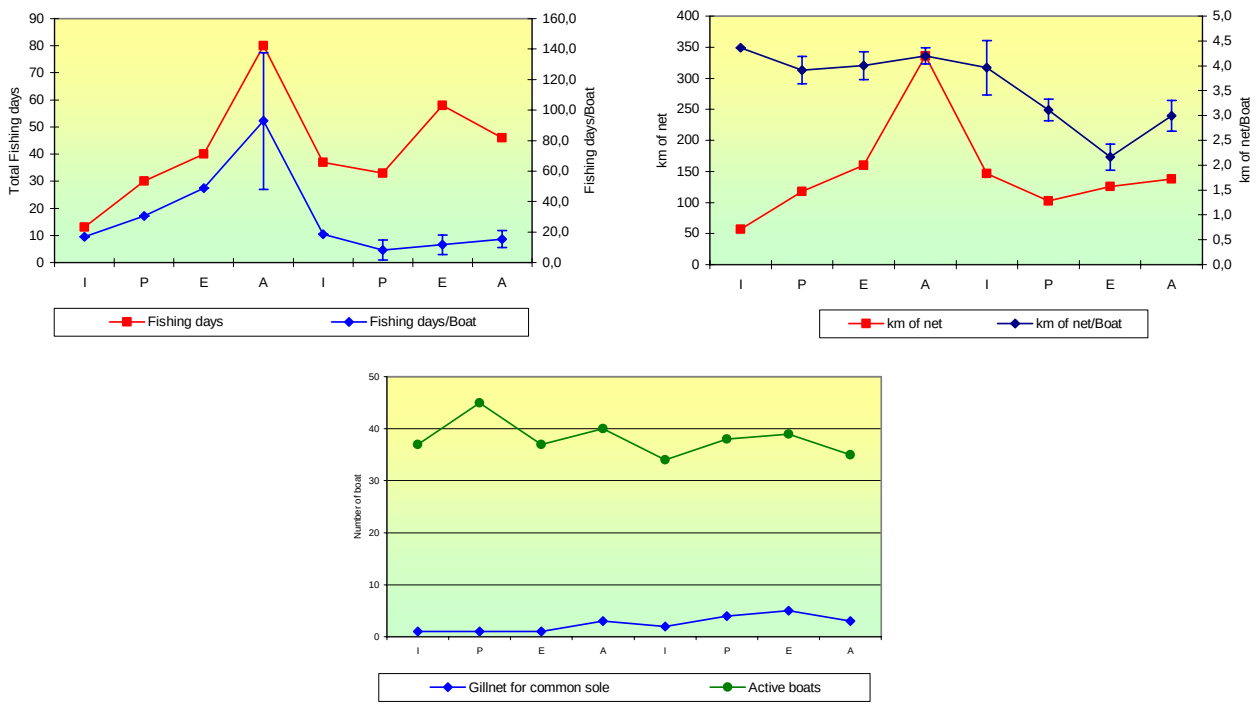
Fishing ground of the fleet of Livorno targeting common sole with gillnet

Fleet

Gillnet fishery targeting common sole, *Solea vulgaris*, is an important activity along the coasts of Tuscany and Latium. Quantification of the number of boats using this gear along the year is very difficult because this technique is utilised only with particular meteo-marine conditions and frequently associated with trammel nets. For example, in Livorno, where 63 artisanal vessels (mean gross tonnage of 4.1 tons ± 2.7 s.d., mean total length of 7.7 m ± 2.6 s.d. and mean engine power of 54.4 HP ± 41.4 s.d.), four boats employed gillnet regularly, while the other fishing units utilised this type of gear only occasionally and jointly with trammel nets. These four boats employed a gillnet of about 3500 m length during each trip; the length of the net varied from 1000 to 5000 m, according to weather conditions.

Fishing time over a year

At Livorno the total number of fishing days carried out from boats with gillnet targeting common sole shows a high variability during the year, ranging from a minimum of 13 days in winter 1999 (about 1% of the total activity of the artisanal fleet of the port) to a maximum of 80 days in autumn 1999 (6% of the activity of the fleet).



Seasonal trend of the fishing activity, fishing capacity and total number of boats of the fleet of Livorno using gillnet for common sole. Fishing days/boat and km of net/boat are already reported. I = winter; P = spring; E = summer; A = autumn.

Fishing equipment

The gear utilised in Livorno is constituted by a single mono-filament panel 3 m high with a 82 mm stretched mesh size.

PANEL							FLOATS				HEADLINE			LEADLINE	
Height (m)	Length (m)	N. mesh width	Material	Stretched mesh size (mm)	Diameter of the filament (mm)	Hanging ratio	Total number	Diameter (mm) max	Diameter (mm) internal	Length (mm)	Length (m)	Diameter (mm)	Material	(gr x m)	Length (m)
3	135	2000	monofilament nylon	82	0.18	0.33	33	30	12	60	45	25	cotton	120	45

Deck layout and machinery involved

Devices are represented by net hauler.

Electronic equipment

The electronic equipment of the vessel is usually constituted only by colour echo-sounder.

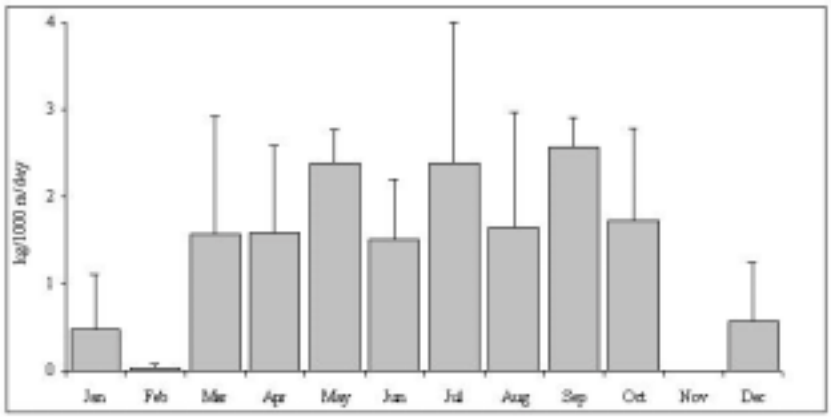
Data on catches

The mean monthly landing of *S. vulgaris*, standardised to 1000 m of net per fishing day, is characterised by a high variability, due to the influence of meteo-marine conditions on the yields of this type of fishery. However, from March to October, noticeable yields were observed, with values ranging from a minimum of 1.5 kg/1000m /day in June to a maximum of 2.6 kg/1000m /day in September.

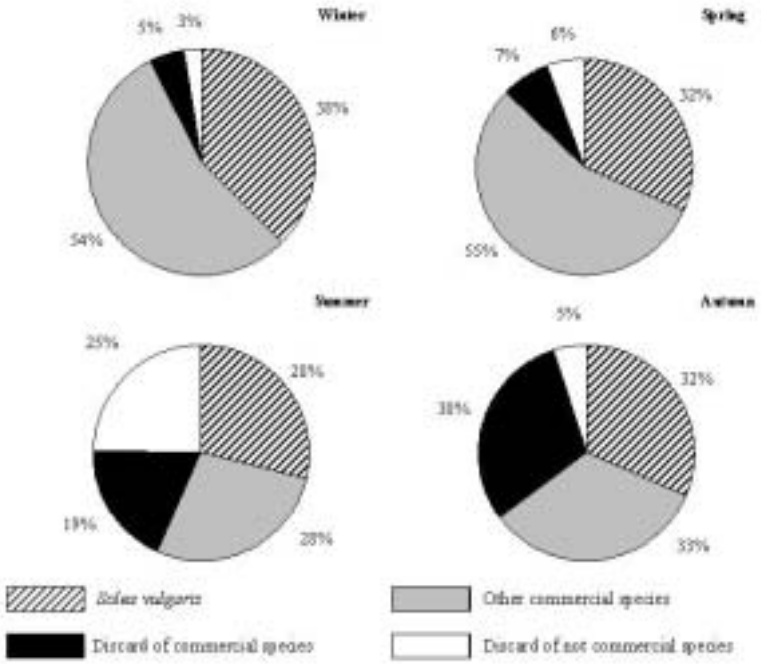
As regards the catch composition, *S. vulgaris* was the most important species reaching 34.4% of the total biomass caught (from 28% in summer to 38% in winter). Among the commercial

species, it is worth of noting *Raja asterias* (21.1% of the total catch), *Squilla mantis* (4.8%) and *Trigla lucerna* (4.5%). Therefore, the above mentioned four species accounted for over 64% of the total biomass caught, confirming the high selectivity of this fishery. Other 64 species were collected (42 fishes, 10 crustaceans, 10 molluscs and 2 echinoderms), but the majority of them resulted occasional in the catches.
The total discarded biomass constituted an important fraction of the total catch, ranging from 8% in winter to 44% in summer. Not commercial species (crustaceans, molluscs and echinoderms) and damaged specimens of commercial species represent a high percentage of the discard of this fishery. A high reject in biomass of not commercial species (25%) is observed in summer, mostly due to the crustacean *Dardanus arrosor* (21.1% of the total catch). The discard of commercial species shows important fluctuations during the year, with higher values in summer (19%) and autumn (30%). The discarded biomass of *S. vulgaris*, exclusively represented by damaged specimens, ranged from 0.3% of the total catch in spring to 5.2% in autumn.

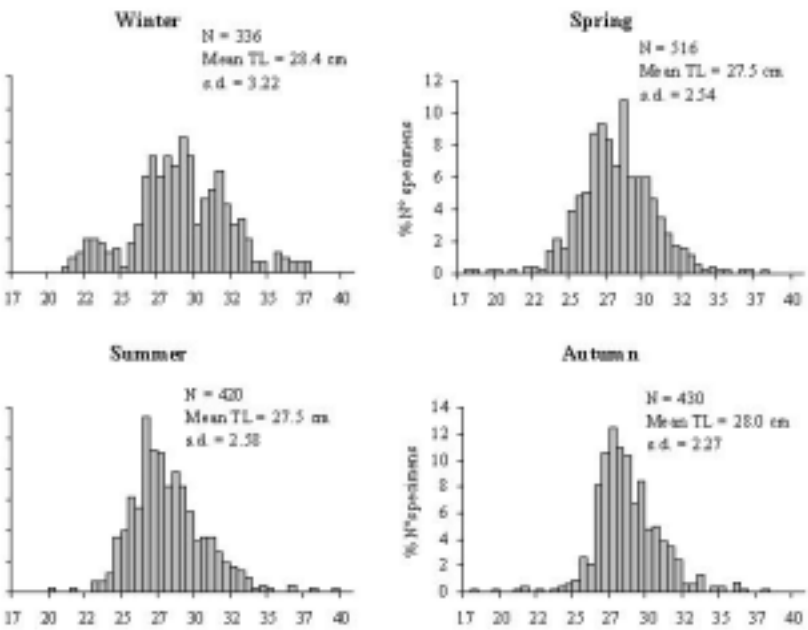
The size composition of the landing of *S. vulgaris* did not show differences among the seasons. The distributions were uni-modal with modal class ranging from 26 to 28.5 cm TL. The majority of specimens, comprised between 23 and 35 cm TL, is larger than the minimum legal size of commercialisation (20 cm TL, EU regulation 1626/94) and of the size at first maturity (25 cm TL).



Landings per Unit of Effort (kg/1000 m /day + s.d.) of S. vulgaris in Livorno



Composition of the gill net catches in Livorno



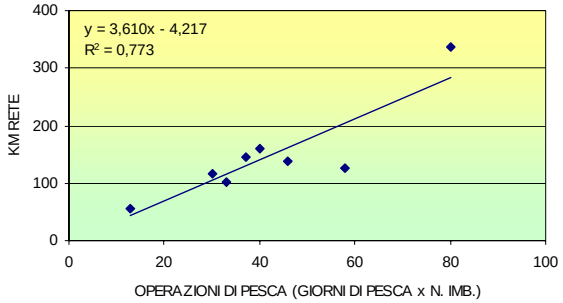
Demographic structure of the landing of S. vulgaris caught with gillnet in Livorno.

Interaction with other fisheries

This fishery is carried out exclusively in the coastal area. A spatial interaction may occur with the illegal fishery carried out by trawlers in the coastal area and with other artisanal gears, mainly trammel nets. Regarding to the resource in question, the common sole is also a target species for rapido. At this moment this activity is carried out only from 2 boats in Viareggio and 3 boats along the Latium coasts. *S. vulgaris* catches are also significant in the trammel net fishery.

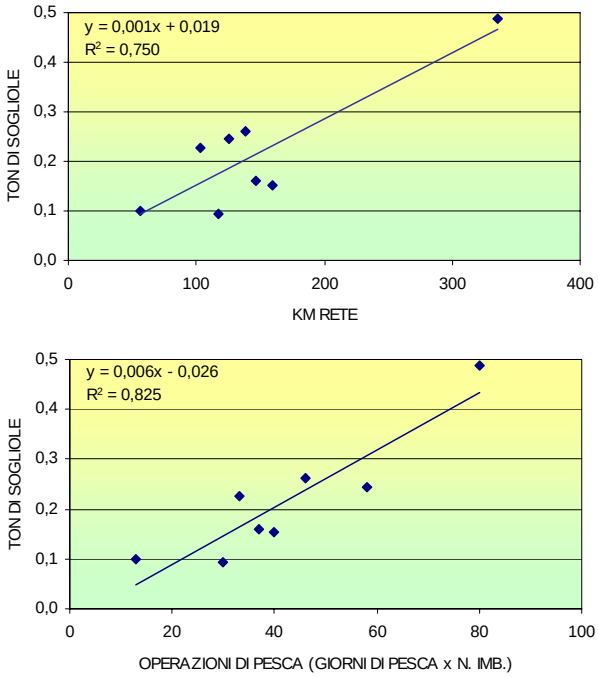
Relationships between fishing effort, fishing mortality and catch rates

The relationship between total fishing capacity (km of net) and fishing activity (fishing days x number of boats) is significant, with a linear increase of the length of the net increasing the fishing activity.



Relationship between fishing capacity (km of net) and fishing activity (fishing days x number of boats) in Livorno

The regressions between total catch of *S. vulgaris* and fishing capacity and fishing activity show a good level of correlation, showing a tendency of the catches to increase increasing the total km of nets and the fishing activity.



Relationship between total catch of S. vulgaris and fishing capacity and fishing activity

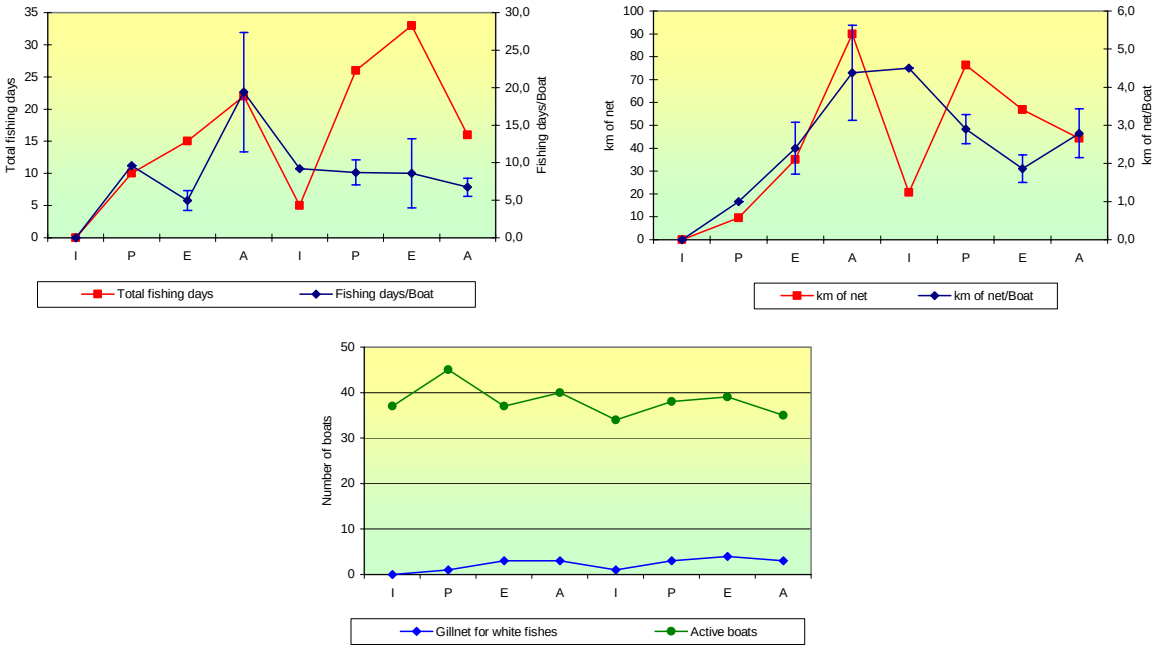
FISHERY 3 - GILLNET TARGETING WHITE FISH

Fleet

It is very difficult to quantify the total number of boats that make part of this fishery in the GSA 9, because this gear is partially utilised during the year and/or with particular meteo-marine conditions (frequently the days after a stormy sea). For example, in Livorno this fishery was carried out by 3 vessels during 1999 and 4 vessels during 2000 (about 8-10% of the artisanal fleet of this port).

Fishing time over a year

This fishery is carried out in the coastal area on sandy and rocky bottoms, frequently in association with trammel nets. Sometimes the gear is also utilised at greater depths (over 50 m), on bottoms localised in correspondence of small banks and rocky emergences. Fishing activity shows a seasonal pattern, with a minimum of activity in winter and maximum in summer-autumn.



Seasonal trend of fishing activity, fishing capacity and number of boats of the Livorno artisanal fleet using gillnet for white fishes. Fishing/day/boat (± se), km of net/boat (± se) and total number of active vessels of the artisanal fleet are also reported. I = winter; P = spring; E = summer; A = autumn

Fishing equipment

The net is constituted by a monofilament panel, with height of 3.0 m and 60mm stretched mesh size. Unlike the gillnet targeting common sole, this type of net maintains a vertical positioning in respect to the sea bottom during the fishing action.

Technical characteristics of the gillnet for white fishes utilised by the artisanal fleet of Livorno

PANEL						FLOATS Total Number	HEADLINE		LEADLINE
Height (m)	Length (m)	N.meshes Length	Meshes		Hanging ratio		Diam. (mm)	Material	(g/m)
			Size (mm)	Diameter (mm)					
3,0	45	2000	60	0,25	0,37	33	2,5	PA	120

The fishing technique provides to lower into the sea this gear before sunrise and soak it at dawn, for about 12 h of permanence at sea. On average, the vessels of the fleet of Livorno utilise about 2500 m of net/boat for each fishing trip.

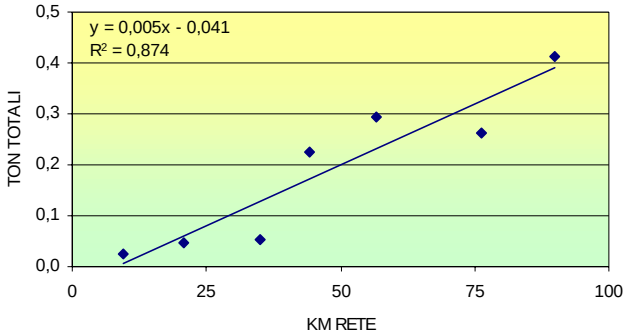
Deck layout and machinery involved
Devices are represented by net hauler.

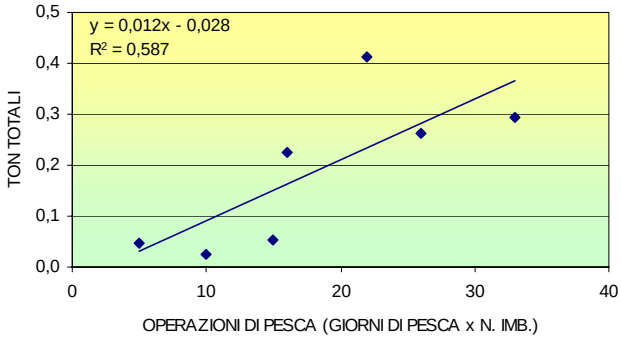
Electronic equipment
The electronic equipment of the vessels is in general only constituted by a colour echo-sounder.

Data on catches
In Livorno the maximum total landings obtained with this gear occur in summer-autumn and the minimum in winter. The catches per unit of effort show a high variability with an increasing trend coming from winter to autumn.
Sparidae represent the most important and highly appreciated target species. The contribute of this family to the total CPUE ranges between 5,3% and 82,0% according to the different seasons. Other important species are *Umbrina cirrosa* (till 22,2% of the total CPUE) and *Squilla mantis* (28,1%). Important by-catches are *Dicentrarchus labrax*, *Solea vulgaris* and *Mugilidae*.

Interaction with other fisheries
This fishery is carried out exclusively in the coastal area. A spatial interaction may occur with the illegal fishery carried out by trawling in the coastal area and with other artisanal gears. As a matter of fact, the resources exploited with this type of gillnet are often target species also for trammel net.

Relationships between fishing effort, fishing mortality and catch rates
A high correlation is observed between total landings and the total kms of net used by the fleet. A lower correlation is found between the total catch and the total number of fishing days.





Relationship between total catch and fishing capacity (km of net, above) and fishing activity

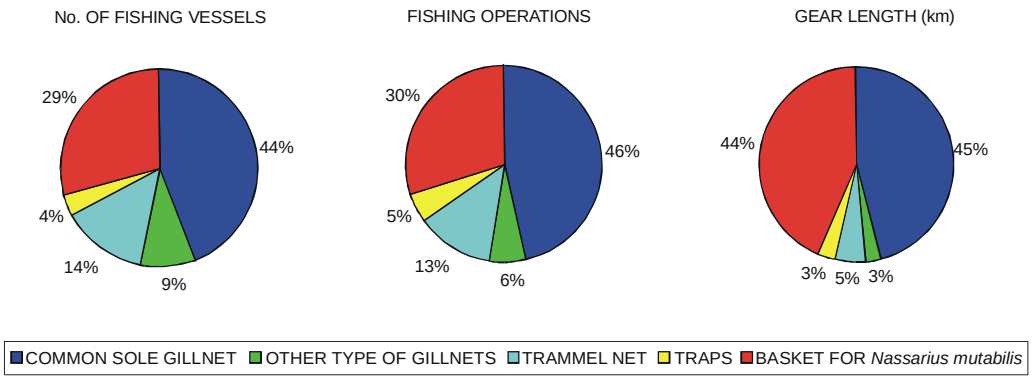
GSA 17 – NORTHERN AND CENTRAL ADRIATIC

General

The artisanal vessels of the Italian side of GSA 17 (northern and middle Adriatic sea) mainly use two types of gillnet: the first one is largely employed for the catch of *S. vulgaris*, *Squilla mantis* and *Trigla lucerna* and, being the common sole the main target species, it is usually called "gillnet for common sole"; the second type is used more sporadically and the target species are: grey mullets, *Lithognathus mormyrus*, *Sciaena umbra*, *Umbrina cirrosa* and *Dicentrarchus labrax*.

Although the same fishing fleets use both types of nets, they have to be considered as two different fisheries because they noticeably differ for fishing grounds, catch composition and fishing season. For example, at present the gillnet for common sole is fished from March to November without interruptions, while the traditional gillnet is occasionally employed from November to March.

In this contest only the gillnet for common sole will be considered because of its greater importance in respect to the other gillnet and to the other set gears adopted over the year by artisanal vessels.

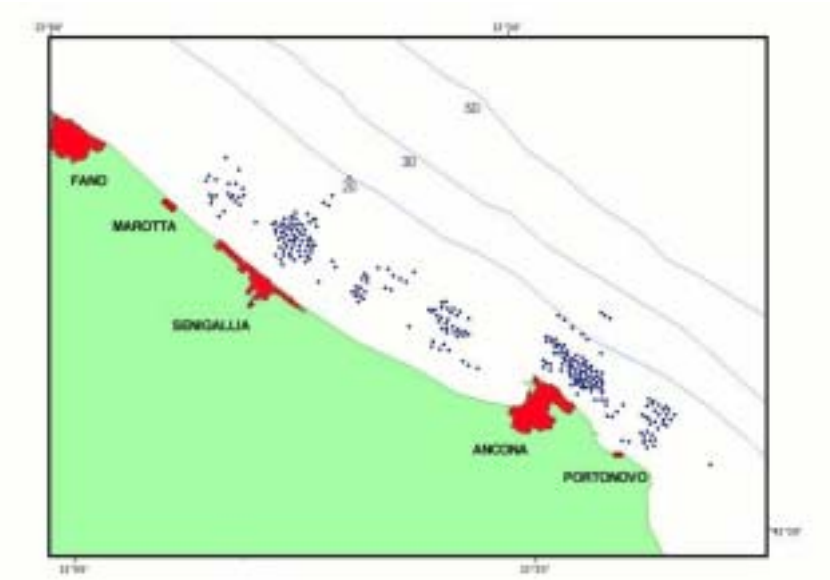


Northern Adriatic sea. Percentage importance of the different types of set gears used by the artisanal fleets of Ancona, Portonovo and Senigallia (1999-2001; Fabi et al., 2002b)

FISHERY 1 - GILLNET FOR COMMON SOLE

Fishing grounds

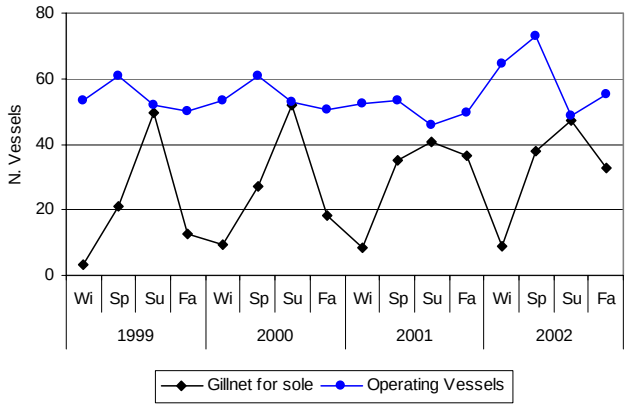
The gillnet for common sole is employed exclusively on the coastal sandy and muddy seabeds inside the 3 miles offshore because outside the gears might be endangered by towed gears (bottom trawling, pelagic trawling and rapido trawls). As example it is reported a map of the fishing areas exploited by the artisanal fleets of Ancona, Senigallia and Portonovo targeting common sole with gillnets, as resulted from a four-year investigation (*Fabi et al., 2002a*).



Northern Adriatic Sea. Fishing grounds of the artisanal fleets of Ancona, Senigallia and Portonovo using the gillnets for common sole

Fleet

This type of gillnet is commonly utilised by most of the small scale fleets of the departments included into GSA 17. The fleet percentage using this gear varies in the different seasons. For example, the artisanal fleet existing in the area between Portonovo and Senigallia (about 35 km of coastline) consists of 77 artisanal vessels having an average GRT of 2.7, an average engine power of 37.3 kW and a crew of 1-2 people; in summer, almost all the operating vessels of this area target the common sole with the gillnet.



Northern Adriatic Sea. Seasonal trend of the number of vessels of the Ancona, Senigallia and Portonovo fleets using gillnets for common sole (1999-2002). The total number of operating vessels is also reported for each season. Wi = winter; Sp = spring; Su = summer; Fa = fall.

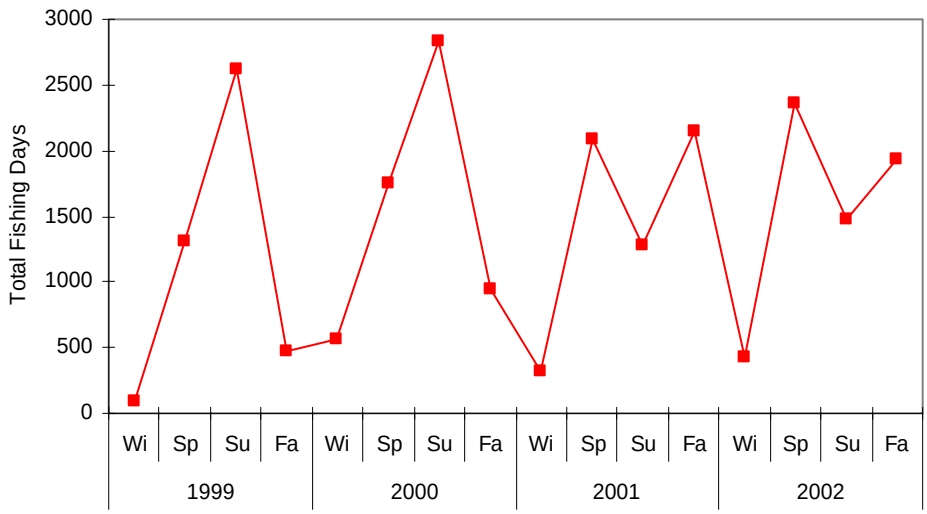
The above picture also shows as the number of vessels devoted to this fishery has gradually increased in the last four years.

Fishing time over the year

The nets are usually sunk at dusk and pulled in at dawn for an average of 12 hours at sea. The fishing activity is carried out over all the week (from Monday to Saturday), depending on the sea conditions.

The fishing activity is practised all the year round, following a seasonal pattern characterised by the highest values in summer, when most of the small scale fishing vessels are involved, and the lowest ones in winter. As example, here is reported the fishing activity carried out in 1999-2002 by three fleets of the Ancona department (Ancona, Portonovo and Senigallia) which can be considered as representative of most of the artisanal fleets included in the maritime departments from Pescara to Rimini (*Fabi et al., 2002b*).

It is evident the strict relationship between the fishing activity and the number of vessels which have practised this fishery. The decrease occurred in summer 2001 and 2002 was due to the great occurrence of "mucillagini" that obstructed the nets noticeably reducing their efficiency. Consequently, many fishermen stopped to fish.



Northern Adriatic Sea. Seasonal trend of the fishing activity carried out by the vessels of Ancona, Senigallia and Portonovo fleets using gillnets for common sole (1999-2002). Wi = winter; Sp = spring; Su = summer; Fa = fall.

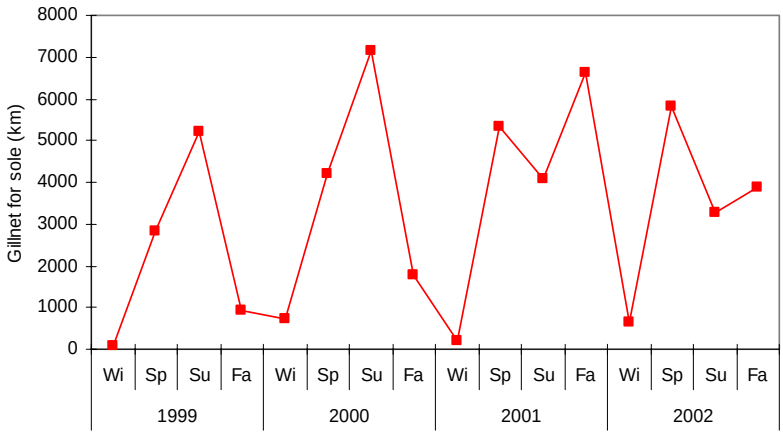
Fishing equipment

The artisanal fleets targeting common sole use a specific, monofilament gillnet made of polyamide and characterised by a low height (1.6-2.5 m) and a very low buoyancy of floatings which allows the gear to partially lay down on the seabed so favouring the capture of benthic fishes. The diameter of the netting yarn can vary from 0.18 to 0.22 mm and the mesh size between 64 and 68 mm (stretched).

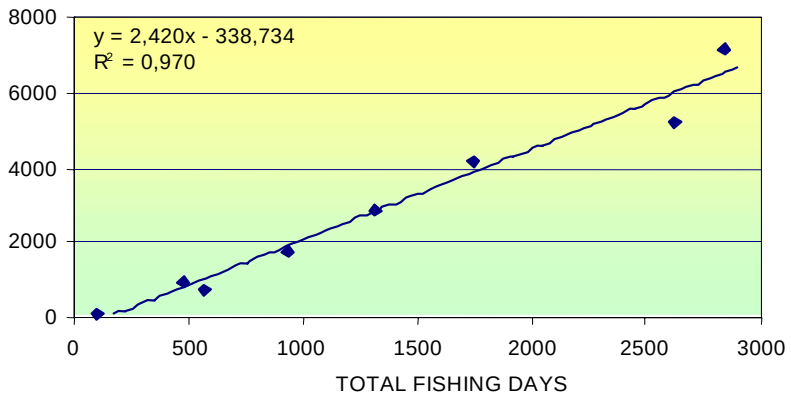
Northern Adriatic Sea. Technical characteristics of common sole gillnet

PANEL						FLOATS	HEADLINE		LEADLINE
Height (m)	Length (m)	No. of meshes /Length	Stretched mesh size (mm)	Diameter of the filament (mm)	Hanging ratio	Total No.	Diam. (mm)	Material	(g/m)
1,6	40	2000	68	0,20	0,29	16	3	PA	35
2,0	42	2000	68	0,18	0,31	16	4	PA	40
2,5	53	2000	64	0,20	0,41	8	5	PE	40
2,5	56	2000	68	0,20	0,41	8	5	PE	35
2,5	56	2000	64	0,22	0,43	8	5	PE	35

The length of nets ranges from 1,000 to 5,000 m, mainly depending on the size of the vessel and the availability of man-power at land for the cleaning of the gears.
The seasonal trend of the total amount of gillnets employed by vessels of Ancona, Senigallia and Portonovo shows an extension of the fishing season which initially was practically limited to spring and summer, while in the last two years has been prolonged until fall.



Northern Adriatic Sea. Seasonal trend of the overall amount of gillnets for common soles used by the vessels of Ancona, Senigallia and Portonovo fleets (1999-2002).(Wi = winter; Sp = spring; Su = summer; Fa = fall)



Relationship between fishing capacity (overall net length) and fishing activity standardised as fishing days x vessels number

Over the time technical changes have been made on the gear in order to increase its efficiency. These changes mainly consisted of the use of thinner filaments to make the net less visible at sea, so increasing its catch efficiency.

Deck layout and machinery involved

Artisanal vessels carrying out this activity are equipped with net hauler which has became more and more efficient over the years, allowing to recover the nets in a shorter time and to noticeably reduce the man-power required for this operation. This also lead to an increase of the number of nets and, hence, of the fishing capacity.

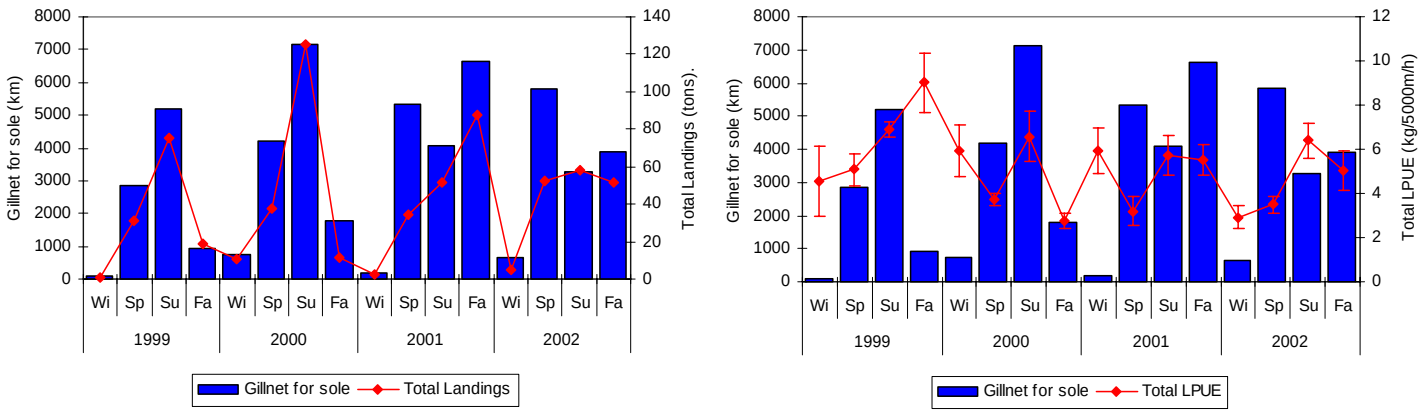
Electronic equipments

The electronic equipment currently consists of a radar, GPS, echosounder and, in most of cases, navigation plotter. Introduction of GPS, double-frequency echosunder and navigation plotter occurred between the end of 1980's and the beginning of 1990's likely increased the vessel fishing efficiency allowing to explore new fishing grounds not exploited before.

Data on catches

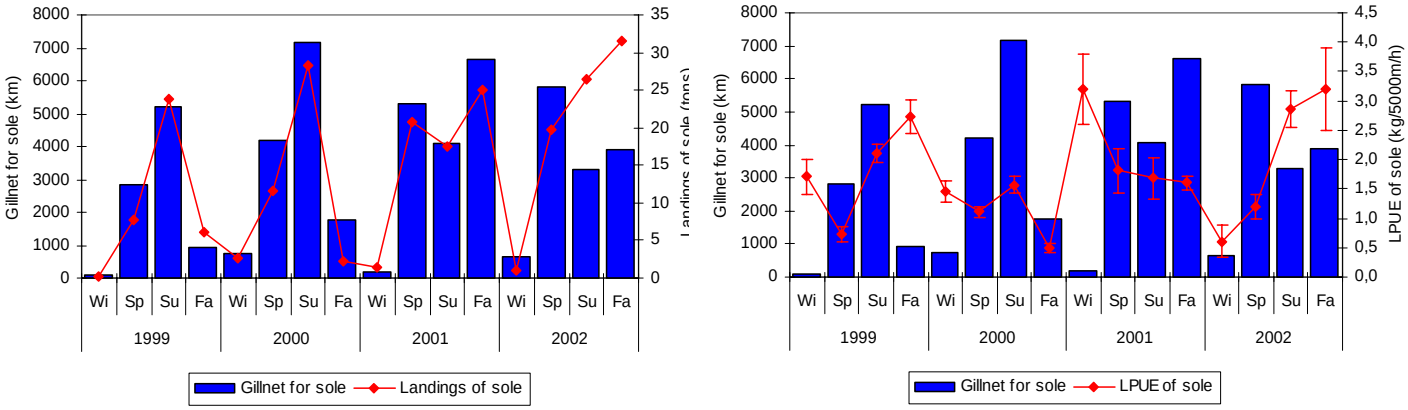
Landing data of the artisanal fleets of Ancona, Portonovo and Senigallia were collected over a period of four years (1999-2002) through weekly sampling at the mooring sites. Data obtained in this way were verified through periodical observations aboard of the professional vessels which also allowed to obtain further information on the composition of the total catch (Fabi *et al*., 2002a; Grati *et al*., 2002).

The extension of the fishing season and the increasing of the fishing effort do not seem to have significantly affected either the overall catches and LPUE as shown by the following graphics.



Seasonal trend of the total catches and LPUE of the Ancona, Senigallia and Portonovo vessels using gillnets for common sole (1999-2002)

The most important target species, *S. vulgaris*, accounted from 19% to 38% of the annual landed catch in weight.



Seasonal trend of the total catches and LPUE of the Ancona, Senigallia and Portonovo vessels using gillnets for common sole (1999-2002)

Data on catch composition of the fleets targeting common sole show that, besides *S. vulgaris*, *Squilla mantis* and *Trigla lucerna* can be considered respectively as second and third target species for this fishery. Other accessory species are *S. impar*, *L. mormyrus*, *L. ramada*, *D. annularis*, even though they appear in the catches more occasionally.

Composition of the commercial catches of artisanal fleets of Ancona, Portonovo and Senigallia using gillnets for common sole (1999-02; Fabi et al., 2002)

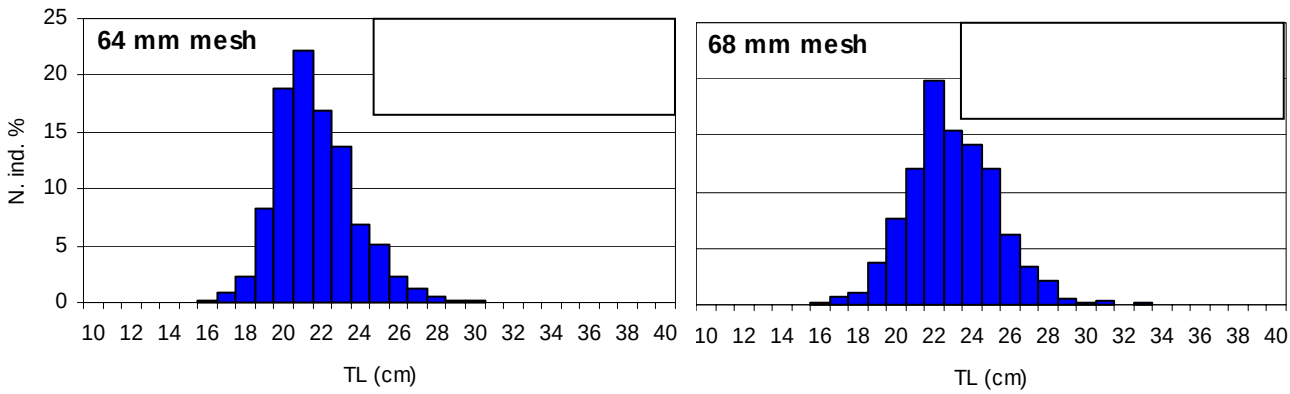
Gillnet for Sole								
GSA	**17**							
Mesh Size	64-68 mm (stretched)							
	Landed Catch		Discard C		Discard NC		Total Catch	
	Weight (%)	Number (%)	Weight (%)	Number (%)	Weight (%)	Number (%)	Weight (%)	Number (%)
Solea vulgaris	**33**	**18**					**27**	**10**
Squilla mantis	37	48	22	9			32	27
Trigla lucerna	13	9	17	21			11	8
Solea impar	6	8					5	5
Aporrhais pespelecani			17	49			1	8
Ostrea edulis			9	3			1	1
Bolinus brandaris			7	6			1	*
Trachurus mediterraneus			6	1			*	*
Liocarcinus vernalis					69	71	8	22
Goneplax rhomboides					17	14	2	4
Corystes cassivelaunus					8	13	1	4
Alosa fallax					4	*	1	*
Others	11	17	22	11	2	2	10	14

* = < 0.5%

Most of the sole catch consist of individuals belonging to age class 1 as shown in the following table realised on the basis of the parameters of the Von Bertalanffy model estimated by *Froglia and Giannetti* (1985; 1986) through the otolith reading method.

Northern Adriatic sea. Length/age percentage composition of the commercial catches of S. vulgaris

Length (cm) / Age class			13-18 / 0		19-25 / 1		26-30 / 2		31-33 / 3		34-35 / 4		36 / 5	
Species	Geographic subarea		W %	N %	W %	N %	W %	N %	W%	N %	W %	N %	W %	N %
Solea vulgaris	GSA 17	Gillnet 64 mm mesh	1.73	3.45	89.56	92.07	8.71	4.48						
		Gillnet 68 mm mesh	0.75	1.84	77.86	85.04	19.83	12.54	1.56	0.58				



Northern Adriatic Sea. Demographic structure of the gillnet catches of S. vulgaris obtained by the artisanal vessels of Ancona, Senigallia and Portonovo with the two mesh sizes mainly used

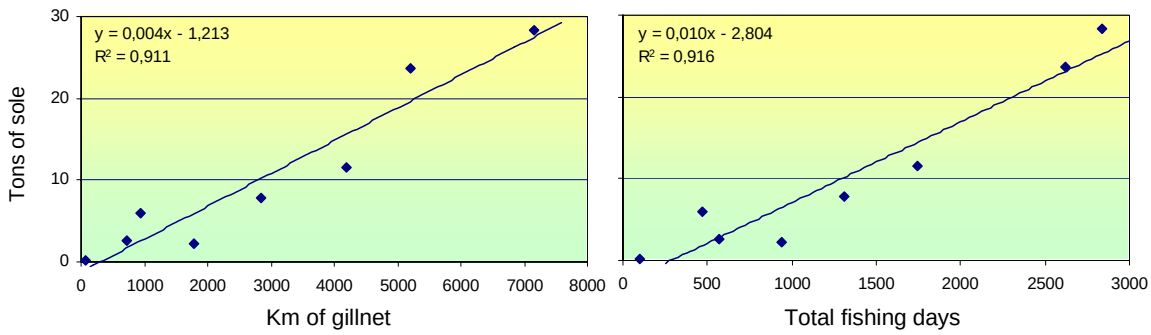
Discard of commercial species assumes a low importance in the total catch of this type of gillnet, representing up to 6-8% in weight. The most important species of this fraction are the gastropod *Aporrhais pespelecani*, *S. mantis*, *Trachurus mediterraneus* and *T. lucerna*. Similarly to other species (*Arnoglossus laterna*, *Engraulis encrasicolus*, *Sardina pilchardus*, etc.), *A. pespelecani* is important for other types of fishery, but it is discarded in this case because it is generally caught in small quantities. *S. mantis* and *T. mediterraneus* are generally represented by damaged specimens, while the discard of *T. lucerna* mainly consists of small individuals of low commercial value. In fact, because of the particular morphology of this species (spines, etc.) the juveniles, which concentrate in the coastal area from spring to fall, remain easily entangled in the nets independently from the used mesh size.

Technical interactions with other fisheries

There is an overlapping between this fishery and rapido trawl fishery targeting common sole due to a competition for the same resources, especially common sole and spottail mantis shrimp (*Fabi et al., 2002c*). There is also a spatial conflict between the artisan fisheries and the towed gears due to the fact that the former have to operate inside the 3 nm offshore to avoid the risk of loosing their gears and the latter often work illegally inside this area.

Special features
Nothing.

Relationships between fishing effort and catch rates
Trends of fishing effort (overall amounts of nets), overall LPUE and sole LPUE of the three considered fleets over the years 1999-2002 are shown in graphics reported at point 3.2.2.1.6. No significant decrease of LPUEs of the common sole has been detected over the considered years, in spite of the extension of the fishing season and, hence, of the increase of fishing effort.
However, it has to be taken into account that the catches of common sole are mainly made of juveniles belonging to the age class 1. Therefore, caution would be suggested in the eventual increase of the fishing effort in terms of either fishing capacity and fishing activity, both mainly depending on the vessel dimensions, primarily overall length and secondarily GRT (*Fabi et al., 2002a; 2003*). Consequently, particular attention would be paid to these two parameters in order to control the fishing effort of this type of fishery.



Relationship between total catch of S. vulgaris, fishing capacity and fishing activity

GREECE

General

Gillnet is one of the most common gears used by the inshore fishery fleet. The extent of the gear use changes from port to port. In some ports it is used all over the year while in other ports it is used during short time periods.

Target species of the gillnets in Greece are: *Mullus barbatus*, *Mullus surmuletus*, *Boops boops*, *Caranx* sp, *Pagellus erythrinus*, *Sarda sarda*, Sparidae, *Scomber scombrus*, *Scomber j. colias*, *Sphyraena sphyraena*, *Merluccius merluccius* and *Atherina hepsetus*.

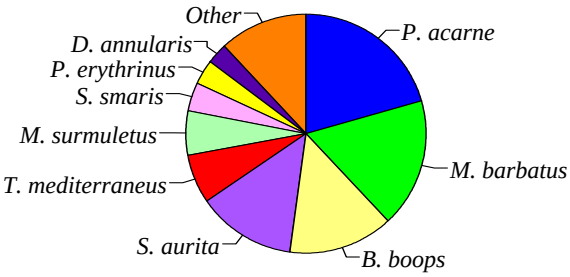
Technical details from the most common gillnets used in Greek inshore fishery

Target species	Mesh size (mm) bar length	Hanging ratio	Depth (m)	Buoyancy (lt/100m)	Ballast (kg/1000m)	Type
Atherina spp	8	0.5	4.8	36.1	14.6	Floating
Belone belone	18	0.5	10.8	13.1	20.7	Floating
Boops boops	20-34	0.5-0.75	2.6-13.2	3.6-9	11-14.2	Bottom
Engraulis encrasicholus	9	0.75	6.1	3.8	22	Floating
Homarus gammarus	80-110	0.32-0.75	1.6	3.8-17.8	6.3-25.7	Bottom
Merluccius merluccius	22-90	0.5-0.6	4.4-24	2.7-10.5	7.5-14.1	Bottom
Mullus spp.	17– 24	0.5-0.67	1.4-6	2.1-16.7	6-20	Bottom
Nephrops norvegicus	26-28	0.5	3.9-5.6	1.2-10.7	6.5-14.3	Bottom
Pagrus pagrus	95-110	0.25-0.75	2.3-4.4	7.9-27.3	22.8-68.2	Bottom
Sarda sarda	36-45	0.67-1	21.6-72	13.9-51	12.5-37.3	Bottom
Sardina pilchardus	11-15	0.5-0.75	6.6-24.4	3.7-38.3	1.5-22.2	Floating
Scomber scombrus	26-32	0.5-0.6	3.4-5.2	2.6-5.7	8.1-14.3	Floating
Spicara smaris	13-16	0.50.72	3.2-3.9	3.2-4.7	11.9	Bottom
Scyliorhinus spp, Mustelus spp, Squallus spp.	60-90	0.5	2.4	6.3	16	Bottom
Thunnus spp	44-240	0.67	8.8	18.8	3.2	Floating
Xiphias gladius	140	0.5	28	50	4	Floating

The red mullets (*Mullus barbatus* and *M. surmuletus*) métiers have been studied from June 1996 to November 1997 (Anon., 1998). Four gillnets with mesh size 34, 38, 42 and 44 mm were used.

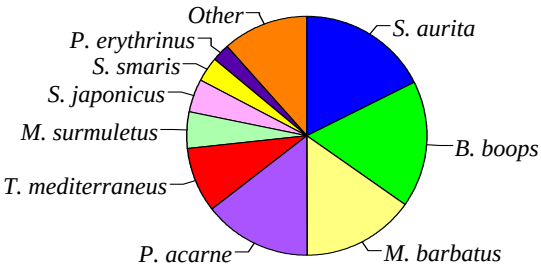
The combined catch compositions by number and by weight of the red mullets métier, for the different gill nets, are the following:

34 mm



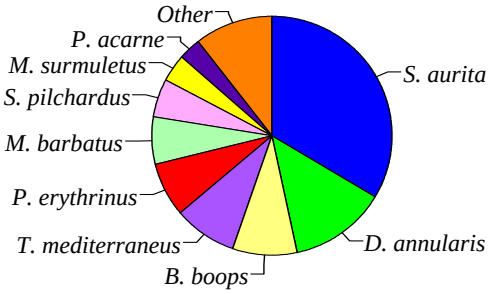
Combined catch composition by number

34 mm



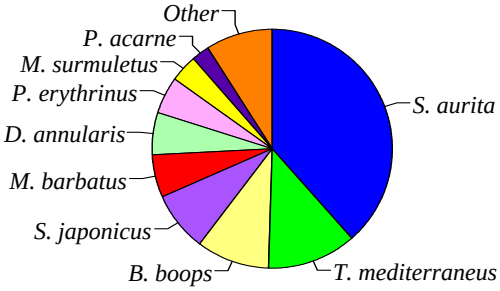
Combined catch composition by weight

38 mm



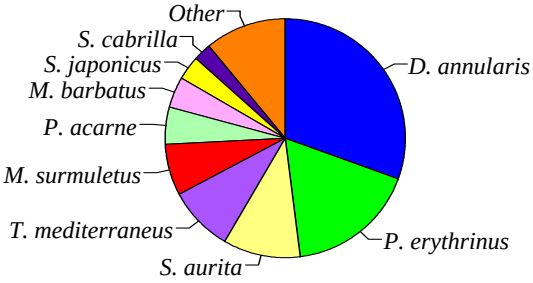
Combined catch composition by number

38 mm



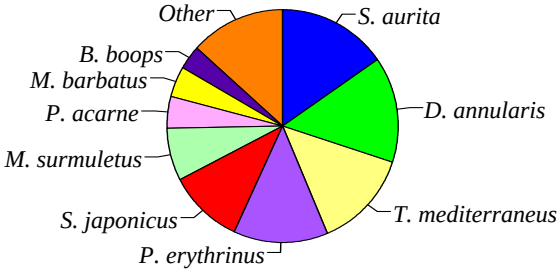
Combined catch composition by weight

42 mm



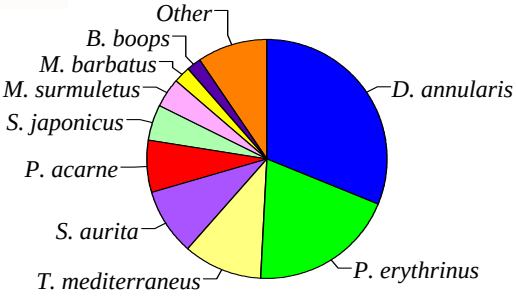
Combined catch composition by number

42 mm



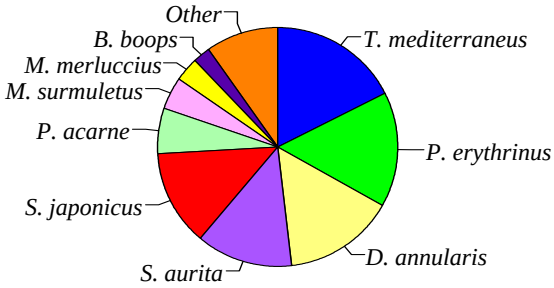
Combined catch composition by weight

44 mm



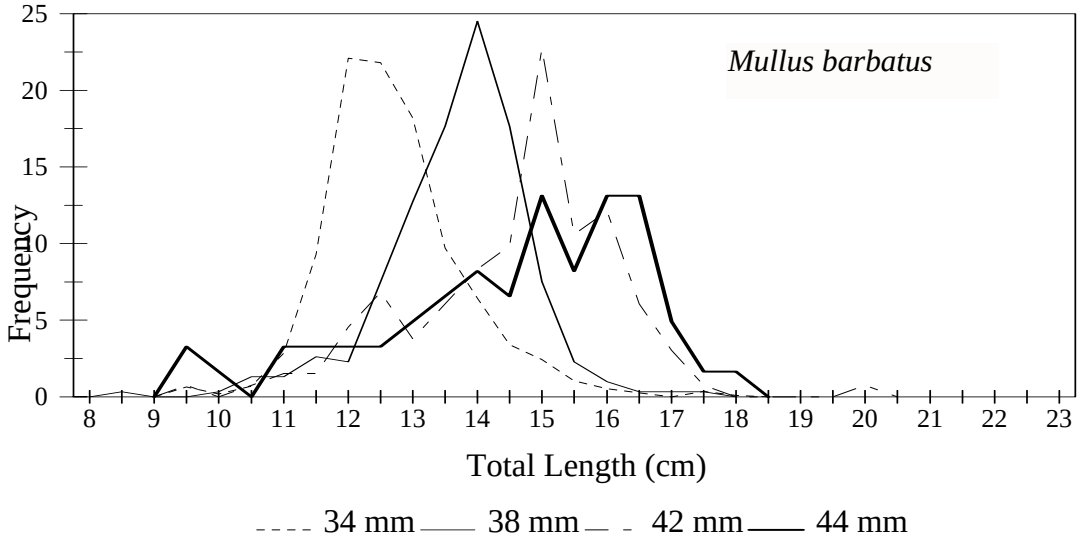
Combined catch composition by number

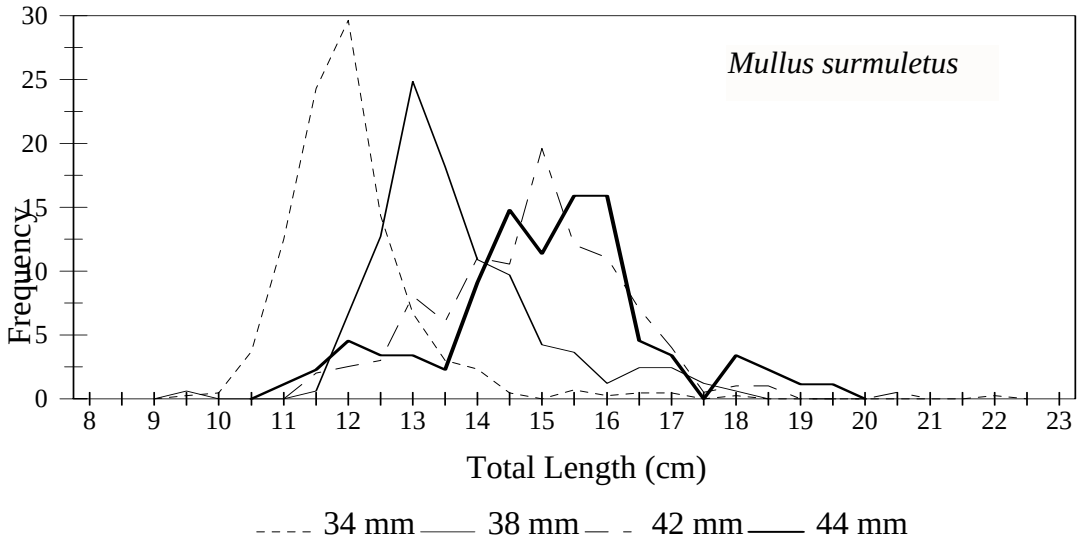
44 mm



Combined catch composition by weight

The length distributions of *M. barbatus* and *M. surmuletus* caught with the different gillnets are presented below.





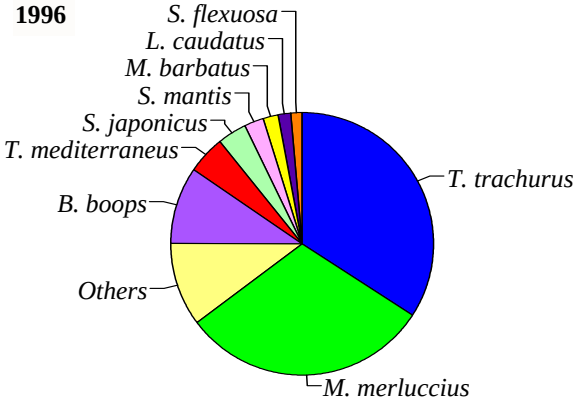
Length distributions of M. barbatus and M. surmuletus caught with the different gillnets

The hake (*Merluccius merluccius*) métier has been studied by sending observers on professional vessels during 1996 and 1997 (Anon., 1998). A gillnet of 56mm mesh size was used.

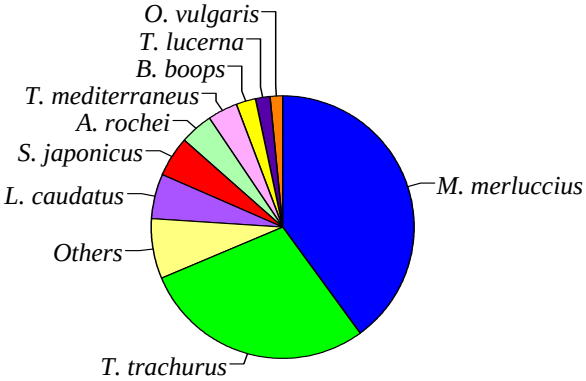
Depth	3-173 m
Total CPUE	4.7 Kg/1000 m of net
Target species CPUE	1.7 Kg/1000 m of net
Total landings CPUE	3.6 Kg/1000 m of net
Total discards CPUE	1.1 Kg/1000 m of net
Landings/Total catch	0.77
Main by catch species	*Trachurus trachurus*
Main discard species	*Raja clavata*
CPUE Main by catch species	1.5 Kg/1000 m of net
CPUE Main discard species	0.7 Kg/1000 m of net

The combined catch compositions by number and by weight of the hake métier, during the two years of observations are the following:

1996

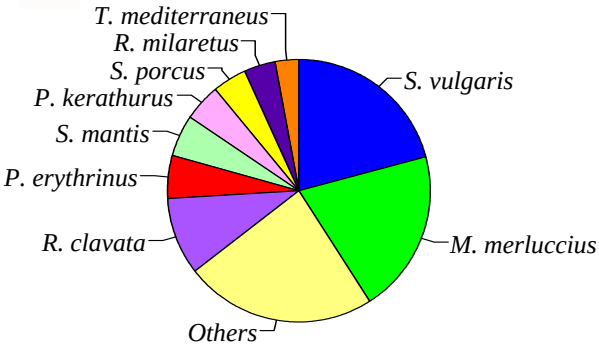


Combined catch composition by number

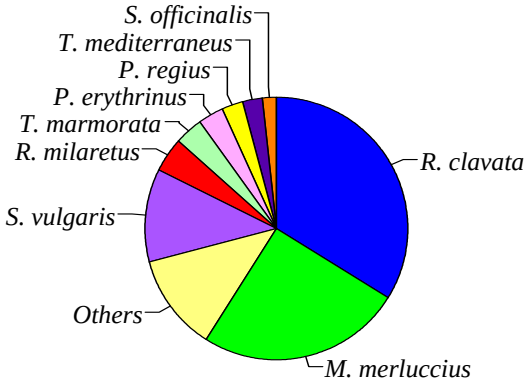


Combined catch composition by weight

1997

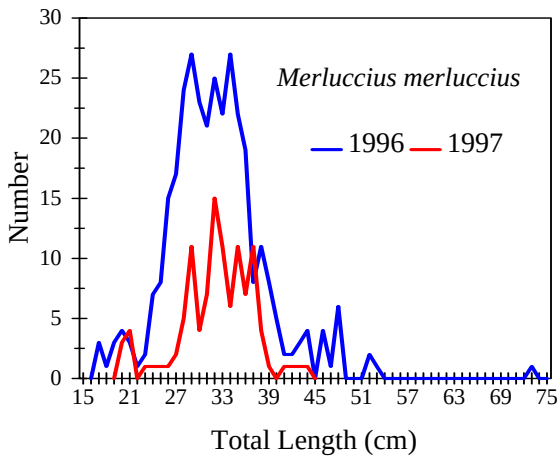


Combined catch composition by number



Combined catch composition by weight

The length distribution of hake during the two sampling years is presented below.



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3.3 – Longline and handline

SPAIN

GSA 1,5,6 – NORTHERN ALBORAN SEA, BALEARIC ISLANDS, CATALAN COASTS

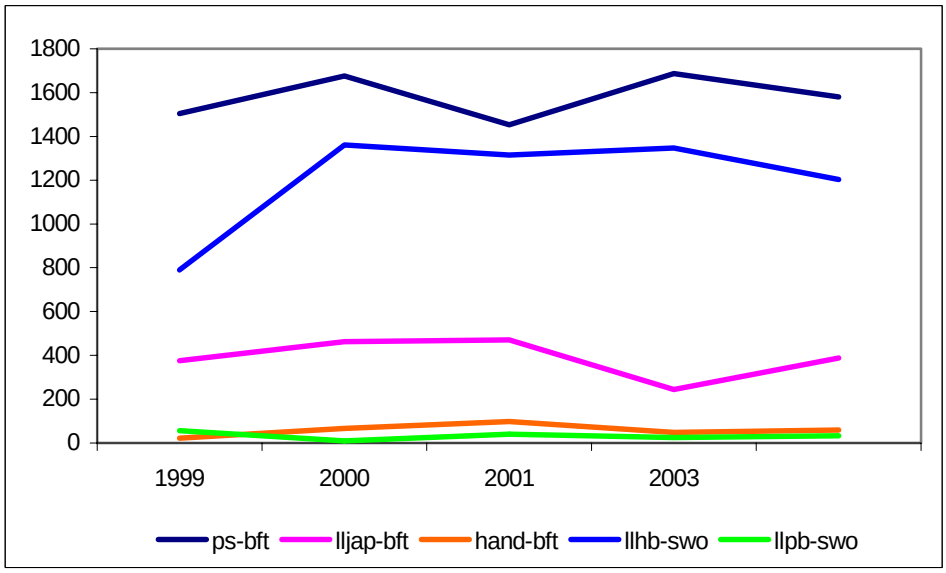
FISHERY 1 – LARGE PELAGICS LONGLINE

General

There is an important Spanish fishery on large pelagics in Western Mediterranean. This fishery is practised mainly in international waters targeting principally Blue fin tuna (*Tunnus thynnus*) and Swordfish (*Xiphias gladius*) as well as other species as pelagic sharks.

Bluefin tuna and sword fish catches evolution in the Spanish Mediterranean 1999- 2002

Species	***Gear***	***Year***			
		1999	2000	2001	2002
Bluefin tuna	*Japanese Longline*	376 t	463 t	470 t	244 t
	Hand line	21t	67 t	98 t	48 t
Swordfish	*Surface Longline*	790 t	1361 t	1315 t	1347 t
	Bottom Longline	56 t	10 t	40 t	25 t



Bluefin tuna and sword fish catches evolution in the Spanish Mediterranean 1999- 2004

An important part of the artisanal fisheries also operates with lines, mainly with handlines and bottom longlines. These fisheries are practising along the Spanish Mediterranean coasts exploiting a large number of different species mainly *Sparids, Conger eel, Scorpenids*.

FISHERY 2 - BLUE FIN DRIFTING LONGLINE

Fishing grounds
Mediterranean waters surrounding Ibiza Channel and Balearic Islands.

Fleet
Total number of vessels changes from year to year. The number for the 1999-2002 period fluctuated about 30- 40.

Fishing time
Seasonal fishery from May to July.

Fishing equipment
The main line can reach a length of 40 nm with 1800 hooks.

Deck layout
One or two hydraulic haulers are set onboard. One or two cranes to haul the catch. An electric winch manages the fish on the deck. One small freezer is on board, to maintain in good conditions the bait. The ice to maintain the catch is directly produced with seawater.

Electronic equipment
GPS, radar (2), echo sounder (2), video plotter with electronic charts, communication systems

Data on catch
Mean annual catch for the 1999-2002 period reached 388 t. This fishery represents about 24% of the total Spanish catch for bluefin tuna in Mediterranean waters

Technical interactions
With other large pelagic fishery

Special features
None

Relationships between fishing effort, fishing mortality, catch
No data available

FISHERY 3 - BLUE FIN HAND LONGLINE

General
This fishery is practised by much different type of vessels, from the artisan ones to medium sized boats with modern equipment.

Fishing grounds
Northwestern Alborán, Spanish Levant and Catalan Sea.

Fleet
Variable, up to 200 small vessels and several medium size vessels.

Fishing time
March to October

Fishing equipment
Information missing

Deck –layout
Information missing

Electronic equipment
Information missing

Data on catch
Mean catch for the 1999- 2002 period reached 58.5 t.

Technical interactions
With other large pelagic fishery

Special features
Information missing

Relationships between fishing effort, fishing mortality, catch
No data available

FISHERY 4 - SWORDFISH DRIFTING LONGLINE

Fishing grounds
Spanish Levant coast, Ibiza Channel, Balearic Islands.

Fleet
The fleet is very heterogeneous with 40 vessels full time dedicated and a variable number of vessels with temporal licence. The total number of vessels practicing this fishery can be estimated up to 120.

Fishing time
The fleet is fishing all year round, principally in summer and fall.

Fishing equipment
The total length of the mainline is about 40-50 nm with 3000-4500 hooks. Usually, up to 500 disposable lights to attract the fish are used each time. In the mainline, 25 radio beacons with a short wave transmitter are deployed.

Deck layout
One or two hydraulic haulers. One or two cranes to haul the catch. An electric winch allows managing the fish on the deck. One small freezer to maintain in good conditions the bait. The ice to maintain the catch is directly produced with seawater.

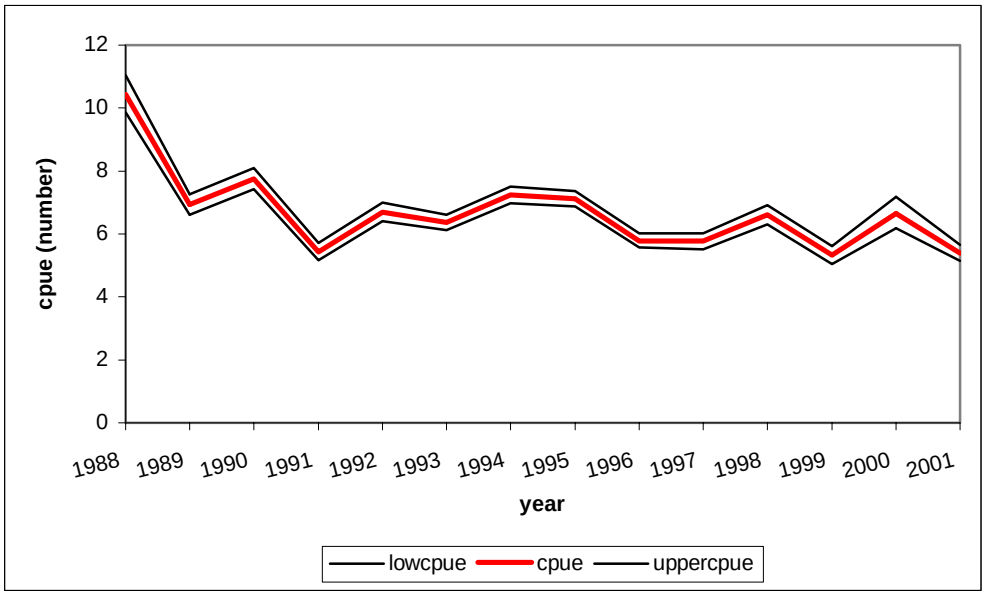
Electronic equipment
GPS, radar (2), echo sounder (2), video plotter with electronic charts, communication systems.

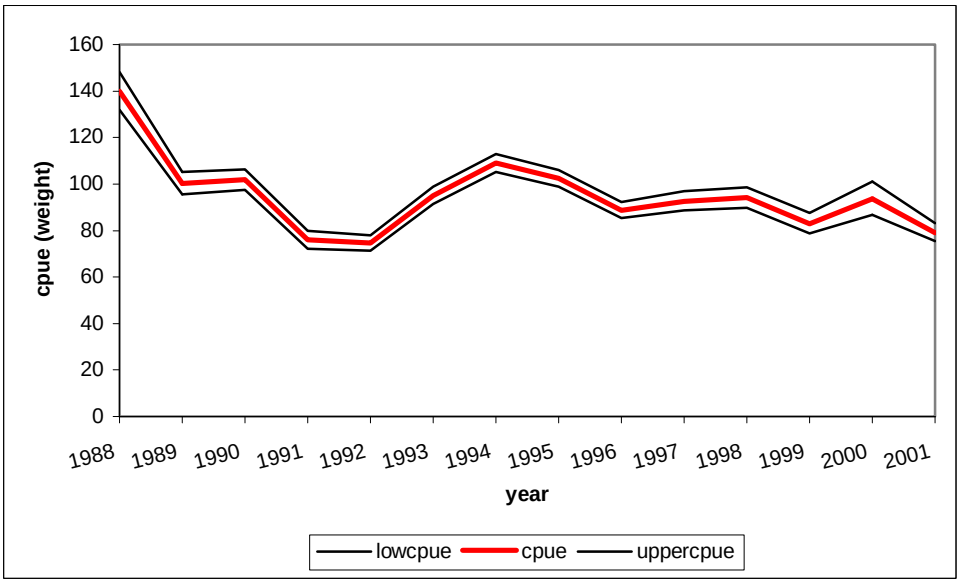
Data on catch
Mean yearly catch over the period 1999- 2002, reached 1203 t.

Technical interactions
With other large pelagic fishery.

Special features
Recently some boats have begun to use the American longline that facilitate to fish deeper than the traditional one. The Spanish legislation only allows a longline with a total length up to 33 nm with 2000 hooks. These dimensions are smaller than those normally used.

Relationships between fishing effort, fishing mortality, catch
Standardized abundance index are elaborated in an annual basis considering both number of specimens and live weight by one thousand hooks. Results for the 1988- 2001 period are as follows:





Values of CPUE in number and in weight over a time period

Spanish Longline. CPUE in number

Year	lsmean	std. err.	Low 95% cpue	cpue	Upp 95% cpue
1988	2.3453	0.0290	9.8642	10.4413	11.0522
1989	1.9354	0.0238	6.6134	6.9288	7.2593
1990	2.0480	0.0217	7.4309	7.7540	8.0911
1991	1.6921	0.0251	5.1721	5.4327	5.7064
1992	1.9013	0.0221	6.4128	6.6966	6.9929
1993	1.8497	0.0195	6.1203	6.3592	6.6074
1994	1.9789	0.0181	6.9835	7.2361	7.4978
1995	1.9633	0.0174	6.8844	7.1239	7.3718
1996	1.7550	0.0197	5.5647	5.7844	6.0127
1997	1.7520	0.0227	5.5172	5.7679	6.0301
1998	1.8884	0.0234	6.3145	6.6108	6.9211
1999	1.6716	0.0271	5.0474	5.3226	5.6128
2000	1.8947	0.0382	6.1756	6.6555	7.1726
2001	1.6841	0.0244	5.1373	5.3892	5.6536

Spanish Longline. CPUE in weight

Year	*lsmean*	*std. err.*	*low 95% cpue*	*cpue*	*upp 95% cpue*
1988	4.9405	0.0296	132.0253	139.9071	148.2594
1989	4.6075	0.0242	95.6107	100.2634	105.1424
1990	4.6230	0.0221	97.5067	101.8318	106.3488
1991	4.3303	0.0256	72.2811	75.9962	79.9022
1992	4.3111	0.0225	71.3206	74.5407	77.9063
1993	4.5546	0.0199	91.4460	95.0876	98.8741
1994	4.6912	0.0185	105.1229	109.0012	113.0225
1995	4.6296	0.0178	98.9784	102.4920	106.1303
1996	4.4850	0.0201	85.2631	88.6970	92.2691
1997	4.5286	0.0231	88.5482	92.6546	96.9515
1998	4.5440	0.0239	89.7901	94.0896	98.5950
1999	4.4185	0.0276	78.6283	83.0023	87.6197
2000	4.5389	0.0389	86.7787	93.6598	101.0865
2001	4.3707	0.0249	75.3563	79.1274	83.0871

FISHERY 5 - SWORD FISH BOTTOM LONGLINE

Fishing grounds
Spanish Levant waters.

Fleet
Fishing time
Seasonal. Second half of the year.

Fishing equipment
- 3 baskets with 30 nm of wire and 2500 hooks
- stones
- floatings as the trawl

- branch lines
- 2 radiobuoy

Deck –layout
Information missing

Electronic equipment
Information missing

Data on catch
Mean catch for the 1999- 2002 period reach 133 t.

Technical interactions
With other large pelagic fishery

Special features
Information missing

Relationships between fishing effort, fishing mortality, catch
ICCAT does not make any specific regulation for swordfish. The present yields and the exploitation pattern seem to be sustainable for a short time according to the last evaluation (May 2003). However, there is an increasing concern due to the high level of juveniles in the Mediterranean catches.

FISHERY 6 - ARTISANAL BOTTOM LONGLINE

General
A part of the artisanal fleet uses bottom longline as main gear while a great part uses them as an accessory gear.

Fishing ground
Bottom longlines are distributed along the Spanish coast. They are used in several types of grounds, more frequently on rocky bottoms or besides these.

Fleet concerned
No data available.

Fishing time over a year
All year round.

Fishing equipment
Generally the fleet uses three different types of bottom longlines. Two of them are deployed in the same way: on the bottom the main line stands parallel to a short distance from the ground and the hooks are very close to it or even lying on it. In the case of the “piedra bola” longline, the main line has alternatively a lead and a buoy, so the disposition respect to the bottom is in a W form.

Deck layout and machinery involved
Most of the vessels have a line hauler.

Electronic equipments
Scarce

Data on catch
Main species caught from this fleet are: *Sparids as Pagellus acarne, P. bogaraveo, Dentex spp., Pagrus pagrus*,. Other species with high interest are *Conger conger, Epinephelus marginatus, Polyprion americanus and Helicolenus dactylopterus*.

Technical interactions with other fisheries
With other artisanal fisheries and trawl fishery.

Special features
Information missing

Relationship between fishing effort, fishing mortality and catch rates
In a study on the artisanal fishery in the Gulf of Alicante (GSA5) standardized abundance indexes were obtained. The main results for bottom longline fishery was as follow:

Main characteristics of the more discriminant species identified in the analysis

Species/ Group	Gear	Nominal CPUE mean ± SD (kg/boat/day)	Standardised CPUE ± SD (kg/boat/day)	Deviance % Explained GLM	Annual Trend	Season	Maximum CPUE
Sparids	Long Line	13.5 ± 12.22	6.51 ± 1.07	36.57	Sinusoidal Max.1997 Min.2001	All Year	April and Autumn
Conger eel	Long-Line	6.61 ± 10.87	1.69 ± 1.12	46.10	Sinusoidal Max.1997 Min.1999	All year	Autumn and Winter

GSA 7 – GULF OF LIONS

FISHERY 1 - HAKE BOTTOM LONGLINE

General
A Spanish fleet using bottom longline operates in the Gulf of Lion targeting hake (*Merluccius merluccius*) shared stock. This fleet specially caught the biggest specimens of the hake population, making a special incidence in the spawner fraction.

Fishing ground
Gulf of Lion fishing grounds.

Fleet concerned
The fleet consists of 20 vessels with a mean power of 128 HP (it ranges from 48 to 190), a GRT between 6 and 19, with a mean value of 13, and lengths between 8 and 14.5 m (mean value 11.7 m). The fleet is quite modern; the mean year of construction is 1991.

Fishing time over a year
All year round

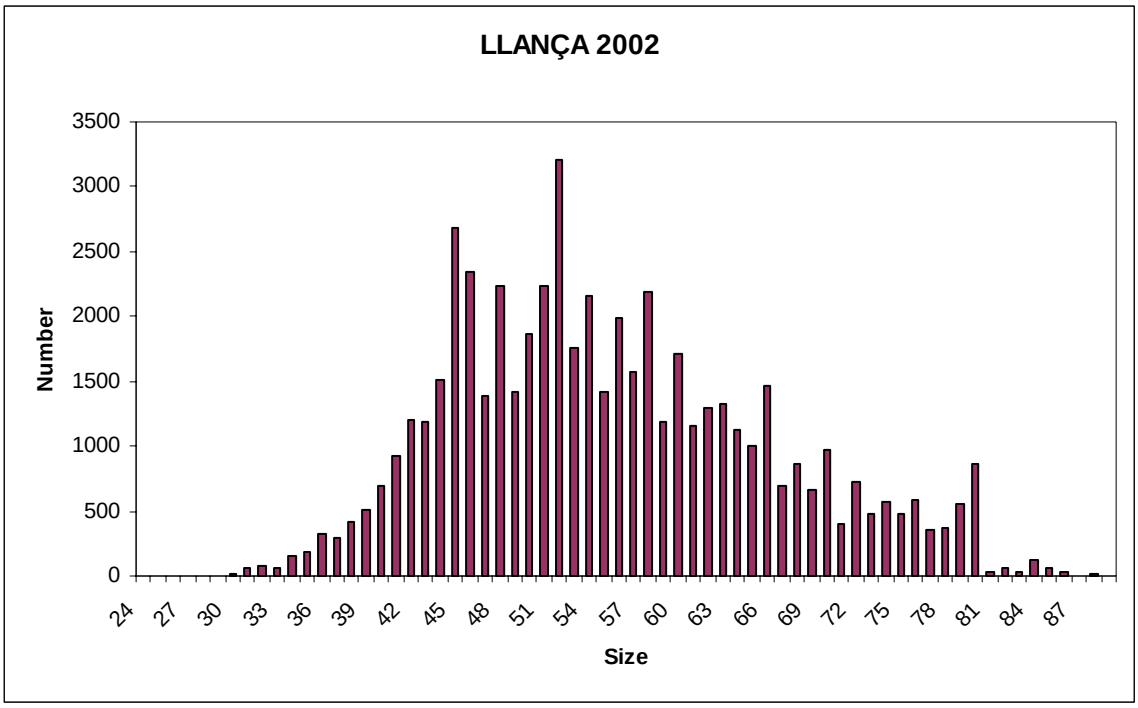
Fishing equipment
Line hauler.

Deck layout and machinery involved

Electronic equipments
GPS, echo sounder, communications devices.

Data on catch
The evolution of the catches over the last years is as follows. The average catch in same period was 126 t.

YEAR	1998	1999	2000	2001	2002
CATCH (t)	101	109	174	163	82



Size frequency distribution of the catch

Technical interactions with other fisheries
With trawl and gillnet fisheries

Special features
The fleet has increase in the recent past years from 13 vessels in the 1988-1991 to 20 nowadays.

Relationship between fishing effort, fishing mortality and catch rates
A jointly assessing of this fleet and the trawl fleets (Spanish and French) targeting hake in the GSA6 have been made for the last years. The main result shows that the resource has a growth overfishing and a risk of recruitment overfishing as well.

FRANCE

General
Longlining is practised all along French coast of Mediterranean sea as an alternative technique to other set gear as netting or traditional beam trawling.
Handlining and bottom longlining are not clearly distinguished because these 2 techniques can be practiced in the same time. Only the hook number would allow separating them.

Fishing grounds
Most of the longlining activity (about 80 %) is concerning hard bottoms placed within 3 nautical miles offshore.
The other fishing grounds are bottoms about slope and edge of continental shelf and offshore waters for drift longlining.

Fleet
The fleet consists of lesser than 100 fishing boats which are about 29 years old. Their characteristics are given in the following table.

	LOA	GT	P (kW)
min	3	1	0
max	19	10	374
mean	7	1	60

GS7 - GULF OF LIONS AND LIGURO-PROVENCAL COASTS

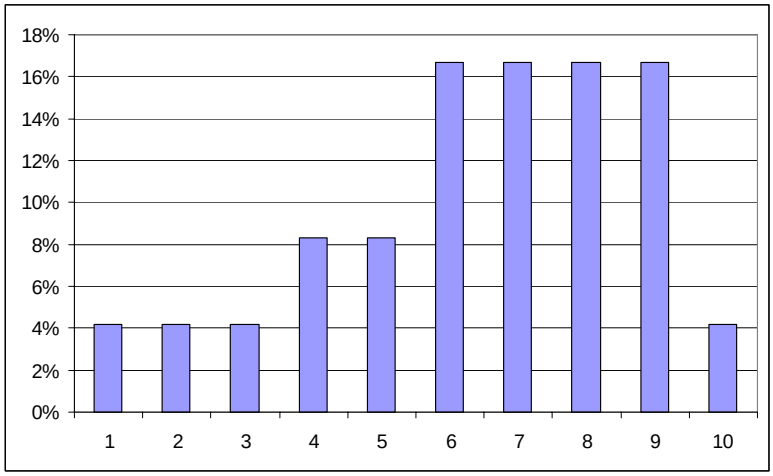
FISHERY 1 - LARGE PELAGIQUES DRIFTING LONGLINE

Fishing grounds
Offshore waters in the Liguro –Provençal current.

Fleet
It consists of lesser than 10 fishing vessels, 27 years old. Their length is 9 m and their power 99 kW in average.

	LOA	GT	P (kW)
min	8	4	37
max	11	8	160
mean	9	6	99

Fishing time



Fleet percentage operating over the year

Fishing equipment
Longlines for this large pelagic fish are similar to the North Italian drift longline with large snoods in monofilament, spaced approximately every 35 to 50 m. Between 400 and 1800 hooks (swordfish hook) can be set.

Deck –layout
Line hauler; open deck with small wheelhouse or completely covered deck.

Electronic equipment
GPS; sounder; gonio; electronic plotter chart.

Data on catch
No available

Technical interactions
With other large pelagic fishery

Special features
Nothing

Relationships between fishing effort, fishing mortality, catch
No data available

FISHERY 2 - BOTTOM LONGLINE FOR CONGER

Fishing grounds
Hard bottoms from 10 to more than 100 m depth.

Fleet
The fleet consists of 34 bottom longliners, 29 years old. Their mean values are 8 m (length) and 79 kW (power).

	LOA	GT	P (kW)
min	6	1	12
max	12	8,5	242
mean	8	2,8	79

Fishing time
All the year round but mainly from October to January.

Fishing equipment
Bottom longline of 200 to 1000 hooks (2/0 to 5/0).
Main line is made of PA of 4mm diameter and its length is between 2500 and 3500 m.
The length of the branch lines is 80–200 cm; they are set every 4 or 5 m and are made of PA of 1,4-1,8mm diameter.
Baits are sardinella (*Sardinella aurita*), mackerel (*Scomber* spp.) or bogue (*Boops boops*).

Deck layout
Open deck with small wheelhouse. Line hauler and rack-boxes for storing the line.

Electronic equipment
Information not available

Data on catch
Annual catch are estimated to be between 130 to 150 tons for Gulf of Lions.

Technical interactions
With conger trap fishing

Special features
Information not available

Relationships between fishing effort, fishing mortality
No data.

FISHERY 3 -VARIOUS BOTTOM FISH

Fishing grounds
Hard bottoms between 10 and 50 m.

Fleet
The fleet consists of about 82 fishing boats, 32 years old. Their mean values are: 7 m (length) and 72 kW (power).

	LOA(m)	GRT	GT	P (kW)
min	4	1	1	4
max	12	14	12	258
mean	7	4	3	72

Fishing time
All the year round.

Fishing equipment
Hooks: 120-2500 (2/0 and 3/0)
Main line: length =3500-5000m, material: PA, diameter Ø=3mm.
Branch line: length=100cm, material: PA, diameter Ø=1,2-1,5mm.
Distance between branches lines: 4-5m.
Bait: "bibi" (*Nereis* spp.); couteau droit d'Europe (*Solen marginatus*), "piades" (*Pagurus sp*.) for Sea bream (*Sparus aurata*) or small pelagic fishes.

Deck –layout
Information not available

Electronic equipment
Echo Sounder and GPS

Data on catch
Not available

Technical interactions
With other static gear activity and bottom trawling

Special features
Information not available

Relationships between fishing effort, fishing mortality, catch
Information not available

FISHERY 4 - SEA BASS LONGLINE

Fishing grounds
Shallow waters within 10 to 50 m.

Fleet
It consists of 11 fishing boats, 31 years old, with average values of 6,5 m (length) and 41 kW (power).

	LOA(m)	GRT	GT	P (kW)
min	4	1	1	19
max	9	4,6	4,6	110
mean	6,5	2	2	41

Fishing time
All the year round.

Fishing equipment: 60-500 hooks are set by monofilament longline.
Deck –layout no data available
Electronic equipment no data available
Data on catch no data available
Technical interactions no data available
Special features no data available
Relationships between fishing effort, fishing mortality: no data available

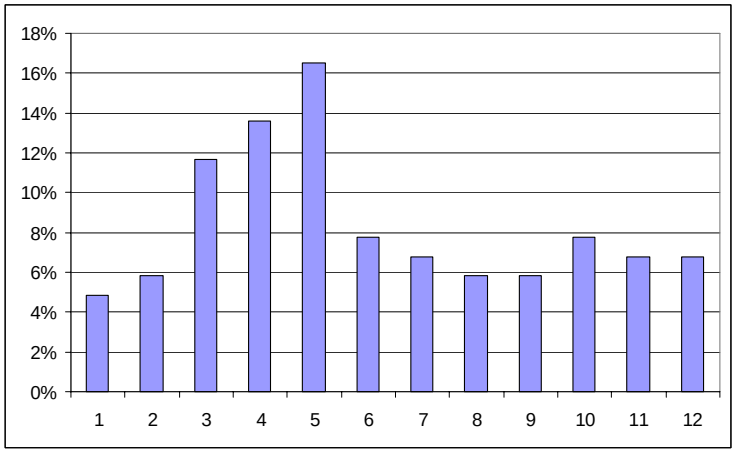
FISHERY 5 - HAKE BOTTOM LONGLINE

Fishing grounds
Hard bottoms of edge and slope of continental shelf and canyons, from 50 to 200 m.

Fleet
17 fishing boats, 34 years old, are involved in this fishery. Their mean values are: 7.6 m (length) and 65 kW (power).

	LOA (m)	GRT	GT	P (kW)
min	4,6	2	1	10
max	11	7	8	155
mean	7,6	4	3	65

Fishing time



Fleet percentage operating over the year

Fishing equipment
Same as Spanish technique ("piedra bola") monofilament and between 300-1200 hooks 3/0.

Deck layout
Same as for other small scale fishing boats.

Electronic equipment
Same as for other small scale fishing boats.

Data on catch
No data

Technical interactions
With trawling and gillnetting
Special features
nothing
Relationships between fishing effort, fishing mortality, catch
No data

ITALY

A long-line is made up of a main line, namely a yarn linked up to the branch lines placed at regular distances. At the end of these branch lines, the hooks with baits are fitted out.
According to the lowering method, a distinction is made between fixed long-lines or long-lines anchored to the sea bottom, and drift long-lines or long-lines left at the mercy of sea currents.
For all these systems, that are very common in Italy among small- and medium-sized fishing boats, no specific fishing licence is needed, therefore most fishing boats use these gear alternatively during their trips, with the view to catching a given species in a specific phase of its biological cycle, or in a particular period when the fishermen catch some organisms with these special gear.
Therefore, they represent a real fishing tradition and the experience gained by fishermen over generations has determined their behaviour and the use of special gear that cannot be easily classified.
There exist several types of long-lines, like surface and bottom long-lines, that differ in the type of yarn used for the main-line, in branch lines and in the pattern and size of hooks.
Long-lines are mainly used in the industrial sector with regard to tuna and swordfish fishing, whereas coastal fishermen primarily use bottom long-lines and long-lines for pelagic fish.
Long-lines for tuna
Long-lines for tuna are drift long-lines characterised by very long branch lines (10÷50m) and a mainline from a few dozen up to about one hundred kilometres. The hooks used are not particularly big, except for the diameter of its material. In essence, they should be extremely resistant to guarantee a high number of catches, since tunas are very heavy and strong; in addition, they should not be very visible for tunas should not smell danger. That is why branch lines are so long and made up of thin single-lines (and even by steel in some cases), in that the aim is not to make the main-line, the branch lines and the hooks be too visible.
If hooks are far from the main-line, tunas will be more likely to take the bait.
There are several models of long-lines for tunas, but the most widespread is made up of a big cylinder collecting 50-80 km of 3-3.5 mm-thick single-lines made of nylon.
On this single-line, that makes up the main-line, branch lines with hooks are linked up some 50 metres apart from each other, in addition to buoys aimed at fixing fishing depth and radar buoys aimed at facilitating hauling in. The long-line is lowered in the evening and hauled-in in the morning, and it is essential to verify that no trawlers are operating in that area for they might break the main-line.
Catch capacity depends on depth, baits, hook size, season and fishing ground.
Therefore, the fishing effort could be measured as the number of hauled hooks per each day of haul.
Apart from tunas, target species are three or four, but the uncertainty of catches could be limited if the number of fishing boats using this technology was to increase.
Long-lines for swordfish and albacore
In some cases, the same single-line roll is used, but in most cases fishermen use some hook nests that are linked up to the main-line from 15-20 up to over 90 km.
Typical branch lines are shorter compared to long-lines for tuna (nowadays, deeper longlines are used to catch swordfish in some areas) and the single-line of the main-line and the branch lines is thinner. The size of hooks is variable, bigger for swordfish and smaller for long-finned tuna, and even the number of hauled hooks and fishing grounds are different. In general, the smaller the hook the shorter the branch line, therefore the closer the hooks placed on the main-line.

Even in this case, fishing effort could be measured as the number of hauled hooks per each fishing day.

Bottom Long-line

This gear varies considerably according to the fishing ground, the type of bottom, depth and target species.

Some examples are the bottom long-line for hakes, the bottom long-line for sea-bass and dentex, the bottom long-line for scorpion fish, moray eels, conger eels, white fish, etc.

The main differences lie in the size of the main-line, the model and size of the hook and type of bait. In general, branch lines are shorter in bottom long-lines compared with pelagic long-lines.

Even in this case, fishing effort could be measured as the number of hauled hooks per each fishing day in compliance with the standards adopted at an international level.

Anyway a difference must be made according to target species, when catches per unit effort are used as abundance indexes.

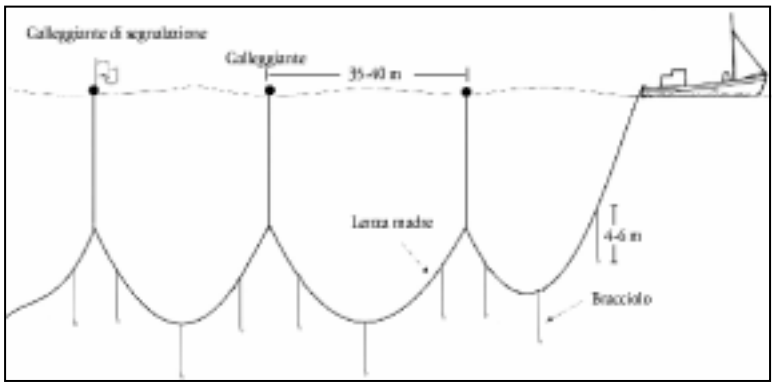
Unfortunately, as regards fishing systems including fish traps, set nets and hooks, in Italy no reliable data on the number of fishing boats using this technology is currently available and therefore no information is provided as to fishing hours, thus limiting use potential.

GSA 18 – SOUTHERN ADRIATIC

General

Long line fishery is carried out in the Southern Adriatic, targeting both large pelagic fish (swordfish, albacore, etc.) and demersal resources (coastal = white fish; off shore = hake). The importance of such fisheries is low if compared with trawling or small pelagics fishery.

Long-lines utilised in the Southern Adriatic correspond to different main categories: drifting long-line and bottom long-line. The first one is used to catch large pelagic fish near the water surface while the bottom long-line operates on sea bottom (soft or rocky).



The drifting long-line.

Drifting long-line fishery mostly targets swordfish and albacore, but some by-catch species are also collected.

Pelagic species from drifting long-line fishery in the Southern Adriatic

Target species :
Xiphias gladius (Swordfish)
Thunnus alalunga (Albacore)
By-catch or occasional species:
Thunnus thynnus (Bluefin tuna)
Auxis rochei (Bullet tuna)
Euthynnus alletteratus (little tunny)
Sarda sarda (Atlantic bonito)
Prionace glauca (Blue shark)
Ruvettus pretiosus (Oilfish)
Alopias vulpinus (Thresher shark)
Brama brama (Atlantic pomfret)
Coryphena hippurus (Common dolphinfish)
Lamna nasus (Porbeagle)
Lichia amia (Leerfish)

Offshore bottom long-line is mainly targeted to hake large specimens. Other valuable species, such as scorpionfish and gurnards, are also caught contributing to the success of the fishery trips. The list of the species (including by-catch) is reported below.

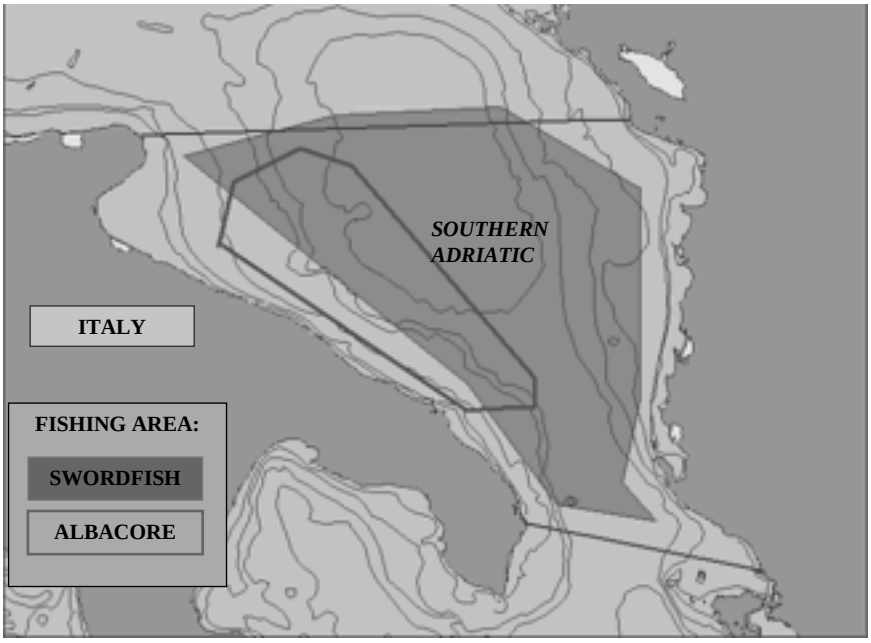
Main demersal species from off-shore bottom long-line fishery
(*modified from De Zio et al.,1998*)

Target species :
Merluccius merluccius (European hake)
By-catch or occasional species:
Conger conger (Conger eel)
Helicolenus dactylopterus (Blue mouth scorpionfish)
Hexanchus griseus (Bluntnose six-gill shark)
Lepidopus caudatus (Silver scabbardfish)
Mustelus mustelus (Smoothhound)
Pagellus bogaraveo (Red sea bream)
Phycis blennoides (Greater forkbeard)
Phycis phycis (Forkbeard)
Polyprion americanus (Wreckfish)
Raja spp. (Skates)
Scorpaena elongata (Slender rockfish)
Scorpaena scrofa (Red scorpionfish)
Squalus acanthias (Piked dogfish)
Trigla lucerna (Tub gurnard)
Trigla lyra (Piper)

FISHERY 1 - DRIFTING LONGLINE (LARGE PELAGICS)

Fishing grounds

Drifting long-line fishery is carried out mostly in offshore waters of GSA 18.



Drifting long-line fishing zones in the Southern Adriatic (*from Marano et al., in press*)

Fleet

The fishery fleets using drifting long-lines came mostly from the Southern Adriatic Italian ports, even if vessels from other Italian areas have been several times reported in the area. The maritime department involved in the activity are Bari and Brindisi. The main ports for landings are Monopoli, Savelletri, Mola and Otranto. Actually the total number of the fishing vessels is officially 15-20 and a decreasing trend is reported in the last years. It is strongly suspected that a much higher number of vessels has a multi-purpose licence and doesn't appear in the official statistics for this gear. As a matter of fact, in the last 20 years the Southern Adriatic became one of the most important fishing areas for the large pelagic species.

Drifting long-line fishery: number of vessels per year in the Southern Adriatic (AA.VV., 2002).

	1984	1985	1986	1987	1990	1991	1992	1993	1994	1995	1998	1999	2000
Mola	7	6	6	7	6	4	2	2	3	6	2	2	2
Monopoli	41	41	36	25	17	32	23	16	20	14	17	12	11
Savelletri	7	5	6	7	4	4	4	4	6	5	5	4	2
Otranto	8	9	7	7	7	7	7	5	4	5	2	2	2

GRT and engine power for the mentioned vessels mostly ranged between 10÷15 and 75÷150 kW respectively.

Fishing regime
The drifting long-line fishery is seasonal: swordfish fishing season is mostly concentrated between July and December (Mola, Monopoli and Savelletri ports), while Albacore fishing season is between September and November. Thirty and twenty days of effective fishery could be estimated for swordfish and albacore respectively.

Fishing equipment
The general information on the characteristic of drifting long-line used in the Southern Adriatic Sea is reported in the following table.

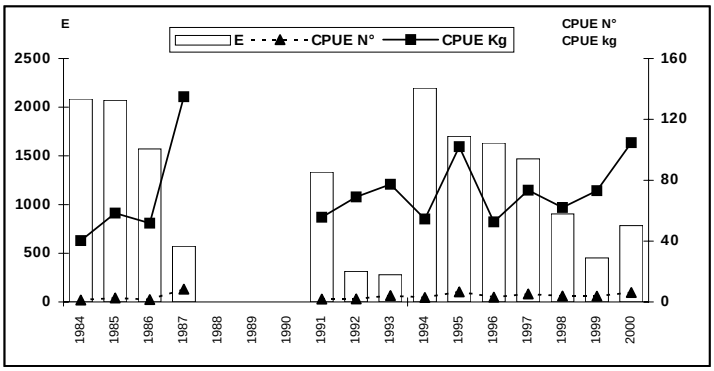
Some features of the drifting long-line used in the Southern Adriatic Sea (AA.VV., 2002)

Hook measure (swordfish)	8-10 cm
Hook measure (albacore)	4-5 cm
Number of hooks (swordfish)	2000 – 3500
Number of hooks (albacore)	3500-5000
Mainline diameter	1.40-1.60 mm
Mainline length	40-70 Nm
Branch line diameter	1.20 mm
Branch line length	4-6 m
Distance between floats	35-40 m
Line material	Nylon
Bait for swordfish	Mackerel
Bait for albacore	European pilchard

Deck layout and machinery involved
With regard to the changes in machinery occurred in the last 10 years, an increasing use of line hauler has been detected.

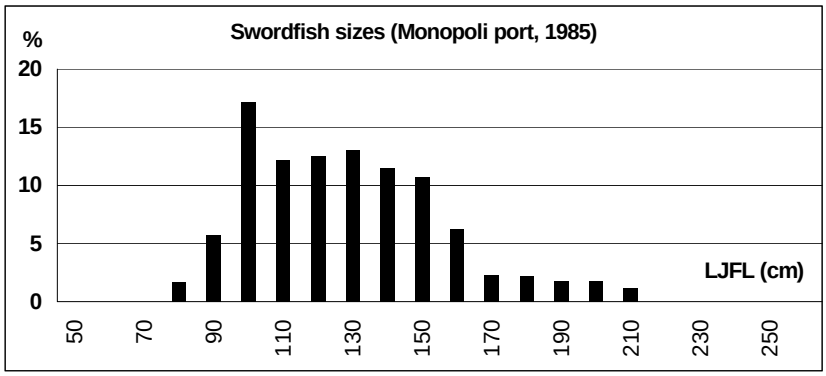
Electronic equipment
The increasing use of GPS didn't produce remarkable modification in the distribution and availability of fishing areas in the last 10 years.

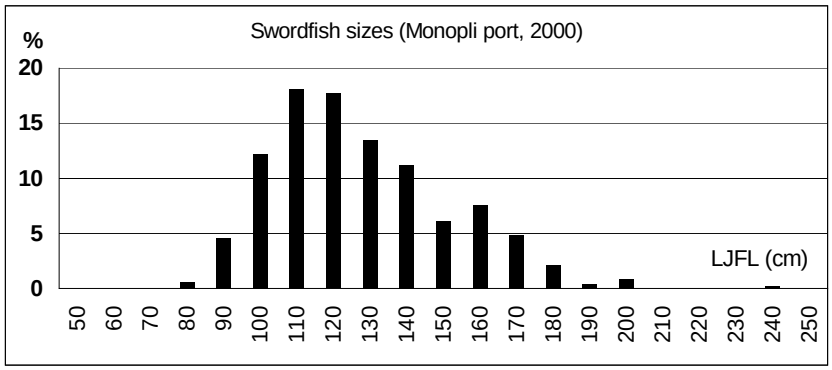
Catch data
The drifting long-line fishery appears to be selective with respect the target species, swordfish and albacore. Other species are negligible, with the exception of the blue shark that can represent percentages of 10-30% in the catches.
With regard the target species, swordfish catches decreased in the last five reported years in the Southern Adriatic, from 205,890 kg during 1995 to 84,632 kg and 63,566 kg during 1998 and 1999 respectively, but the 1995 value represented the maximum estimation for the full 1984-2000 period. However, a light increase (92,155 kg) has been reported for the year 2000. Monopoli resulted the most important port for landings (more than 70-80% of total catches). Fishing effort (E = total number of the hauled hooks by year) was highly variable, as well as C.P.U.E. (Catch per Unit Effort) values in weight and number.



Swordfish fishery: trend of fishing effort and CPUEs (n° and weight)* (*years 1984-2000*). *Data not available for 1988-1999-1990 (*from Marano et al., in press****).***

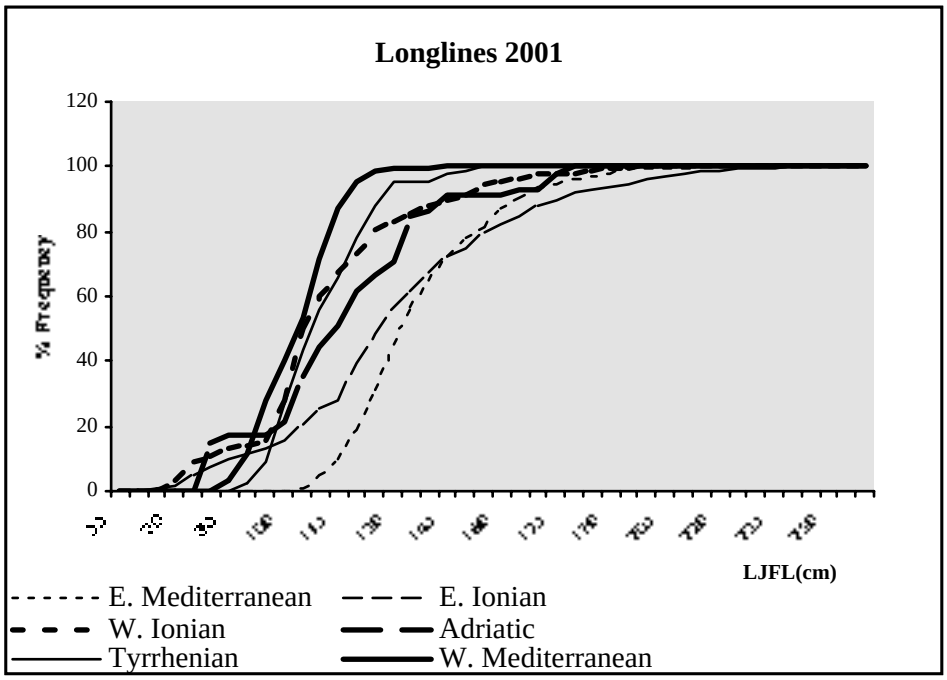
Length frequency distributions from fishing ports (Monopoli, Savelletri and Mola) were different, but the percentage of specimens smaller than 120 cm Lower Jaw Fork Length (LJFL), the minimum legal size, was always higher than 50%. The comparison between size distribution in 1985 and 2000 highlights small differences. Noticeable information was the apparent decrease of large individuals (LJFL >180-200 cm). Mean weight of fished specimens was below 20 kg in the last years of XX Century, while it was mostly between 20 and 30 kg during the 1980s (*Marano et al., in press*).





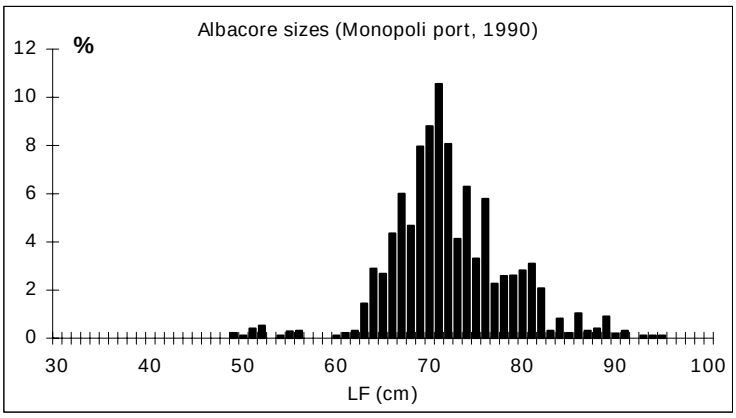
***Swordfish length distributions from commercial catches* (*up = 1985; down = 2000*) (*from Marano et al., in press*).**

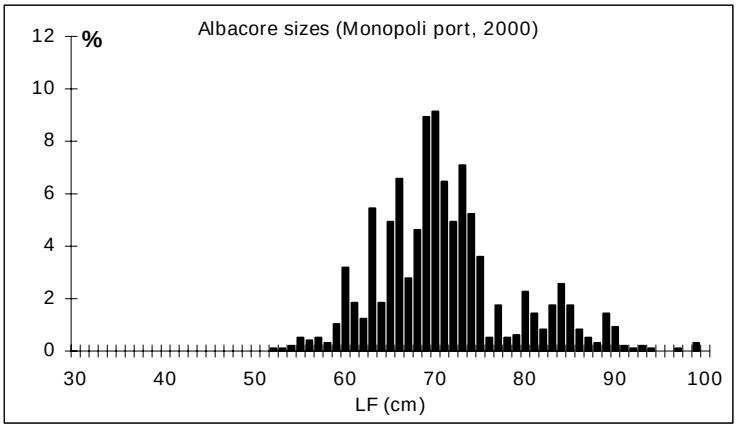
Albacore catches didn't shown a well-defined trend, as well as C.P.U.E. values, but during the last years of the investigated period albacore fishery was self-regulated by fishermen from Monopoli port. In fact, the fishermen ban the activity in order to protect the swordfish juveniles. The Albacore fishery was totally banned during 1998, while the number of fishing trips during 1999 was 87 (Marano et al., in press).



Cumulative percentage length frequency distribution of swordfish long-line catches in various Mediterranean areas during 2001 (source St. Proj. 99/032).

With regard to the size distributions most of caught specimens were larger than 60 cm Fork Length (FL) all over the investigated period. Mean weight of fished specimens was very stable it ranged mostly between 5 and 6 kg during the years from 1984 to 2000.





***Albacore length distributions from commercial catches* (*up = 1990; down = 2000*) (*from Marano et al., in press*).**

The incidence of discarded species mostly refers to *Dasyatis violacea* (Blue stingray). Moreover, the gear accidentally catches specimens of loggerhead turtle (*Caretta caretta*), but they are immediately released at the sea.
Discard of undersized (immature) swordfish also occurs, and it could be very important mostly during albacore fishery.

Technical interactions
The technical interaction of drifting long-line in the GSA 18 could be related to the trawling activity due to the fishing areas sometimes overlapped.

Specific feature
No derogation to the current general rules.

Relationships between fishing effort, fishing mortality and catch rates
Both catches and C.P.U.E. values from Large Pelagics fishery in the Southern Adriatic Sea underlined a high variability mostly due to the restriction/enlargement of fishing seasons year by year and the number of operating vessels. The fishery could be considered as "opportunistic"; during each year fishermen decides to fish Large Pelagics after preliminary fishing trials. If the catches result unsatisfactory, fishery activity is targeted to other resources (i.e. demersals) by using different gear (trawl nets, bottom long-line) (*Marano et al*., in press).
The fishery of swordfish has to be carefully monitored due to the large number of immature specimens collected by the gear. In fact, size at maturity of swordfish was 110-120 and 130-140 cm LJFL for males and females respectively corresponding to specimens aged 2 and 3 (*Megalofonou et al.,* 1987; *Orsi Relini et al.,* 1993; *Orsi Relini et al.,* 1996).
Most of albacore catches refer to adult individuals considering that size at maturity was 60-65 cm FL, corresponding to 2 years aged specimens (*Marano et al.,* 1999).

FISHERY 2 - OFFSHORE BOTTOM LONGLINE (DEMERSALS)

The offshore bottom long-lines exploit demersal resources (mostly hakes) in the GSA 18. Both soft and rocky bottoms, mostly in the Southern zones, are explored at depth range 150-400 m.

Fleet

The fishery is mainly concentrated in the maritime department of Bari. A rough number of 20-30 vessels could be estimated for this fishery, mostly allocated in the ports of Monopoli and Mola.
GRT and engine power for the mentioned vessels mostly ranged between 10 and 15 and between 75 and 150 kW respectively.

Fishing regime

The fishery is carried out all along the year. Due to the gear and activity features (good sea condition are needed as a rule) the number of effective days at the sea is high variable; 20-30 days per year can represent a preliminary estimation.

Fishing equipment

The main characteristics of the mostly utilised off shore bottom long-line in the area are reported in the following table. Each vessel can use more than one bottom long line set during the fishing trip.

Some features of the off shore bottom long-line used in the GSA 18

Hook type and measure	Mustad 5-7
Mainline length	3500 m
Mainline material and diameter	Multifilament, 5.0 mm, Monofilament, 2.0 mm
Branch line length	1.8 m
Branch line diameter	1.20 mm
Distance between branch line	5.5 m
Baits	European pilchard, squids

Deck layout and machinery involved

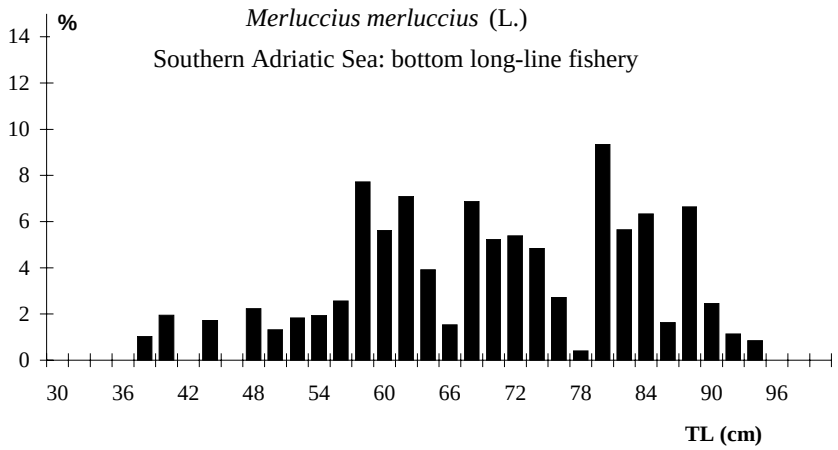
With regard to the changes in machinery occurred in the last 10 years, an increasing use of line hauler has been detected.

Electronic equipments

The increasing use of GPS didn't produce remarkable modification in the distribution and availability of fishing grounds in the last 10 years.

Catch data

The off shore bottom long line is mainly targeted to the hake. The hakes represent from 40 to 70 % of the total catches (in weight) (*De Zio et al.*, 1998; *Romanelli & Tarulli*). Other commercial species fished with remarkable yields are: Conger eel (10-20%), Blue mouth scorpionfish (5-10%), Red sea bream (2-4%) and Tub gurnard (1-2%).
The C.P.U.Es (U.E. = 100 hauled hooks) for hakes can range between 5 and 7 both in number and weight (kg); C.P.U.E. values for all the caught species can range between 10 and 20 in number and 10 and 30 in weight (*Romanelli & Tarulli*).
The quantity of landed catches could be estimated at 300-500 kg/vessel/fishing trip.
The sizes of the hake's captured specimens are larger than 25-30 cm as a rule.



Length-frequency distributions of M. merluccius from bottom long-line fishery in the Southern Adriatic Sea (*from Ungaro et al., in press*).

The incidence of discarded species mostly refers to Galeus melastomus (Black mouth catshark), which can reach an important percentage at deeper bottom only (*Romanelli & Tarulli*)

Technical interactions

The technical interaction of off shore bottom long-line in the GSA 18 is related to the trawling activity. In fact the European hake is the main target species for both the activities and sometimes the fishing areas are overlapped. However the fraction of population exploited by the two fisheries is quite different; in fact, trawl fishery mostly catch individuals from first age and length cohorts (juveniles) while long-line mainly works on larger sizes (spawners) (*Ungaro et al., in press*).

Special features

No derogation to the current general rules.

Relationships between fishing effort, fishing mortality and catch rates

Catches from off shore bottom long line is mostly composed of large sized individuals (post maturative lengths) for all the fished species. Nevertheless, the increase of the fishing mortality on older cohorts and the depletion of the spawning biomass could affect the population of some species, such as the hake, very important for other fishery (i.e. Trawling) (*Ungaro & Marano,* 1996).

DRIFTING LONGLINE FISHERY IN SICILY

Drifting long-line fishery in Sicily has as mainly target species: swordfish, albacore and bluefin tuna. As concerns the distribution of the fleets, the swordfish fishery is diffused all along the Sicilian coast and the islands, with a higher concentration along the Ionian coast and in the Strait of Sicily. Tirrenian and Ionian fleets traditionally carry out the albacore fishery. The blue fin tuna fishery is carried out mainly by the fleet based in the Strait of Sicily and, more recently, by some vessels based in Ionian harbours.
A large majority of the catches are related to the three main target species, but a larger number of species are included in the by-catch, even if their total usually minor both in number and weight (*Di Natale et al., 1992, 2001*). Some of these species are landed and traded.

Pelagic species from drifting long-line fishery in Sicily

SPECIES	LL SWO	LL BFT	LL ALB	SURF LL
Xiphias gladius	X	x	x	X
Thunnus alalunga	x	x	X	X
Thunnus thynnus	x	X	x	X
Sarda sarda	x			x
Katsuwonus pelamis			x	x
Tetrapturus belone	x		x	x
Coryphaena hyppurus	x		x	x
Coryphaena equiselis	x			x
Ruvettus pretiosus	x			x
Brama brama	x		x	x
Polyprion americanum			x	x
Lepidopus caudatus	x			x
Mola mola	x	x		x
Pomatopus saltatrix		x		x
Muraena helena	x			x
Remora sp.			x	x
Alepisaurus ferox				x
Campogramma glaycos				x
Carnx hippos				x
Pseudocaranx dentex				x
Seriola dumerilii				x
Istiophorus albicans				x
Tetrapturus angustirostris				x
Tetrapturus albidus				x
Luvarus imperialis				x
Euthynnus alletteratus				x
Orcynopsis unicolor				x
Alopias vulpinus		x		x
Prionace glauca	x			x
Carcharhinus plumbeus	x			x
Galeorhinus galeus	x			x
Isurus oxyrhinchus	x			x
Lamna nasus	x			x
Sphyrna zygaena				x
Dasyatis violacea	x		x	x
Mobula mobular	x			x
Alopias superciliosus				x

Carcharhinus brachiurus				x
Carcharhynus brevipinna				x
Carcharhinus falciformis				x
Carcharhinus limbatus				x
Carcharhinus obscurus				x
Cetorhinus maximus				x
Heptranchias perlo				x
Hexanchus griseus				x
Carcharodon carcharis				x
Eugomphodus taurus				x
Odontaspis ferox				x
Sphyrna lewini				x
Sphyrna mokarran				x
Sphyrna sp.				x
Squalus acanthias				x
Squalus blainvillai				x
Mustelus asterias				x
Mustelus mustelus				x
Myliobatis aquila				x
Pteromylaeus bovinus				x
Raja fullonica				x

Fishing grounds

The Sicilian drifting longline fleet carries out its activity either in coastal or offshore waters. The swordfish fishery is usually carried out far from the coast, even if some activities can take place over the continental shelf or the slope, particularly along the Tirrenian and the Ionian areas. The most important fishing grounds of this fleet are in the Strait of Sicily, in the Southern Mediterranean, close to Crete, in the Balearic Sea and along the Northern African coast. All the tuna long line activities are offshore; minor fishing grounds are about all the Sicilian islands and along the Ionian coast.

The albacore fishing grounds of the Sicilian longline fleet were originally in the Southern Tirrenian and Ionian Sea; in the most recent years, important quantities of albacores have been detected in the Southern Mediterranean, where this species was not present before.

The blue fin tuna longline fishery is carried out mostly in the Strait of Sicily and in the area between Malta and the Gulf of Sirte, with minor areas in the Ionian Sea.

The characteristics of high mobility of this fishing activity and its poor coverage by observers programmes create problems in understanding the real distribution of the fishing grounds for the three target species. Furthermore, relevant changes could happen every year, mostly depending on oceanographic factors.

Fleet

It is very difficult to define the Sicilian longline fishing fleet fishing for large pelagic species. As a matter of fact, some vessels have a specific licence for drifting longlines or quota for blue fin tunas, then becoming clearly identified; the majority of the fleet has a multi-gear licence, without a clear distinction of the main gear. The result is that this fleet is not defined, but it is believed to reach about 1200 vessels of different sizes, from 5 to over 30 metres, capable to carry on the longline fishery in a variable number, according to various factors. Among these factors, the most important one is the presence of the target species in coastal waters, which may allows important numbers of vessels to take part in the fishery or not.

Fishing regime

The drifting long-line fishery was traditionally a seasonal fishery: the albacore fishery was shared in two main season, spring and autumn; the blue fin tuna fishery was between May and June, sometimes with a second period in fall, for the smallest fishes; the swordfish season was mostly in spring and autumn.

In the most recent years, due to evident environmental factors, like a higher temperature in the upper stratum of the sea, the fishing season for all these three species was extended. The swordfish fishery almost cover the whole year, with differences from area to area, mostly reduced along the Tirrenian coast (September-December) and much more extended along the Ionian coast and the Strait of Sicily, where most of the offshore fleets are based.

The albacore fishery is now carried out even in summer, particularly in the new fishing grounds in the Southern Mediterranean, while important contractions of the fishing seasons have been noticed in the Southern Tirrenian Sea in 2003, where albacores were found mostly in spring.

The blue fin tuna longline fishery is now from February to July, with important changes from year to year, mostly in the Strait of Sicily and in the Ionian Sea, while it is almost absent in the Southern Tirrenian sea.

Fishing equipment

The main features of the various types of drifting long-lines used for large pelagic species in Sicily (*Di Natale, 1992, revised*) are reported in the following table.

Some features of the drifting long-line used in Sicily for large pelagic species:

Hook measure (swordfish)	10-5.5 cm h / 4.5-2.5 cm w
Hook measure (albacore)	5 – 3.5 cm h / 2.8-2 cm w
Hook measure (bluefin tuna)	12-7 cm h / 5.5-3.5 cm w
Number of hooks (swordfish)	250 – 3500
Number of hooks (albacore)	250 - 5000
Number of hooks (bluefin tuna)	250 - 2000
Mainline diameter (swordfish)	1.40 - 1.80 mm
Mainline diameter (albacore)	1.00 – 1.40 mm
Mainline diameter (bluefin tuna)	1.6 – 4.0 mm
Mainline length (swordfish)	10 - 100 km
Mainline length (albacore)	10 – 90 km
Mainline length (bluefin tuna)	15 - 100 km
Branch line diameter (swordfish)	1.20 – 1.8 mm
Branch line diameter (albacore)	0.8 – 1.2 mm
Branch line diameter (bluefin tuna)	1.4 – 2.0 mm
Branch line length (swordfish)	4 – 10 m
Branch line length (albacore)	3 – 5 m
Branch line length (bluefin tuna)	5 - 10 m
Distance between branches (swordfish)	25 – 150 m
Distance between branches (albacore)	15 – 30 m
Distance between branches (bluefin tuna)	35 - 50 m
Distance between floats (swordfish)	50 – 300 m
Distance between floats (albacore)	50 – 100 m
Distance between floats (bluefin tuna)	105 – 150 m
Float line length (swordfish)	5 – 150 m
Float line length (albacore)	3 – 6 m
Float line length (bluefin tuna)	5 – 50 m
Line material	PA mono, PES mult, steel(rare)

Deck layout and machinery involved
With regard to the changes in machinery occurred in the last 10 years, an increasing use of line hauler has been detected.

Electronic equipment
The increasing use of GPS didn't produce remarkable modification in the distribution and availability of fishing areas in the last 10 years, while, on the opposite, it created a more precise fishing patterns to the distant fleet, trying to better intercept the migration courses of each species.

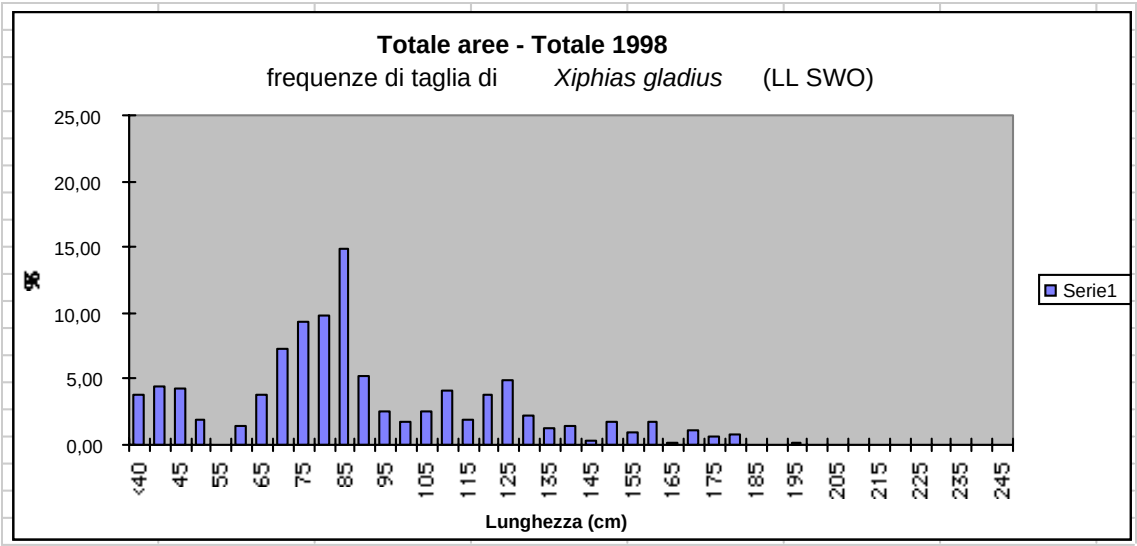
Catch data
The drifting long-line fishery appears to be usually species/selective with respect to the main target species (*swordfish, bluefin tuna and albacore*). Other species are caught as a by-catch, as reported in the previous table, in a percentage variable according to the area, the season and the main target species.
Total catch data are quite difficult to collect, because they are reported in various formats directly to the Maritime Authority and are difficult to collate in the proper way (usually, the national statistics refers only on national catch data, without reference to the single region).
As concerns the CPUE series, these have been collected according to the national research programmes, with holes from time to time.
The swordfish longline CPUE data for the southern Tirrenian sea are the following:

YEAR	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
CPUE	121,14	109,73		104,81	132,15		87,69	153,16	164,83	69,67	113,73

Due to the characteristics of the fisheries, albacore and blue fin tuna longline CPUE data are not collected on a regular base, with serious gaps.
Yearly variations in CPUE data are linked to various environmental changes and are not always related to the fishing area, but only to the landing place. Abundance is consequently difficult to be correlated.
Observers data, collected on board of various Sicilian long-line vessels in 1998-1999 and reported on the following table, can provide a better understanding of the different realities.

CATCH	LL SWO			LL ALB			LL BFT		
SPECIES	kg	CPUE-kg	CPU-kg	kg	CPUE-kg	CPU-kg	kg	CPUE-kg	CPU-kg
SWO	17302	120,02	142,99	113,1	3,45	16,16	0	0	0
ALB	160	1,11	1,33	9051,4	275,96	1293,06	0	0	0
BFT	1275	8,84	10,54	66,0	2,01	9,43	340,0	121,43	113,33
OTHERS	6853	47,54	56,64	1756,7	53,56	250,96	304,5	108,75	101,50
SPECIES	no.	CPUE-no.	CPU-no.	no.	CPUE-no.	CPU-no.	no.	CPUE-no.	CPU-no.
SWO	1096	7,60	9,06	51	1,56	7,29	0	0	0
ALB	17	0,19	0,14	2369	72,23	338,43	0	0	0
BFT	23	0,16	0,19	11	0,34	1,57	6	2,14	2,00
OTHERS	476	3,30	3,93	500	15,24	71,43	10	3,57	3,33

Length frequency distributions are available for most of the main species and here there are some examples.



Size frequency for Xiphias gladius

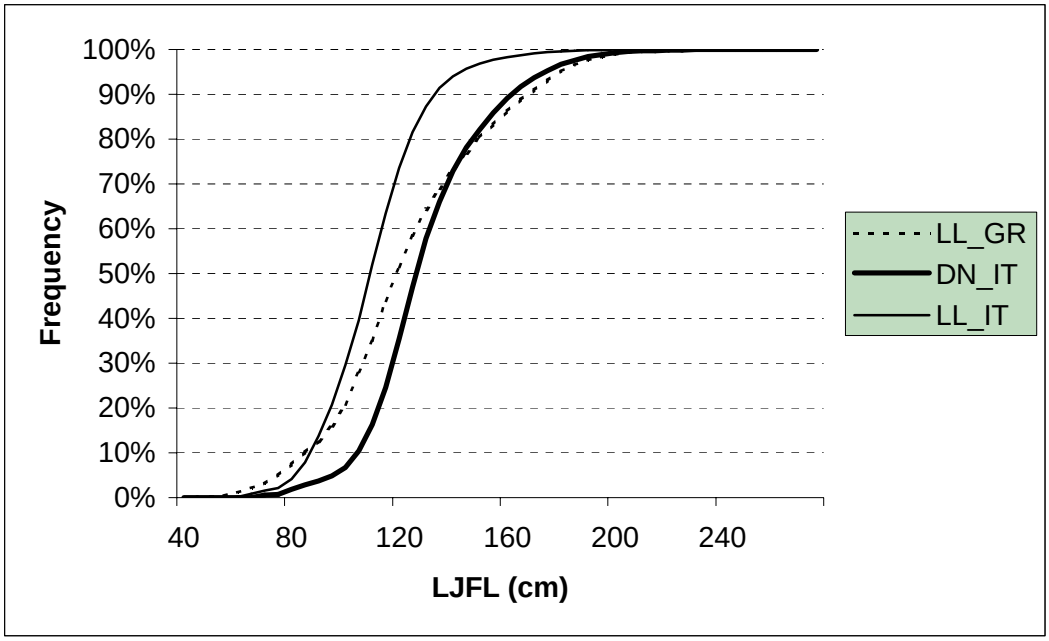
The incidence of discarded species is very variable according to the gear type, the target species, the fishing grounds and the season. Data are very difficult to obtain but some observers data confirm that the most discarded species is the blue stingray *Dasyatis violacea*, while even the blue shark (*Prionace glauca*) is almost all discarded in the Sicilian longline fishing activities.
The drifting longline incidentally takes marine turtles (mainly the loggerhead turtle, *Caretta caretta*) and, even if all the majority of the specimens are released alive at sea, this is one of the main problems for this gear category.
Catch data specifically referred to these fishing activity in the area are very difficult to find. The last published data on total catch from the longline fishery, in the Strait of Sicily, and the Southern Tirrenian Sea were reported by *Di Natale et al. (1998).* According to this data, referred to 1994 and 1995, swordfish catches in longlines are respectively 1919 t and 2660 t, blue fin tuna catches in longlines are respectively 711 t and 1781 t and albacore catches in longlines are respectively 387 t and 81 t.

Technical interactions
Longlines fishing in the Strait of Sicily during the tuna-fishing season could interfere with the tuna purse seine activity. In recent years, several interferences have been also reported with

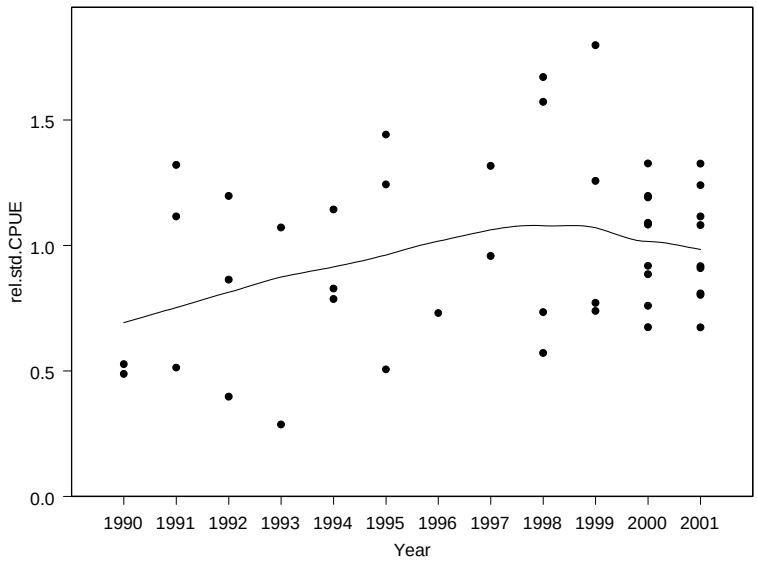
the tug vessels used to tow the tuna cages from the fishing grounds to the farming sites. This problem is particularly relevant and able to create conflicts.
The drifting longline fishing also has frequent interactions in all the areas with navigation (large ships are able to cut the main line into several pieces, creating troubles to recover gear and catches.
Interactions have been also reported in coastal areas or above the continental shelf with bottom trawling activities.

Specific feature
The current length limit established by EC Reg. 1626 appears far from the reality of the real offshore fishery, particularly in the case of swordfish and blue fin tuna. As a matter of fact, the recent modification of the gear, increasing the distance between the branch lines up to 150 m, together with the behaviour typical of these species (the swordfish is usually a non-schooling species) suggests a revision of the regulations, mostly taking into account the real effort components.
According to ICCAT suggestions in 2002 and 2003, related to the possible reduction of juvenile swordfish catches (*Di Natale et al., 2002*), a close season approach might help in reducing catches of juveniles, as well as the general effort.

Relationships between fishing effort, fishing mortality and catch rates
Taking into account some observations from the previous chapters, both catches and CPUE values obtained from the Sicilian longline fishery show a high variability. Even if this fishery, at the beginning, was considered as “opportunistic”, then it became more stable and several international fishing organisms, like the ICCAT, now currently use longline data.
One of the major problems is the lack of standardisation of most of the data collected in several areas and the consequent difficulty in makes proper comparisons. Furthermore, data sets are often affected by various factors, like the fact that several tuna fishes are stolen from the gear, particularly in the Strait of Sicily or in the Southern Mediterranean areas. This strange factor was properly taken into account during the GFCM/ICCAT meeting in 1997 and resulted in a strong revision of the data outputs.
The mortality seems almost stable for the albacore, even if no assessment has been conducted so far in the Mediterranean, because no important differences were noticed in the last 20 years in the size frequency data.
Surprisingly, the same can be stated for the swordfish, as confirmed by the results of the EC Study Project 98/034 and the GFCM/ICCAT stock assessment for the Mediterranean swordfish. Both analyses confirmed a stable trend of the population in the last 15 years. Besides of this stable trend, the number of juveniles in the catches continues to be quite relevant and its reduction might help the Mediterranean swordfish population to be healthier. The mean length of the longline swordfish catches in the last 15 years is very close to the former minimum length established by the original EC Reg. 1626 (120 cm), confirming the fact that something is to be done on this issue.



Cumulative % frequency LJFL distribution of swordfish landings in the period 1986-1999 for different fisheries (LL_IT = Sicilian long-liners, LL_GR = Greek long-liners, DN_IT Sicilian drift-netters). It clearly shows the fact that longline catches are smaller compared to driftn,et catches. source: EC St. Proj. 99/32).



Harmonised abundance indices of Mediterranean swordfish by year. The fitted line represents a locally weighted smoother *(source: EC St. Proj. 99/32).*

As concerns the blue fin tuna mortality induced by the longline fishery, it is not currently considered as one of the relevant factors affecting this species, because a very large majority of the catches are due to tuna purse-seines. Several juvenile blue fin tunas might occur in drifting longlines used for the albacore fishery in particular years in some coastal areas.

GREECE

GSA 20, 22, 23 – IONIAN, AEGEAN AND CRETAN SEA

It is a very common gear used in all Greek seas. The extent of the gear's use changes from port to port. In some ports it is used all over the year while in other ports it is used during short time periods. The most common target species of the longlines in Greece are: *Pagellus erythrinus, Sparus aurata, Pagrus pagrus, Diplodus sargus, Merluccius merluccius, Epinephelus spp, Mustellus spp.* Long lines are also used for the fishery of large pelagic species which is a special type of fishery.

Fishing is taking place mainly in rocky bottoms. The depths range according to the target species. In shallow waters down to 90 m target species are: Sparidae, *Epinephelus spp*. In deeper waters (150 – 500 m) target species is *Mercluccius merluccius, Pagellus bogaraveo,* and Sparidae (big specimens).

The characteristics of the most common long lines are described in the following table.

Target species	Length of branch line (m)	Distance between branch lines	Hook no.	Buoyancy (lt/100m)	Ballast (kg/1000m)	Type
Anguilla anguilla	0.5-2	0-3.6	2-13	0	0-0.2	Bottom
Dentex dentex	1-1.5	5.4-10.8	8-13	0	0.3	Bottom
Diplodus sargus	0.8-1	4.5-9	5-14	0	0.1-0.3	Bottom
Epinephelus spp	0.9-1.8	7.2-9.9	5-12	0	0.3	Bottom
Merluccius merluccius	0.8-1.8	6-9.9	4-10	0-0.1	0.1-0.5	Bottom
Mustelus spp	1	4-5.4	7-12	0-0.1	0.5	Bottom
Pagellus erythrinus & Sparus aurata	0.6-1	2.7-5.4	5-15	0	0.1-0.2	Bottom
Pagrus pagrus	1-1.5	4.5-14.4	8-12	0.1	0	Bottom
Thunnus alalunga	1.8-18	0-14.4	4-9	0-2.1	0-0.1	Floating
Thunnus thynnus	1-12.6	0	1	0	0	Floating
Xiphias gladius	1.1-7.2	18-50.4	2-7	0.6-5.6	0	Floating

The most usual equipment of a long liner is a two or three drums hydraulic or mechanic winch. All the vessels are equipped with navigation systems and VHF. Some of them (specially the large vessels) carry electronic equipment (radar, echo-sounder, GPS- Plotter).

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3.4 – combined bottom set nets

SPAIN

Information not available

FRANCE

GSA 7 – PROVENCE AND FRENCH LIGURIAN COASTS

These nets are well known as *battudes entremaillées* or *resclares* in France, *cabri-boucs* or *boleros* in Spain, *reti combinate* or *incastellate* in Italy.

Fishing ground
This fishery concerns mainly the Provence and French Ligurian coasts, between 5 and 40 m depths.
These nets are generally set as "post nets", near caps or in channels, or on shoals in well known areas as passage or melting point for migratory fish.

Fleet
Fishing boats involved in this fishery, are 26 years old. Their mean values are: length 9,2 m, tonnage 5.5 GRT and engine power 74 kW.

Characteristics of the fleet

	Loa	GRT	P(kW)
min	6,6	1,6	22
max	14	21,4	178
mean	9,2	5,5	74

Fishing time
The different fishing seasons for the different target species are generally fixed by local fishermen organisations (prud'homies) according to the area. Soak time don't last more than 15 hours. Fishing activity for combined nets is from 150 to 200 days/boat.

Fishing equipment
These nets are characterised by the superposition of a gillnet above a trammel of the same inner mesh size as the gillnet.
They can be used for the catch of transient pelagic and mid-water fish ("battudes") as well for littoral bottom fish ("battudons").
The inner mesh size and the net height of the gillnet part are fitted to the target species as it is possible to find Boops boops, Mullus surmuletus, Lichia amii, Scombrus spp., Sarda sarda, Melva spp., Thunnus spp.

Gear characteristics and target species

gillnet	trammel		total stretched height	Total set length	target species	Main fishing season
mesh	inner panel	outer panel				
42-50	50	400	5-6	500-1100	Scorpaena spp., Mullus spp.	Dec- March
56	83	400-450	5-6	500-1100	Scomber sp., Boops boops	March -April
56-100	83-100	450-500	10-20	400-800	Sparus aurata	April-June
62-83	83	500	25-30	400-800	Sarda sarda, Lichia ami	Sept-Dec
125	160	440	20-25	400-800	Seriola dumerili, Thunnus sp.	All the year

Most of these nets are set in fleets of length lesser than 1500 m. On “post” they are set in straight line from the coast to the deeper bottoms. The end of the net must make a loop as the fish schools leading by the straight part of the net are finally trapped in it.

Whatever is the fishery type, nets must be haul after sunrise; hitting the hull or the water (“battude”) provokes the enmeshment of the fishes. The most important combined nets are used for Sparidae and large pelagic fish.

Deck-layout
Net hauler placed forehead, small wheelhouse. Nets are stored on the stern deck and inside the hull.

Electronic equipment
Echo sounder, GPS.

Data on catch
Big catches are not really frequent depending on the seasonal occurrence of migratory species, current direction and availability of fishing spots. Compared with those of gillnets, catch of the combined nets is more diversified. Together with pelagic and mid-water fishes also some bottom fishes, as sole (Solea spp.), monkfish (Lophius spp.) and gurnard (Triglidae) can be caught by the trammel part.

Technical interactions
Only with tourism activities.

Special features
Because they are used more as trap nets, these gears must be considered to be different from gillnet and trammel. Their use is extremely well regulated by “Prud’homies” legislation as well their seasonal characteristics and the setting period. Each “post” is generally allocated for 24 hours.

Relationships between fishing effort, fishing mortality, catch
No data

ITALY
Information not available

GREECE
Information not available

3.5 - traps, pots

SPAIN

GSA 1, 5, 6 – NORTHERN ALBORAN SEA, BALERIC ISLANDS, CATALAN COAST

FISHERY 1 - TRAPS FOR SHRIMPS

General
In the Spanish Mediterranean, the use of traps in artisanal fishing has been falling into disuse as a means of productive fishing. As a matter of fact the traps are being used only for personal consumption to catch species such as morey eel, conger eel and some crustaceans. An exception occurs in the use of traps for the capture of the caridean shrimp *Plesionika edwardsi* (*Brandt, 1851*), which is mostly targeted in the Spanish Eastern coast, where boats dedicated exclusively to this species are used.

Fishing ground
The fleet using this gear operates at 350-500 m, close to rocky areas, in the Alicante, Columbretes and Balearic waters.

Fleet concerned
In the port of Santa Pola, a ship using this gear has about 65 GRT and an average length of 19 m. The number is unknown.

Fishing time over a year
All year round.

Fishing equipment
It attracts the prey by means of baits placed inside. Their shape is variable and they are manufactured of cane, wicker and, currently, plastic. The traps used for shrimp fishing differ a little between zones (González *et al.*, 1987, Lozano *et al.*,1990 a). For instance, in the port of Santa Pola, they are cylindrical, with 1 cm plastic mesh. They measure 45 cm in height by 50 cm in diameter and have a frame of steel ribs. They are lowered in lines of 350 traps and are collected every day. They are baited with horse mackerel, sable, common mackerel, etc

Deck layout and machinery involved
Hydraulic trap hauler

Electronic equipments
GPS, navigaton plotter, echo sounder, radar, several communication equipment.

Data on catch
The annual landings vary between 60 and 100 tonne/year (González *et al.*, 1992).
The target species appeared in 81% of the fishings carried out. The highest yields were obtained around the Balearic Islands, Columbretes Islands and occasionally at certain other points (off Cape Palos, Alicante and in the Alborán zone). The Balearic was followed by Levant, whereas Alborán produced the minimum yields. A tendency appears to exist for fishing with greater intensity at greater depth and for longer periods of time in the most productive zones. The mean and maxima values found are very similar to those yields reported by Aquila (1991) in the Alicante gulf, being lower than those from Secci *et al*, 1994 in Sardinia.

Hierarchical results for the main accompanying species found, based on their mean yields (cpue=g/trap/day) for the different zones, as well as for all the fishings together (* absent) in a pot fishery.

TOTAL	**cpue**	**GSA1 (ALBORÁN)**	**cpue**	**GSA5 (BALEARES)**	**cpue**	**GSA6 (LEVANTE-CATALUÑA)**	**cpue**
Conger conger	4.38	*Plesionika narval*	3.74	*Conger conger*	3.18	*Conger conger*	7.09
Plesionika narval	1.66	*Conger conger*	2.09	*Scyliorhinus canicula*	1.73	*Plesionika narval*	0.94
Scyliorhinus canicula	0.72	*Plesionika heterocarpus*	0.33	*Helicolenus dactylopterus*	1.72	*Galeus melastomus*	0.71
Helicolenus dactylopterus	0.62	*Helicolenus dactylopterus*	0.30	*Phycis blennoides*	0.96	*Scyliorhinus canicula*	0.61
Galeus melastomus	0.33	*Etmopterus spinax*	0.13	*Phycis phycis*	0.62	*Etmopterus spinax*	0.15
Phycis blennoides	0.32	*Pasiphaea multidentata*	0.10	*Pasiphaea multidentata*	0.36	*Phycis blennoides*	0.14
Phycis phycis	0.18	*Galeus melastomus*	0.06	*Plesionika narval*	0.24	*Helicolenus dactylopterus*	0.11
Plesionika heterocarpus	0.15	*Chlorotocus crassicornis*	0.04	*Etmopterus spinax*	0.18	*Plesionika heterocarpus*	0.03
Etmopterus spinax	0.15	*Parapenaeus longirostris*	0.02	*Plesionika heterocarpus*	0.12	*Chlorotocus crassicornis*	0.02
Pasiphaea multidentata	0.14	*Phycis phycis*	0.01	*Galeus melastomus*	0.09	*Plesionika martia*	0.02
Chlorotocus crassicornis	0.05	*Plesionika martia*	0.002	*Chlorotocus crassicornis*	0.09	*Pasiphaea multidentata*	0.01
Parapenaeus longirostris	0.01	*Phycis blennoides* *	-	*Parapenaeus longirostris*	0.02	*Phycis phycis*	0.01
Plesionika martia	0.009	*Scyliorhinus canicula* *	-	*Plesionika martia*	0.007	*Parapenaeus longirostris*	0.003

Technical interactions with other fisheries
No interactions with any fishery.

Special features
Information not available

Relationship between fishing effort, fishing mortality and catch rates
No data available.

GSA 1 – NORTHERN ALBORAN SEA

FISHERY 1 - POTS FOR OCTOPUS

General
This fishery is relatively recent and is practised by the same fleet fishing by dredges.

Fishing ground
Shallow waters, generally up to 50 m depth and no farther than 2 miles from the shore.

Fleet concerned
The same fleet fishing with dredges but the number of vessels is unknown.

Fishing time over a year
All year round, depending on the yields.

Fishing equipment
Pots adopt several sizes and forms. More common are the plastic pots, shaped as the traditional clay pots. The number of pots deployed at the sea at the same time by ship can reach 2000 units.

Deck layout and machinery involved
Same as dredge fishery in the GSA

Electronic equipments
Same as dredge fishery in the GSA

Data on catch
Not available, since a great part of the catches are sold out of the fishing markets.

Technical interactions with other fisheries
Information not available.

Special features
Minimum landing size for the species is one kilogram. The Autonomous Government of Andalucia regulates this fishery.

Relationship between fishing effort, fishing mortality and catch rates
No data available.

FRANCE

GSA 7 – GULF OF LIONS

FISHERY 1 - OCTOPUS POT FISHERY

Fishing ground

Thi fishery is mainly carried out on sand bottoms of Gulf of Lions within depths from 10 to 30 m.

Fleet

The fleet involved in this fishery consists of 34 boats which are 23 years old in average.

	LOA (m)	GRT	GT	P (kW)
min	6	2	1	29
max	14	15	19	294
mean	**9**	**5**	**4**	**121**

Fishing time

The activity is carried out approximately all the year round but the best fishing period stands between September to December, on 3 to 10 m depths, and from March to August, on 14 to 25 m depths.

Fishing equipment

Traps are mainly cylindric pots in ceramic (60 - 70 cm length and 20 cm diameter) or in PVC (20 – 40 cm length and 15-20 cm diameter) with 1 entrance. The mainline is made of 600 m of 8 mm PP and the pots are fixed on it every 3 or 4 meters by branch lines of 1.85 m length. 300 to 2000 pots can be set for several hours or more than 3 days of soak time.

Deck –layout

Pot line hauler; open deck with small wheel house or completely covered deck.

Data on catch

Estimation of the catch is around 100 t/year.

FISHERY 2 - CONGER TRAP FISHERY

Fishing grounds

Same bottoms and depths as for conger longline fishery

Fleet

Some fishing boats belonging to the small scale fleet.

Fishing time

Approximately all the year

Fishing equipment

Traps for conger are shaped as a parallelepiped, with a steel frame of about 2 m length and 50– 80 cm height with a double conical entrance. They are completely covered by netting or

plastic grill of 35 to 40-bar mesh. The number of set traps is between 60 and 80 per boat/day. Soak time is ranges between12 and 24 h. Bait is sardinella (*Sardinella aurita*); mackerel (*Scomber* spp.); bogue (*Boops boops*).

FISHERY 3 - DEEP CRUSTACEAN TRAP FISHERY

This fishery uses different kinds of traps targetting *Plesionika spp., Palinurus mauritanicus, Nephrops norvegicus.*

Fishing grounds

The fishing grounds consist of muddy and sandy bottoms of the slope, continental shelf and canyons. The depth ranges between 200 and 400 m.

ITALY

No information available to this WG.

GREECE

No information available to this WG.

CAP. 4 – SUMMARY OF SPECIAL FISHERIES

SPAIN

GSA 5 - BALEARIC ISLANDS

FISHERY 1 - "JONQUILLO" FISHERY

The transparent goby fishery is a seasonal fishery carried out from December to April by 40 vessels with a mean length of 7m, using small boat seines. The target species, named "Jonquillo", are *Aphia minuta* and *Pseudaphia ferreri*. This fishery is very selective since only detected schools are fished and is regulated by autonomous legislation.

FRANCE

GSA 7 – PROVENÇAL AND LIGURIAN COASTS

FISHERY 1 - SEA URCHINS FISHERY

Fishing grounds

This fishery is carried out on hard bottoms (from 0 to 30m) of the Provence and Roussillon coasts.

Fleet

Twenty seven fishing units are involved in this fishery. Their characteristics are given in the following table.

	Loa	GRT	GT	P(kW)
min	4	1	0	17
max	18	29	30	316
mean	8	5	4	107

Special features

This fishery is submitted to a licence regime fixing the number of fishermen to 36 and the fishing season according to the fishing harbours.

FISHERY 2 - RED CORAL FISHERY

Fishing grounds

This fishery is practised on hard bottoms, from 30 to 150m depths.

Fleet

Fourteen fishing units are involved in this fishery. Their characteristics are listed in the following table.

	Loa	GRT	GT	P(kW)
min	6	2	0	55
max	10	9	5	147
mean	8	5	3	103

Special features

This fishery is submitted to a licence regime fixing the number of divers to 18 and the fishing season according the fishing harbour.

FISHERY 3 – BEACH SEINE

General

This fishery is essentially practised along the Ligurian coast and target, following the season, mainly juveniles of small clupeids ("poutine") as sardine, anchovy and shad, small fishes ("friture") or coastal species (sea bass, sea bream, red mullets,…).

Fishing grounds

Fishing grounds are within the first 200 m from the shore on pebble bottom.

Fishing equipment

This gear is called *seine* or *senne de plage* in France, *sciabica* in Italy, *jabega* in Spain, *vintzotrata* in Greece.

There are 3 types of beach seine with approximately the same characteristics i.e. length: 200 m; wings length: 80m and bag length in the middle of the gear:12 m. The vertical opening reaches 12m. The mesh size ranges between 6 mm for "poutine" and 18 mm for fish.

Fleet

Beach seines handled from the shore need only small boats, whose length is ranging from 4 to 5 m, with a mean engine power of 48 kW. Larger vessels are needed to use beach seine for small fish. The total fleet consists of about 27 vessels. Their characteristics are listed in the following table.

	LOA (m)	GRT	GT	P (kW)
min	7	2	1	13
max	14	16	21	178
mean	8	5	5	48

Fishing time

Besides other fishing technique as gillnettting or bottom longlining, the fleet practises beach seining for about 60 days/year/boat.

	Fishing season	**No. of fishing days**	**Annual catch (t)**
"poutine"	Mid February to mid April	25	540
"friture"	July to September	35	480
"mixed coastalspecies"	Autumn and winter	130	968

Deck layout

The gear is handled by hand from the beach or from the boat with 1-3 power blocks.

Electronic equipment

No electronic equipment

Data on catch
The production reaches about 25 t/year.

Technical interactions with other fisheries
There are no other clupeids fisheries and only the static gear fisheries, which are practised in the area by the same fleet, are concerned by the beach seine activity.

Special features
National regulation fixed both characteristics of the beach seines and how to use them.
The practice is limited by a licence regime.

Relationships between fishing effort, fishing mortality, catch rates
No data available

FISHERY 4 – SURFACE GILL NET FOR BLUEFIN TUNA

General
The fishing areas of the small-scale fishery boats remain quartered to the Gulf of Lions and Genoa. From April to May in the Gulf of Lion, from June to July in the Gulf of Genoa and from September to middle-November in the West of the Gulf of Lions.
The fishing trips are of short duration and vessels don't need large storing capacity. The crew doesn't exceed 5 or 6 men.

Fleet
Some 60-100 small-scale fishery vessels are practising static gear for different species. Most of them are based in the fishing harbours of Gulf of Lions.
A small part of the Mediterranean small-scale fishery fleet practises tuna fishing. It consists of small wooden or fibreglass made vessels whose length is 7 ÷15 m and engine power less than180 kW. These boats are mainly polyvalent gill-netters, practising an opportunist and seasonal fishing activity, shared between tuna, hake and sole.

Fishing equipment
The main gear used for tuna fishing by small scale fishery vessels is a type of drift surface net, the so-called *thonnaille*, made of a nylon multi-filament panel, brown or black coloured, in thread of 600 to 1110 m/kg . The stretched mesh size is 240 mm and the height of the panel is 40 to 50 meshes of 240 mm giving a depth of 7,50 to 9,40 m. The panel is maintained between 2 rope lines by large staples (about 60 cm), which give to the thonnaille an efficient power of capture by entanglement. These nets are generally maintained hanging in surface by means of buoys.

Deck-layout
The deck is equipped with a net hauler. Sometimes there is also a small hold for ice.

Electronic equipment
The fishing equipment of small-scale fishery vessels is generally reduced to a video echo sounder for prospecting.

Data on catch
About 300 t/year

Technical interactions
There are interactions with all bluefin tuna fisheries and with hake gillnetting.

Special features
In the aim to take the “thonnaille” out of the frame of the European interdiction for drift netting, French fishermen organisation decided to use this gear as a fixed surface net and moreover to fix systematically acoustic repellent devices for dolphins.
The autorisation of the practice as the technical characteristics and the use of this technique are under control of the French Fisheries Administration.

Relationships between fishing effort, fishing mortality, catch
No data available

ITALY

GSA 9 – LIGURIAN AND NORTHERN-CENTRAL TYRRHENIAN SEA

FISHERY 1- DANISH SEINE AND SURROUNDING NET WITHOUT PURSE LINE FOR TRANSPARENT GOBY

General
The transparent goby, *Aphia minuta*, is a small fish with a maximum size of about 6 cm, which constitutes a very important resource in the local artisan fishery because of its high commercial value.

Fishing grounds
The Danish purse seine for transparent goby is operated in Tuscany. The area off Livorno is the most exploited by boats mainly operating on sandy bottoms between 5 and 20 m depth around the rocky Meloria's area.
The use of this technique occurs at depths between 5 and 30 m on muddy-sandy bottoms. Fishing pressure is exerted on smaller size individuals, when they still concentrate in schools easily detectable by electronic devices (echo sounders). As soon as the school is detected, a buoy is positioned at sea and the fishers set the seine net around the school that will be successively hauled by a hydraulic winch. The catch composition is almost always monospecific.

The fleet
Fifty boats with the Danish seine exploit the transparent goby. Their mean tonnage is 6.5 TSL and the power is 93 HP (68 kW).

Fishing time
This fishing activity is practised in wintertime, between November and March.

Fishing equipment
The small surrounding net without purseline (Danish seine or sciabica) can reach 60 m for each wing and a vertical opening of 10 m. The mesh sizes are bigger in the sides (200mm) and progressively reduced towards the codend. The codend is a hexagonal meshes tulle with 3-4mm stretched size. Being the catch composed almost exclusively by *Aphia*, the use of any separation device is unnecessary.

Deck layout
Information missing

Electronic equipment
Fishermen, in general, do not utilise any electronic equipment in order to localise the schools near the bottom.

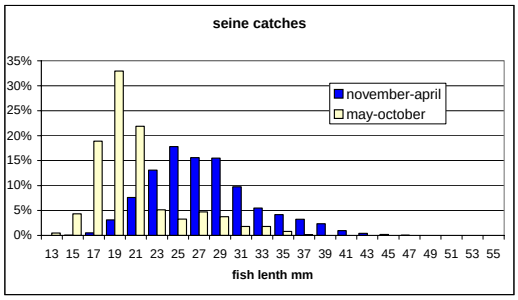
Data on catch
The landings are quite variable during each season and range between 10000-25000 kg/year. The individuals caught with the sciabica are between 20-40 mm.

Catch and effort time series for Danish seine in Tuscany

(Incomplete data for the 1998-99 season.)

Fishing seasons	1990-91	1991-92	1992-93	1993-94	1994-95	1995-96	1996-97	1997-98	1998-99
november	0	1309	394	4725	1617	4553	2548	3331	7721
december	4011	11564	11129	4953	3595	4763	4426	1810	5576
january	16439	9986	13439	1822	2390	5663	7694	5399	2507
february	3739	1869	2800	3023	1394	5084	3459	1927	1425
march	1106	549	829	913	43	3420	2209	371	
april	0	0	74	30	55	0	1074	0	
Total catch (kg)	**25295**	**25275**	**28665**	**15465**	**9093**	**23483**	**21409**	**12838**	**17229**
fishing days	765	954	1120	1056	917	1169	1394	827	817
fishing boats	38	41	45	48	44	48	48	51	48
CPUE = kg/day	**33.1**	**26.5**	**25.6**	**14.6**	**9.9**	**20.1**	**15.4**	**15.5**	**21.1**
CPUE = kg/boat	**666**	**616**	**637**	**322**	**207**	**489**	**446**	**252**	**359**
CPUE = kg/boat	**666**	**616**	**637**	**322**	**207**	**489**	**446**	**252**	**359**

The figure shows the size composition of the *Aphia* individuals caught by Danish seines.



Size distribution of the catch of Aphia by Danish seine, during the fishing season (blue) and during other periods of the year

The by-catch of the Danish seine is in general negligible, mainly due to the procedure of searching of schools (*Aphia* schools show a very characteristic shape) and to the fishing method. However, a reduced number of individuals of several species can be found in the catch.

Technical interactions with other fisheries

The impact of the *Aphia* fishery by Danish seine on early stages of development of many species of clupeids and sparids of commercial interest, living close to the shore and potentially vulnerable by these fishing strategies, is negligible.

Danish seine by-catch is in general modest, and mainly consists of some small individuals of the gurnard (*Lepidotrigla cavillone*), mantis shrimp (*Squilla mantis*), squids (*Loligo vulgaris*), anchovies (*Engraulis encrasicolus*) of size over 10 cm, small sea breams (*Pagellus erythrinus*) with size ranging between 3 and 9 cm.

In conclusion, Danish seine fishery doesn't produce any negative impact either on the resource (a relatively light level of exploitation of the species has been estimated) or on the accompanying species and environment.

Special features

Relationships between fishing effort, fishing mortality, catch rates
There is evidence that the recruitment timing is highly variable from year to year with different micro cohorts whose relative importance and timing are crucial for the success of the subsequent harvest. It was possible to construct a dynamic population model, which simulate growth, mortality and fisheries catch assuming different recruitment patterns.
When the main recruitment occurs too early, by the time of the fishing season opening (November) the individuals are grown over the aggregate phase (15-35 mm) and they are no more vulnerable to the Danish seine. On the other hand, when the main recruitment occurs later, the legal fishing season corresponds to the massive presence of individual with the optimal size range and the harvest will be higher.
In any case, an amount of catch of less than a half of the mean standing stock as normally occurs, combined with a policy of fixed number of licenses, seems to be enough to ensure the stock maintenance.

FISHERY 2 - INSHORE BOTTOM TRAWL FOR TRANSPARENT GOBY

General
The transparent goby *Aphia minuta* is a small fish with a maximum size of about 6 cm that constitutes a very important resource in the local artisanal fishery because of its high commercial value.

Fishing grounds
This fishery generally operates inside the 3 miles strip where trawling operations are forbidden and that constitutes the traditional exploited ground by the small-scale fishers.
The use of this technique mainly occurs at depths between 5 and 20 m, on muddy-sandy bottoms. and perform several trials in order to determine where the schools are more concentrated. Tows last for approximately 30 min.
In the codend ("*sacco*"), only the individuals of several species of bigger sizes remain, while in the 1st cover, the smallest and the most part of the *Aphia minuta* pass through the meshes and remain retained in the 2nd and more external cover ("*fine*"). The proportion in weight of *Aphia*, compared to the total catch, is in general reduced. The number of vessels that utilise *Aphia* trawl net is now very limited, 13 in 1995, 7 in 1997-99. Over the last years, only 3 or 4 vessels continue to target *Aphia* with this technique in the Viareggio area. This represents 40-50 days fishing by month.

The fleet
The rossetto bottom trawl net is mainly utilised in the Viareggio Maritime Division. In the last years, only a very reduced number of vessels fished on *Aphia* (in the fishery season 1994-1995 around 15 vessels were operative and only 4 in the season 2002-2003).
The operating vessels number changes depending on the availability of the resources, considering the profitability of the seining in relation with the use of entangling techniques targeting alternative resources. Trawlers have a mean TSL of 7.5 and 100 HP

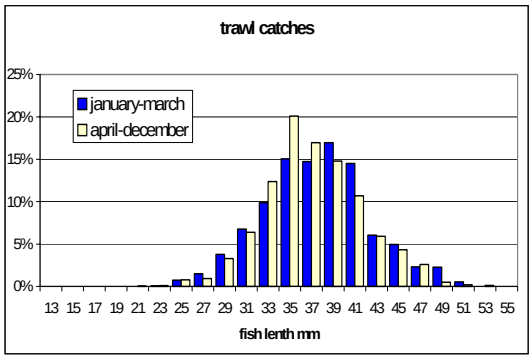
Fishing time
From January to March

Fishing equipment
The **bottom trawl net** is of small dimensions and is composed by a codend of 12 mm of mesh size with two covers, the more internal one with 8 mm stretched mesh and the more external with meshes of 4mm. They are conventionally called *sacco,* cover e fine respectively. *Aphia* remains retained mainly in the more external fine meshed cover. In this way it is not necessary an excessive manipulation of the catch that should reduce the quality of the product.

Deck layout

Electronic equipment
Fishermen, in general, do not utilise any electronic equipment to localise the schools near the bottom.

Data on catch
Official statistics have shown that up to 1995, trawlers landed about 1000 to 1500 kg of *Aphia* each year. This is probably an underestimate of the true landings. Anyhow, during the last years, the number of vessels targeting *Aphia* was drastically reduced and consequently the landings that can be estimated in 500 kg. In the present season, only 3 or 4 vessels exploit *Aphia minuta* with bottom trawl nets. The yields are very variable, with a mean catch of 12 kg per day. The size range of the *Aphia* catch with this technique is between 30-50 mm.



Size distribution of the catch of Aphia during the fishing season (blue) and during other periods of the year obtained with trawl nets

Trawling with *Aphia* trawl net is multispecific. In particular in the cod end and first cover, individuals of many species of different sizes remain retained, but mostly small-sized individuals, due to the fact that this fishery exerts its fishing pressure on shallow waters.
The presence and relative amount of the different species may vary along the year depending on the recruitment schedules of each single species, considering that the coastal strip, where fishing activity is performed, represents the main nursery area for many species (Triglidae, Sparidae, etc). *Aphia minuta* always represent a very reduced portion of the catch in weight.

Technical interactions with other fisheries
As regards the impact of the *Aphia* fisheries on early stages of development of many species of clupeoids and sparids of commercial interest that live close to the shore and potentially vulnerable to these fishing strategies. The fishery with the *Aphia* trawl net clearly have a major impact on other species' mortality, but many times is only modest, due to differences in time schedules of *Aphia minuta* fishing season and recruitment of each single species. This happens for instance for *Alosa falax* and *Sardinella aurita*, and partially for *Sardina*

pilchardus and Engraulis encrasicolus. Trawling may produce a not easy to quantify impact on the *Posidonia* beds that are present close to the shore at depths between 10 and 30 m where *Aphia* trawling fleet operates. Any negative impact on these benthic phanerogams can be hypothesised if the Danish seine is utilised.
Moreover, trawling has a negative impact on several species that are very concentrated near shore. This negative impact, however, is not as important as potentially could be because of the lacking of coincidence between fishing activity and recruitment time schedules. The negative impact should grow in case the fishery extends its activity all along the year, but this hypothesis is not sustainable because *Aphia minuta* is not available for this fishery in other seasons. The impact is also reduced due to the modest number of fishing vessels that currently exploit the transparent goby grounds with trawl nets.

Special features

Relationships between fishing effort, fishing mortality, catch rates
From 35 to 50 mm the transparent goby starts its strictly "*demersal phase*" and it is fished with the trawl net; in this period, spawning occurs and then a massive death, probably because of reproductive stress. The species whole life cycle is about one year long.

FISHERY 3 - DANISH SEINE AND SURROUNDING NET WITHOUT PURSE LINE FOR SARDINE FISH FRY (BIANCHETTO) AND TRANSPARENT GOBY (ROSSETTO)

General
This fishery takes place in Liguria. Moreover there is also a fishery for sand eel with the same fishing gear of sardine and transparent goby.

Fleet
About 80 boats in 1997, smaller than 10 GRT and 150 HP in engine power practise this fishery..

Fishing time over a year
60 days per year between January and April.

Fishing equipment
Minimum stretched mesh size is 5 mm.

Special feature
Annual tax for the licence

Data on catch
95% sardine and transparent goby.

GSA 10 –SOUTHERN TYRRHENIAN SEA

FISHERY 1 - DANISH SEINE AND SURROUNDING NET WITHOUT PURSE LINE FOR SARDINE FISH FRY (BIANCHETTO)

No information available to this WG.

GSA 17- NORTHERN AND CENTRAL ADRIATIC

FISHERY 1 - INSHORE BOTTOM TRAWL FOR TRANSPARENT GOBY

Fleet
In 1997, the fleet consisted of twenty boats, smaller than 10 GRT and 150 HP in engine power.

Fishing time over a year
60 days per year between January and April.

Fishing equipment
Bottom trawls with a minimum stretched mesh size of 5 mm.

Special feature
Annual tax for the licence.

Data on catch
95% sardine and transparent goby.

FISHERY 2 - BOTTOM TRAWLING IN WESTERN ADRIATIC INSIDE THE 3 MILES ZONE

General
Small trawlers, registered in 5 maritime compartments (Monfalcone, Venezia, Chioggia, Ravenna and Rimini) with engine power lesser than 150 HP and tonnage lesser than 10 GRT are allowed to operate from November to March, in coastal waters, with a mesh size bigger than 12 mm.
Such allowance is justified by the presence, in coastal waters, in wintertime, of a number of adult species of *Atherina boyeri, Arnoglossus laterna, different gobidae, Sepiola spp, Alloteuthis media* etc.
The absence or very low captures of shared stocks and young of commercial species is the biological support to maintain this fishery.

Fleet
528 boats in 1997, smaller than 10 GRT and 150 HP in engine power.

Fishing time over a year
November to March

Fishing equipment
Bottom trawls, minimum mesh size is 12 mm stretched.

Special feature
Annual tax for the licence and compulsory catch declaration

Data on catch
Sand smelt, scaldfish, little squid, small gobies.

FISHERY 3 - BOTTOM TRAWLING CUTTLEFISH IN WESTERN ADRIATIC INSIDE THE 3 MILES ZONE

General
Small trawlers, registered in 5 maritime compartments (Monfalcone, Venezia, Chioggia, Ravenna and Rimini)

Fleet
528 boats in 1997, smaller than 10 tons GRT and 150 HP in engine power.

Fishing time over a year
April to half June

Fishing equipment
Bottom trawls, minimum stretched mesh size 40 mm.

Special feature
Annual tax for the licence and compulsory catch declaration.

Data on catch
Cuttlefish, scaldfish, little squid, small gobies.

FISHERY 4 - MANUAL SEINE FOR JUVENILES FOR AQUACULTURE

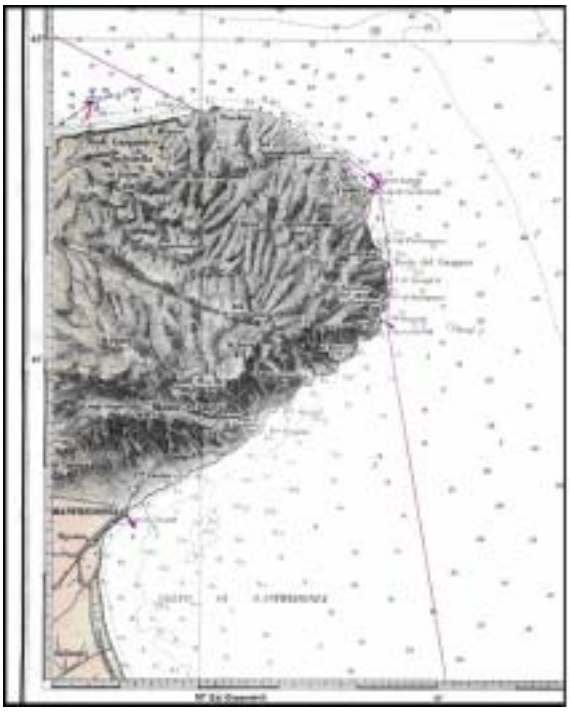
General
About 1000 people coming mainly from north western Adriatic collect juvenile fish from all over Italy to provide extensive aquaculture plants of new fish. Main species collected are mullets, eel and sea bass and sea bream.
A similar procedure, without a net, is in place for the collection of bivalve juveniles.

GSA 18 – SOUTHERN ADRIATIC

FISHERY 1 - INSHORE BOTTOM TRAWL FOR TRANSPARENT GOBY AND SARDINE FRY

General
Transparent goby and sardine fry fishery by means of towed gear exploits soft bottoms in the Gulf of Manfredonia (GSA 18) mostly from 8 m up to 15-20 m depths (*Ungaro et al., 1994;*

Casavola et al., 1999). The commercial catches mainly consist (> than 90%) of A. minuta and sardine fry specimens although low quantities of other species are also captured.



Bottom exploited by transparent goby and sardine fry fishery

Fishing fleet

The fishery is concentrated in the maritime department of Manfredonia. Actually the approx. number of authorised vessels is 150, but a decrease is planned for the next times.
The vessels are smaller than 10 GRT and their engine power is lesser than 110 kW.

Fishing time over a year

The fishery is authorised and carried out during wintertime for a period of 60 days between January and April but the effective number of operative days is lower.

Fishing equipment

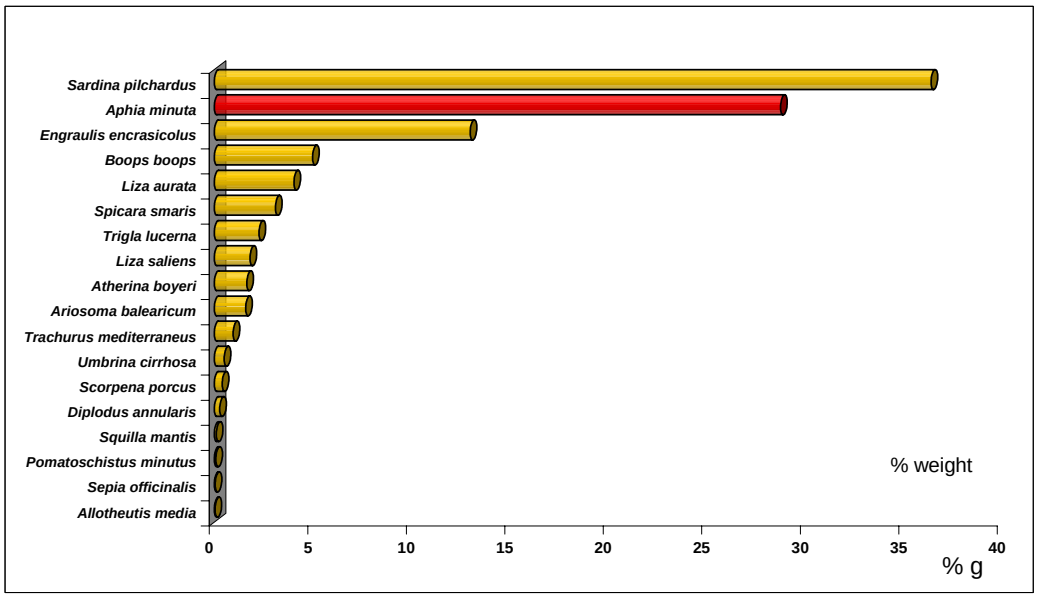
Two different towed gears are used. The first one is the "Italian" otter trawl; the second is a high vertical opening otter trawl. Both the gears are provided with a cover – cod end system. The mesh size at the cod-end is 40 mm (stretched) as a rule, while the mesh size at the cover is 5 mm. Target species, transparent goby and sardine fry, are mostly collected in the cover and by-catches are usually retained in the cod end. The main features of the utilised nets (length, doors etc.) correspond to the gears used in bottom trawl mixed fishery as a rule.

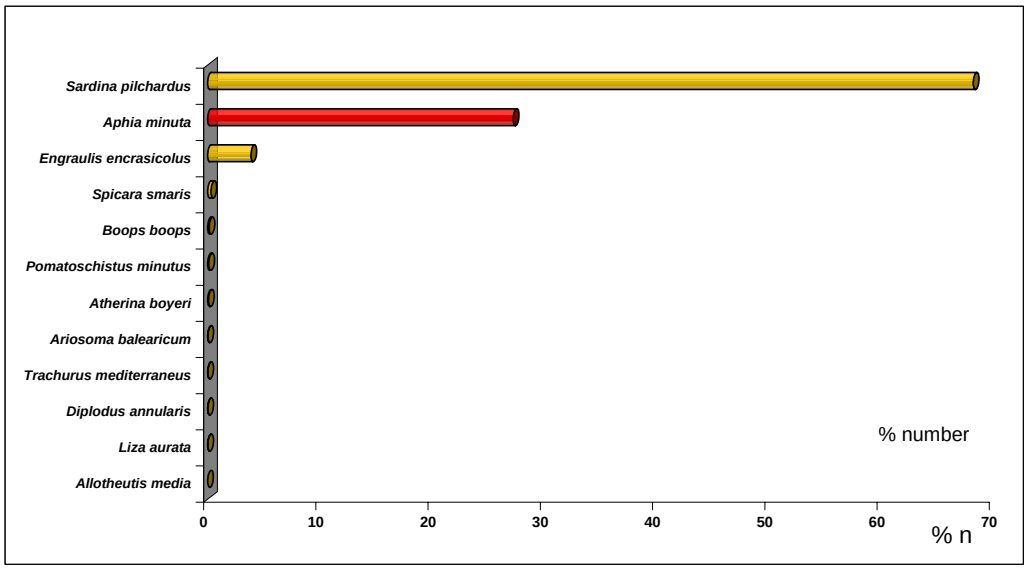
Deck layout and machinery involved

Although both the fishing nets are actually used, in the last ten years the shift from the traditional otter trawl net to the high vertical opening trawl was recorded. No significant changes occurred regarding the machinery involved in the activity.

Electronic equipment
The increasing use of GPS didn't produce remarkable modification in the distribution and availability of fishing grounds in the last 10 years.

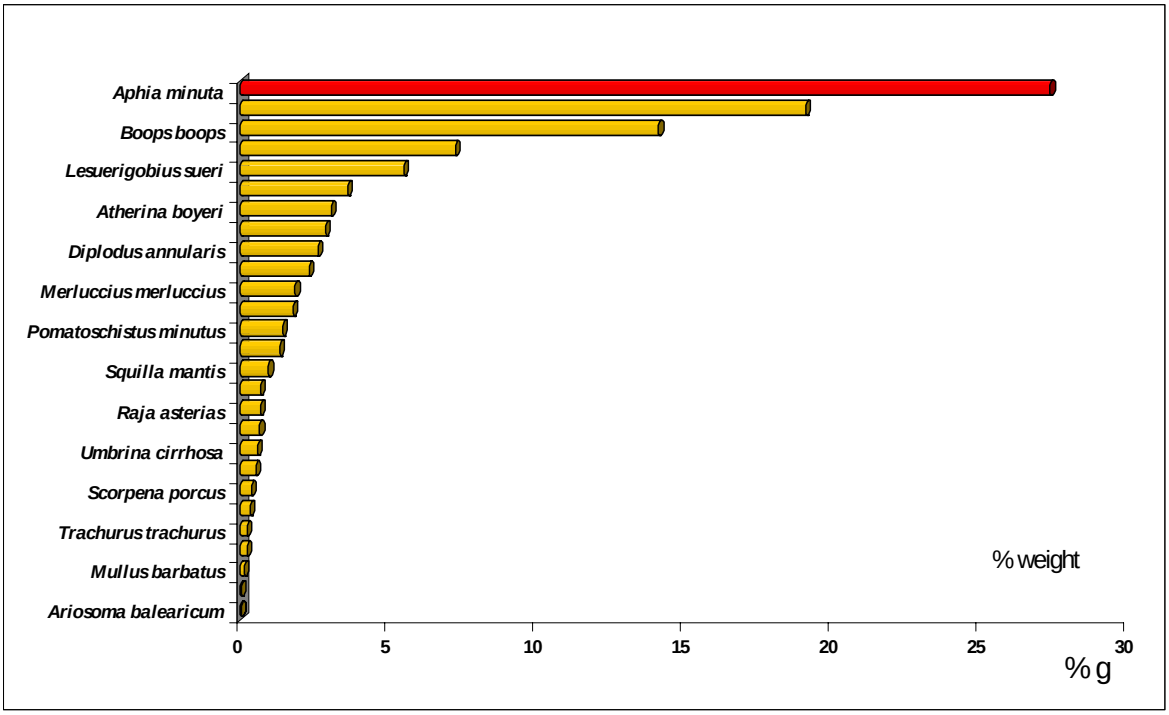
Catch data.
Transparent goby and sardine fry fishery by means of towed gears could be considered as semi-selective activity.

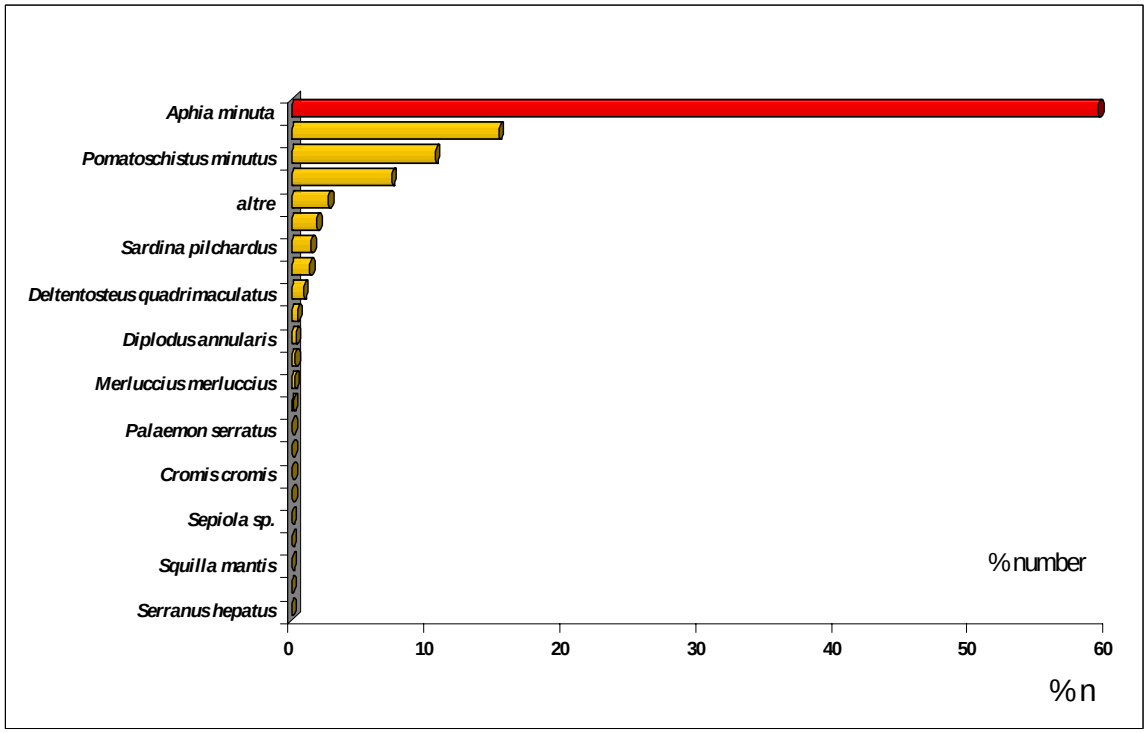




Percentage in weight and number from high vertical opening trawl net catches (cover + cod-end) (*Ungaro, unpubl. Data*).

In fact, most of the catches consist of the target species (more than 50% in weight and 75% in number of individuals considering both the cover and cod-end retained species) although other species are collected also. Preliminary analysis shows the high vertical opening trawl net more selective compared with the traditional otter trawl.





Percentage in weight and number from Italian otter trawl catches (cover + cod-end) (*Ungaro, unpubl. Data*).

***Main by catch species from A. minuta fishery*.**

Allotheutis media	Little squid
Arnoglossus spp.	Scaldfish nei
Boops boops	Bogue
Deltentosteus quadrimaculatus	Four spotted goby
Diplodus annularis	Annular seabream
Engraulis encrasicolus	European anchovy
Gobius niger jozo	Black goby
Lesuerigobius suerii	Goby
Liza spp.	Grey mullets
Merluccius merluccius	European hake
Mullus barbatus	Red mullet
Pomatoschistus sp.	Sand goby
Sardina pilchardus	European pilchard
Sepiola sp.	Lesser cuttlefish
Spicara spp.	Picarels
Squilla mantis	Mantis squillid
Trigla lucerna	Tub gurnard

Technical interactions
No technical interaction with other fisheries occurs.

Special features
The fishery is currently operating under the derogation allowed by the Italian Presidential Decree 1639/68. An annual tax for the licence and compulsory records of catches are needed.

Relation between fishing effort, fishing capacity and fishing mortality
No relationship between fishing effort and transparent goby / sardine stocks have been pointed out.

GSA 19 –WESTERN IONIAN SEA

FISHERY 1 - DANISH SEINE AND SURROUNDING NET WITHOUT PURSE LINE FOR SARDINE FISH FRY (BIANCHETTO) and BEACH SEINE FOR SARDINE FISH FRY (BIANCHETTO)

This fishery takes place in Calabria and Sicily but no data on Sicily available to this WG.

Fleet
About 130 boats in 1997, of these about 70 using beach seine, smaller than 10 GRT and 150 HP in engine power.

Fishing time over a year
60 days per year between January and April

Fishing equipment
Minimum mesh size is 5 mm stretched.

Special feature
Annual tax for the licence

Data on catch
95% sardine and transparent goby.

FISHERY 2 - BEACH SEINE

General
The fleet consists of 70 unpowered small boats using beach seine in Calabria, all the year around with a mesh size of 40mm.

SOUTHERN ITALIAN SEAS

FISHERY 1 – SURFACE GILL NET FOR SWORDFISH AND ALBACORE

General
The fishing grounds for this fishery are traditionally in the Southern Tyrrhenian sea (around the Pontine islands, Ustica island, off Capri and Ischia Islands, off the Eolian islands, off the coasts of Campania, Basilicata and Calabria, Northern Sicilian coast) and off the Sicilian and Calabria Ionian coasts.
Other fishing grounds are off the Northern African coast and around the island of Crete, for the few vessels engaged in the distant offshore fishery.
The fishing season is traditionally from late April (or the beginning of May) to August, with small variations from year to year, according to the environmental and oceanographic conditions.
The fishing trips are usually very short, more often with daily trips. A small part of the fleet has fishing trips ranging from 1 to 5 days, while only a few vessels have been engaged in distant offshore fishery, staying far from the home harbour for long period, but landing the fishes in various harbours, because of the limited storage capacity.

Fleet
The surface gillnet fleet in the area at the beginning of the ‘90s consisted of about 500 vessels (*Di Natale at al., 1992*). Then, after the adoption of the Italian plan to reconvert the driftnet fleet, the total number gradually decreased to about 100 till the enforcement of the EC driftnet ban on 1st January 2002.
Most of the fleet is engaged only in the swordfish fishery, but a smaller portion target the albacore. Some vessels target both species, either by changing the gear at a certain time of the fishing season or by using a mixed net (for albacore on both terminal sides and for swordfish in the middle).
The overall length of the vessels ranges from 7 to over 30 m. The fleet was traditionally made of wood, but in the last 10 years several vessels were made of fibreglass or steel, often replacing older dismissed vessels.
All the vessels have a multi-purpose licence but, in the reality, only a part of this fleet practises an opportunistic fishery with other gears at the end of the main fishing season.

Fishing equipment

The gear used for swordfish surface gillnet fishing is traditionally a net with stretched mesh size between 280 to 520 mm (Rtex 500 to 1100), even though the most used was about 420 mm. The net length is usually between 7 and 9 km and high between 28 to 32 m, but the real high in water is about 14 metres, due to the typical behaviour of the fishing gear and the hanging ratio. Each net presents different feature characteristics given by the individual fisherman. This net is able to catch the species either by entanglement and, more rarely, by gilling.

The gear used for albacore surface gillnet fishing is traditionally a net having stretched mesh size between 180 to 240 mm (Rtex 300 to 600). The net length was usually between 3 and 9 km. The net is usually high between 20 to 24 m, but the real height is more than the swordfish net, due to the typical behaviour of the fishing gear and the hanging ratio.

Deck-layout

The deck is equipped with a net hauler placed on the back, or along the side or, more rarely, forehead. Sometimes there is also a small hold for ice.

Electronic equipment

The fishing equipment is usually reduced to a minimum, with a GPS and sometimes an echo sounder. Larger vessels are much more equipped by long distance radars and other electronic devices.

Data on catch

Several data have been reported to ICCAT in the past about this fishery. Catches reached peaks of over 12000 t of swordfish and 6000 t of albacore in the ‘90s. The last published data specifically referred to this fishery and this area in the years 1994 and 1995 are provided by *Di Natale et al.* (1998). The swordfish catches in surface gillnet fishery were 2396 t and 6543 t respectively, with an average length of 128,7 cm and 130,8 cm LJFL respectively and an average weight of 27.5 kg and 26.5 kg GG respectively. The albacore catches in surface gillnet fishery were 759 t and 1027 t respectively, with an average length of 72 cm and 76,5 cm FL respectively.

According to observers’ data (*Di Natale et al., 1996*), the commercial fraction of the catch is, in average, 83.05% in number and 65.07% in weight of the total catch. Most of the non commercial fraction (like the sunfish, *Mola mola*, and the loggerhead turtle, *Caretta caretta*) is released still alive at sea.

As concerns CPUE series, one of the most relevant is from the harbour of Ponza (central Tyrrhenian sea), while other shorter series are available for the harbours of Lipari and S. Agata Militello (Southern Tyrrhenian Sea).

In Ponza, where the CPUE time series is more consistent, the trend is more or less flat, with yearly variations, till 1999, then showing a relevant increase in all the parameters taken into consideration (mean swordfish length and weight, CPUE and CPU for swordfish, CPUE and CPU for total commercial catch). This is probably due to a higher availability of the target species and most favourable environmental conditions.

Some of the most relevant catch parameters from the swordfish driftnet fishery in the harbour of Ponza (central Tyrrhenian sea).

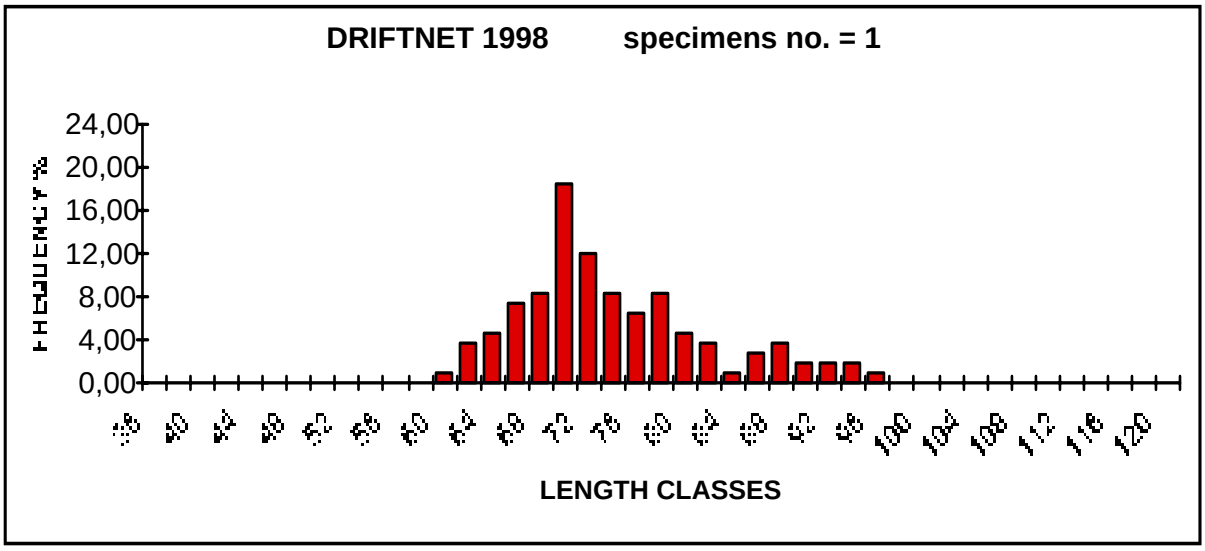
YEAR	no. fishing days controlled	SWO mean LJFL	SWO mean weight	CPUE swo (kg/km)	CPU swo (kg/v/day)	Total CPUE (kg/km)	Total CPUE (kg/v/day)
1990	29	123,75	26,69	13,06	168,85	14,11	182,41
1991	54	135,22	31,51	11,44	79,47	13,14	91,29
1992	61	137,42	34,10	20,39	177,43	22,64	196,95
1993							
1994	100	127,64	25,25	15,45	115,88	16,78	125,83
1995	92	128,84	24,44	17,15	176,94	18,64	192,31
1996	80	130,57	26,66	13,81	124,22	16,58	149,11
1997	71	133,98	29,21	19,33	162,96	21,64	182,51
1998	66	131,05	26,94	12,44	116,96	14,15	133,05
1999	74	124,20	23,34	13,12	137,44	14,30	149,85
2000	80	133,91	28,74	18,06	188,19	20,28	211,30
2001	65	138,46	29,61	17,62	189,84	19,59	211,05

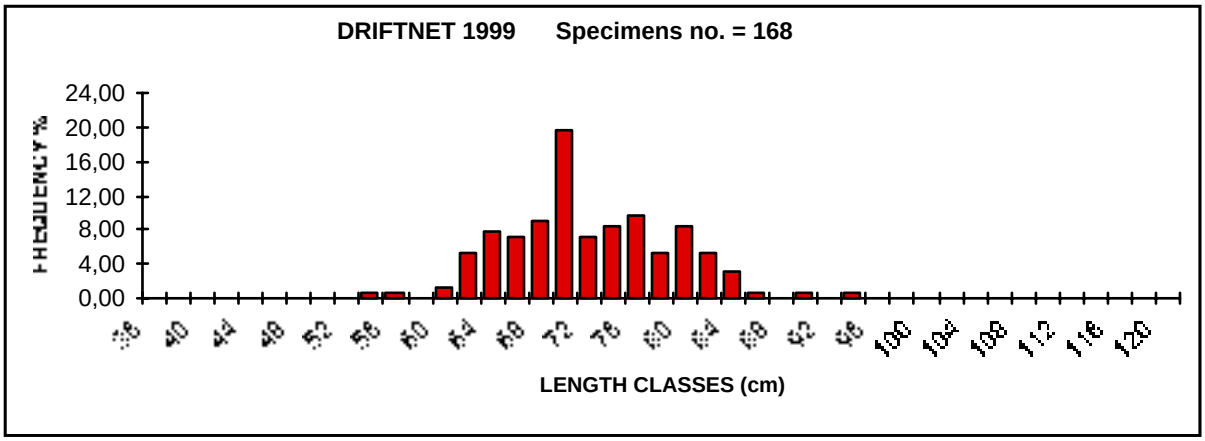
Trends are not easily detectable in the CPUE time series in other harbours, because data shows relevant variations from year to year.

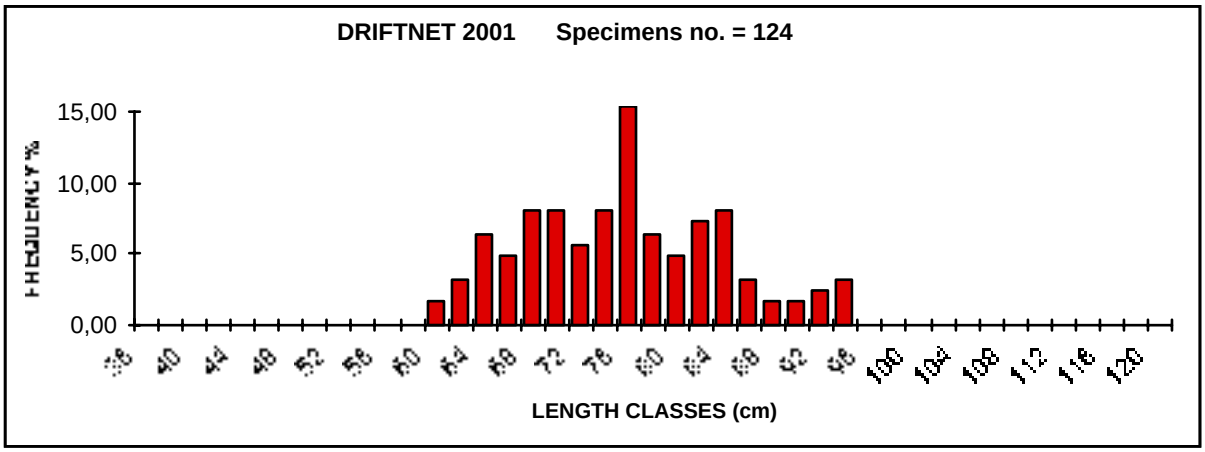
CPUE (in kg) data from the driftnet fishery in several harbours in the Southern Tyrrhenian sea

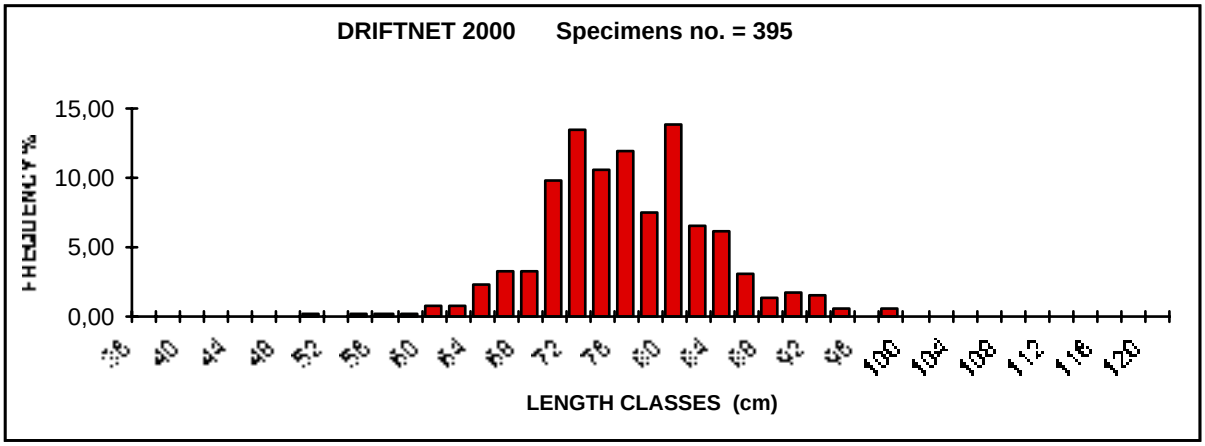
HARBOUR	TYPE	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
VIBO MARINA	SWO	6,6									
BAGNARA CALABRA	SWO+ALB	4,7	3,7								
LIPARI	SWO		8,1				6,974	10,22	11,98		9,09
LIPARI	ALB								0,50		1,41
S.AGATA MILIT.	SWO	6,7	13				4,201	9,83	9,21	10,87	8,87

The most recent data on albacore from the surface gillnet fishery in the Tyrrhenian sea, have been reported by *Di Natale et al. (2002).* The related graphs are herewith reported.









Catches of bluefin tuna with pelagic gillnets are negligible in the Southern Italian seas, because this species is a by-catch. In the past, there was a specific coastal driftnet fishery target on juvenile bluefin tunas and, even if the CPUE were relevant (particularly in number) the total catch was not important.

Technical interactions

According to *Di Natale et al.* (1992), the surface gillnets used in the large pelagic fisheries are reported to create some interactions with commercial navigation and with the sailing leisure vessels. Interactions with other types of fishing gears (longlines and trawlers) were only rarely reported.

Special features

According to the European regulation, the driftnets for large pelagic species have been banned from 1st January 2002. Gillnets must be rigged with an anchor system.

Relationships between fishing effort, fishing mortality, catch

The swordfish catches obtained by surface gillnets are always bigger in mean size (both length and weight) compared to the longline catches in the same areas ((*Di Natale et al., 1996*).

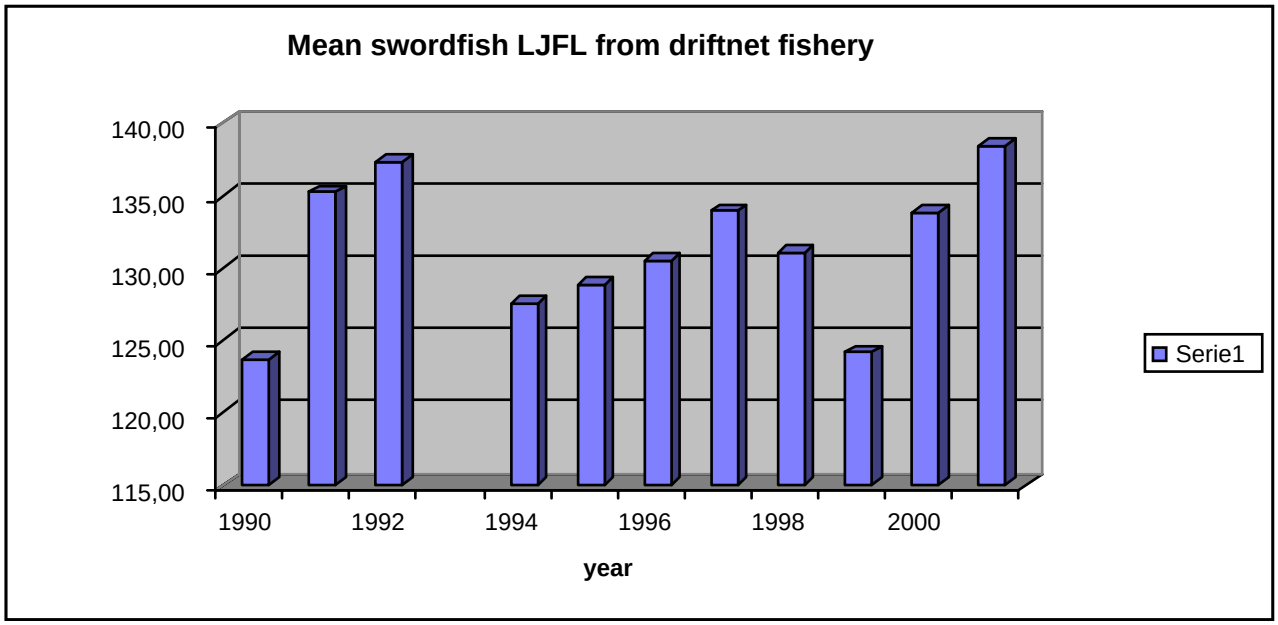
As concerns the possible relationships between the fishing effort, fishing mortality and catch, the situation is really very unclear in surface gillnets used for large pelagic species. Despite the fact that a logical decrease was forecasted after the great effort applied at the end of the '80s and the beginning of the 90's, the reliable data collected in several harbours revealed a different reality, particularly related to the main target species, the swordfish (*Xiphias gladius*).

After a comprehensive analysis carried out on Italian and Greek data (EC projects 98/034 and 99/032) it was clear that there was a stable long-time trend in all the parameters, apparently independent from the variation of the effort applied. The average length of the target species had little yearly variations and, in the last two years, even an increase.

Looking at the data, joined with all the other data coming from other fishing gears, it was clear a sort of balancing movement, with a higher CPUE in the Southern Italian basins when there was a lower CPUE result in Greece and vice versa. It has been considered that this fact was probably linked to different oceanographic conditions in the different years, able to affect the concentration of the fish resource in one area or the other. Furthermore, in all the years taken into consideration, a strong recruitment was always reported.

The international community has considered these data with some reserves at the beginning but, after the assessment of the Mediterranean swordfish stock carried out by the ICCAT/GFCM group, including even the Spanish data series, they were confirmed and accepted.

As a matter of fact, the Mediterranean swordfish population appears almost stable in the last 20 years (even if the average length in catches is very low).



Average LJFL from the driftnet fishery in the harbour of Ponza over the last 12 years

The same situation exists for the albacore (*Thunnus alalunga*), because the population appears almost stable in the long period, with a few variation from year to year and without showing particular trends. An assessment of the Mediterranean albacore has never been tried.

GREECE

GSA 20, 22, 23 - IONIAN, AEGEAN AND CRETAN SEA

FISHERY 1 - BOAT SEINING

Fleet

The fishing fleet allowed to operate beach seine fishing in Greece consists of 430 vessels according to the data of the Ministry of Agriculture. The fishing capacity of the fleet is 2,820 GT and 26,123 kW corresponding to 3.4% and 4.8% (approximately) of the total tonnage and engine power of the Greek fishing fleet, respectively. The average tonnage is about 6.5 GT, the average power 61 kW and the mean boat length 10 m. The average values of tonnage, engine power and length for the three GSA areas, are presented in the following table. In the Aegean Sea, the majority of the vessels are operating in Central and South Aegean Sea. Southern of the line connecting Lesvos Island and Pagassitikos Gulf there are registered about 10% only.

AREA	NO. OF VESSELS	LENGTH (m)	GT (mean)	kW (mean)
GSA 20 Eastern Ionian Sea	108	9.5	5.1	54.1
GSA 22 Aegean Sea	316	10.2	7.6	62.8
GSA 23 Cretan Sea	6	9.7	5.4	71.3

Fishing equipment

The netting of the commercial boat seine operating in Greek waters consists of four main sections: the cod end, the bag, the shoulders and the wings. The total net length ranges from 200 m to 440 m (stretched) and the circumference of the mouth opening from 58 m to 135 m (stretched). The depth of the gear is closely related to the slope of the shelf in the fishing area, the target species and the number of hauling ropes that are used. The bag is the central part of the net. It is 12-43 m long and the netting stretched mesh size is 18-28 mm. It consists of 8-16 rectangular pieces of netting of the same mesh size and twine thickness. The rearmost part of the bag, the codend, is 1.8 m to 2 m long and the netting stretched mesh size is 16-20 mm. Shoulders are made of two half sections. The length of the shoulders varies from 10.8 m to 42 m and the stretched mesh size from 22 mm to 60 mm. They consist of 2-10 rectangular pieces of netting with different mesh sizes and twine thickness. The wings are the longest part of the net representing 72- 91% of the total length of the gear. They are also made of two half sections. They have a length of 144 m to 400 m and a stretched mesh size of 600 mm to 1200 mm. A strengthening piece of enforced netting, in the wings and shoulders, is used to join the main netting to the headline and the ground rope. A spreader is used at the end of each wing to attach the netting to the ropes. The headline and ground rope are made of braided PA or PP rope and have a thickness of 6-12 mm and a length of 400-500 m. The rigging of the gear is very much related to both the targeting species and the geomorphology of the fishing area. Oval and cylindrical floats are usually used in headline for buoyancy and leads in ground rope for weighing down, which progressively increase from wings to bag. The weight ranges from 200 to 400 g/m. There are 2-12 hauling ropes on each side of the net that define the circumference of the enclosed area. No doors are used for the operation of the gear.

Fishing time over a year

The activity of the boat seine depends in a great extent on the weather conditions. During the fishing period, from 1st October to 31st March (April-September is closed season), their activity never exceed 20 days per month. In particular, from January to March their activity reduces more. According to Armeni-Agiovlassiti and Argyrokastritis (1997) in Saronikos Gulf the average days at sea per month was 18.3, in Cyclades Islands was 15 and in the Ionian Sea 14 during 1994-1995. Besides the weather, another limiting factor for the operation of the gear is the geomorphology of the fishing area. Beach seine cannot operate in rocky bottom as the twine thickness of the netting in shoulders, in bag and in cod end is small (210/3-210/9 Denier) and the net can be very easily damaged. Moreover, it cannot operate in areas with extended continental shelf because the inclination of the bottom is not sufficient for the proper function of the gear (this is the main reason for the total absence of the beach seines in the coasts of Thracian Sea).

Deck layout and machinery involved

Usually the gear is hauled by a mechanical winch.

Electronic equipment

Generally, the boat seine vessels are small and not well equipped. All of them carry bythometers.

Data on catches

Data presented below comes from a study for the evaluation of the consequences of the prohibition of the beach seine fishery in Greece. During the project, observer-based estimates of the quantities of discarded and retained catches from the commercial boat seine in three areas: Ionian Sea, Cyclades Islands and Pagassitikos Gulf, were made (Petrakis et al., 2001a). Additional data for Saronikos Gulf and Cyclades Islands, comes from a research project carried out by the Fisheries Laboratory of Ministry of Agriculture in the frame of PESCA project (1998-2001) and for Thracian Sea (Lefkaditou & Adamidou, 1997) and from the working group on the "Evaluation of the consequences of the prohibition of the beach seine fishery in Greece, under the auspices of the Ministry of Agriculture (Anon., 2001). Concerning the catch composition of beach seines, the target species vary between the different fishing areas. Thus, in Ionian Sea as target species could be considered *S. smaris* and *L. vulgaris*, in Saronikos Gulf, *S. smaris* and *B. boops*, in Cyclades Islands, *B. boops, S. smaris* and *S. pilchardus*, in Pagassitikos Gulf, *P. erythrinus, S. flexuosa, S. smaris, S. pilchardus* and *T. mediterraneus* and in Thracian Sea *S. pilchardus, L. vulgaris, B. boops* and *S. smaris*.

In Saronikos Gulf, *S. smaris, B. boops, P. erythrinus* and *M. barbatus* were the most important species, consisting 30.1%, 10.2%, 6.0% and 4.8% of the total catch (by weight) respectively. In Cyclades Islands, *B. boops, S. pilchardus, S. smaris, Atherina hepsetus, and Coris julis* consisted 91% of the total catch by number. More abundant was *B. boops* participating with 50.9%, whereas *S. pilchardus* participated with 18.5%. In Ionian Sea, the catch was consisted (in terms of numbers) almost exclusively of *S. smaris* (87.7% of the total catch). *B. boops*, *Chromis chromis* and *C. julis* consisted 4%, 2.6% and 1.2% of the total catch, respectively, whereas *P. erythrinus* only 0.6%. In Pagassitikos Gulf, the catch composition changed between the months. More abundant species, in terms of number, were *S. flexuosa* (23%), *T. mediterraneus* (23%), *S. pilchardus* (16.5), *P. erythrinus* (12.2%) and *S. smaris* (7.3%).

In Thracian Sea, pelagic species such as *S. pilchardus, E. encrasicholus* and *T. mediterraneus* dominated the catch as they represented more than the half of the catch in terms of density

(N/km^2). Considerable is also the contribution of M. *barbatus* (7.5%), *S. flexuosa* (6.6%), *B. boops* (5.2%), *S. salpa* (3.4%), *S. cantharus* (3.2%), *P. erythrinus* (3.1%) and *D. vulgaris* (2.2%). In terms of biomass (kg/km^2) there is also dominance of the pelagic species that hold over 25% of the total catch. However significant contribution to the catch has *S. salpa* (20.7%). Important is also the proportion of *P. erythrinus* (5.04%), *S. flexuosa* (4.1%) *S. cantharus* (4.1%), *M. barbatus* (3.3%), *L. vulgaris* (3.2%), *B. boops* (2.7%). Minor is the contribution of *M. surmuletus* (1%) and *S. smaris* (0.6%) to the catch.
According to the data of National Statistical Service of Greece, the total catch of boat seine for the most abundant species for the period 1990-2000 (in metric tonnes), and their percentages, are presented in the table below. The following data cannot be considered as accurate.

Landings and % of boat seine catches during 1990-2000 according to NSSG

Landings (ton)	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**
Spicara smaris	3,688.8	3,166.8	1,803.5	2,567.6	8,385.9	2,687.2	2,335.8	1,991.2	1,223.2	2,155.7	1,362.8
Sardina pilchardus	925.7	623.9	927.4	760.5	844.6	869.2	813.5	845.1	413	447.1	923
Boop boops	871.7	538.4	793.9	974.9	1,047.1	923.7	722.4	492	328.7	1234.3	457.4
Trachurus sp.	162.3	394.2	445.6	323.3	391.5	366.8	263.9	192.7	101.9	147.9	219.5
Mullus barbatus	198.5	663.4	88.8	203.7	342.9	240	219.3	131.2	166.6	230.9	146.4
Merluccius merluccius	29.8	70.8	70.8	157.5	393.6	318.1	283.2	217	166	213.5	129.2
Loligo vulgaris	225.8	232.1	171.6	290.2	264,0	261.9	198.5	139,0	88.4	85,0	86.9
Scomber japonicus	47.1	71.9	182.2	447,0	119.3	237.4	393.2	109.6	35.9	82.7	118.3
Spicara flexuosa	90.2	32.4	31.4	152.5	271.7	251,0	304,0	188.8	100.7	104.1	60.7
Others	1,249.5	1,238.8	1,848.4	1,762.1	2,880.4	3,149.6	2,739.4	1,863.6	1,370.2	1,714.1	2,156.4
Landings (%)											
Spicara smaris	49.3	45.0	28.3	33.6	56.1	28.9	28.2	32.3	30.6	33.6	24.1
Sardina pilchardus	12.4	8.9	14.6	10.0	5.7	9.3	9.8	13.7	10.3	7.0	16.3
Boop boops	11.6	7.7	12.5	12.8	7.0	9.9	8.7	8.0	8.2	19.2	8.1
Trachurus sp.	2.2	5.6	7.0	4.2	2.6	3.9	3.2	3.1	2.6	2.3	3.9
Mullus barbatus	2.7	9.4	1.4	2.7	2.3	2.6	2.7	2.1	4.2	3.6	2.6
Merluccius merluccius	0.4	1.0	1.1	2.1	2.6	3.4	3.4	3.5	4.2	3.3	2.3
Loligo vulgaris	3.0	3.3	2.7	3.8	1.8	2.8	2.4	2.3	2.2	1.3	1.5
Scomber japonicus	0.6	1.0	2.9	5.9	0.8	2.6	4.8	1.8	0.9	1.3	2.1
Spicara flexuosa	1.2	0.5	0.5	2.0	1.8	2.7	3.7	3.1	2.5	1.6	1.1
Others	16.7	17.6	29.0	23.1	19.3	33.8	33.1	30.2	34.3	26.7	38.1

In Saronikos Gulf, a time series of data on landings of the main species and on the effort (as days at sea) is provided for the period 1988-1995 (Karlou-Riga et al., 1997). The effort and the landings remained constant during that period. Fluctuations in the amount or in the composition of the landings were attributed mainly to biological reasons (natural changes in abundance) and not to over-fishing problems (especially for *S. smaris*). The landings in Saronikos Gulf were mainly consisted of *S. smaris* (28.4%), *M. barbatus* (19.3%), *P. erythrinus* (13.4%) and Cephalopods (8.5%). The total landings per fishing day ranged from 96 to 166 Kg.

Annual catch (t) of commercial species caught by beach seiner in the Saronikos Gulf and respective number of fishing days during the years 1988-1995

Species	1988	1989	1990	1991	1992	1993	1994	1995
Merluccius merluccius	3	8	2	0	6	0	0	1
Mullus barbatus	143	197	137	185	215	89	111	92
Nephropsnorvegicus	0	0	0	0	0	0	0	0
Penaeus sp.	0	2	1	0	0	0	0	0
Trachurus sp.	51	47	36	31	27	70	10	47
Spicara smaris	371	213	122	123	94	201	315	285
Mullus surmuletus	25	9	5	5	5	1	11	5
Pagellus erythrinus	79	59	38	56	75	169	227	111
Cephalopods	80	97	72	60	45	57	57	47
Others	166	137	127	129	94	314	251	219
Total	918	769	540	589	561	901	982	807
Fishing days	7300	6320	5460	5880	5840	5580	5920	5986

In the Thracian sea, regarding the commercial beach seine landings (*Lefkaditou & Adamidou, 1997*), the pelagic species *S. pilchardus* is the main species (51%), followed by *L. vulgaris* (9.8%), *B. boops* (7.9%), *Octopus vulgaris* (4.5%), *Trachurus sp.* (3.2%) and *S. smaris* (3 %). Significant quantities (> 1% of the total catch) of *S. scombrus, S. japonicus, M. barbatus, S. officinalis, S. salpa, L. mormyrus* and *S. flexuosa* are also caught.

Discards consists a very small proportion of the catch (ranged from 0.04 to 0.17, in terms of weight) in Ionians Sea, Cyclades Islands and Pagassitikos Gulf (*Petrakis et al. 2001a*). The proportion varied between the areas.
The number of the discarded fish of commercial species, was generally low. Analysis of the sizes of retained and discarded individuals red mullet (*Mullus barbatus*), striped red mullet (*M. surmuletus*), common red pandora (*Pagellus erythrinus*) and mediterranean horse mackerel (*Trachurus mediterraneus*), in the boat seine fishery in Greek waters between October 2000 and May 2001 (*Petrakis et al., 2001a*), for which minimum landing size (MLS) restrictions are currently enforced, is presented below.

None or very few individuals of red mullet and striped red mullet were discarded in the three areas. In the Ionian Sea 33% of the retained individuals of both species were undersized (<11 cm), as were 97% of the retained individuals of red mullet and 14% of striped red mullet in Cyclades Islands.

Almost 99% of the discarded individuals of common pandora in the three areas were below the MLS (<12 cm), while 4.8% and 12.6% of undersized individuals were retained in Ionian Sea and Pagassitikos Gulf.

Almost 14% of the retained horse mackerel in Pagassitikos Gulf were undersized (<12 cm), while on the other hand 18% and 53.8% of the discarded individuals were above the MLS in the same area and in Ionian Sea, respectively.

Total, retained and discarded numbers in relation with MLS for the four species, in the boat seine fishery in Greek waters between October 2000 and May 2001

Species		Total		Retained		Discards	
		Number	%< MLS	Number	%< MLS	Number	%< MLS
Cyclades	*Mullus barbatus*	30	96.7	29	96.6	1	100.0
	Mullus surmuletus	528	13.8	528	13.8	-	
	Pagellus erythrinus	214	38.8	130	0.0	84	98.8
	Trachurus mediterraneus	4	75.0	1	0.0	3	100.0
Ionian Sea	*Mullus barbatus*	861	34.4	851	33.6	10	100.0
	Mullus surmuletus	745	34.2	736	33.2	9	100.0
	Pagellus erythrinus	987	44.6	567	4.8	420	98.3
	Trachurus mediterraneus	60	20.0	34	0.0	26	46.2
Pag..Gulf	*Mullus barbatus*	1058	2.3	1058	2.3	-	
	Mullus surmuletus	16	6.3	16	6.3	-	
	Pagellus erythrinus	5785	78.0	1449	12.6	4336	99.8
	Trachurus mediterraneus	10795	17.8	10157	13.8	638	82.0

Technical interaction with other fisheries

The activity of the gear is restricted in a distance of about 1 nautical mile along the coast, only of smooth bottoms and during daylight. Therefore, there is no space competition with bottom trawls or purse seines. Space competition exists with small-scale fisheries, mainly fixed nets, long-lines and fyke nets. Netters and long-liners work mostly on rough substrates and during the night and so the space competition is reduced but for the fyke nets that are usually located in smooth substrates and remain in the sea more than one days, the problem and the conflict between the gears is more serious.

Competition for the resources exists for some species with other gears (e.g. for *S. pilchardus* with purse seine or for *M. barbatus* with trammel net and bottom trawl). The problem is localised mainly in closed gulfs where there are a lot of fishing vessels. The main argument of the coastal fishermen against the operation of the gear is that boat seine is considered to catch juveniles of commercial species.

Special features

According to the Greek Legislation, fishing is closed from April to September included, in all Greek waters and there are more local restrictions. Fishing is allowed from one hour before sunrise until one hour after sunset. The mesh size in the codend is at least 16 mm (full mesh). According to the President's Decree 553/79 and 669/80, new licenses are not issued.

Relationship between fishing effort, fishing mortality and catch rates

FISHERY 2 -PAGELLUS BOGARAVEO GILL NET FISHERY

The fishery of *P. bogaraveo* in Greek waters was carried out since the beginning of 80ties mainly by long lines. Over the last years a gill net fishery has been developed. The first years the catches were extremely high (46 kg/1000 m of netting, whereas for the sole trammel net metier was 9 kg/1000 m of netting) (Petrakis *et al., 1998; 1999*) but very soon the catches declined. According to the fishermen one reason, was the intensive fishing. When they trace down the fish they work on the same place as long as the catches are good. Other important

issues were the introduction of nets and the ghost fishing. The fishing grounds are rough rocky banks at depths from 300 to 600 m and the possibility to lose pieces of netting is high.
As a response to the catch declining, some fishermen quitted the metier and other decreased the mesh size with a number of negative consequences: increased quantities of the discards, lower prices in the market, more pressure on the population, reduction of the spawning stock. The lack of assessment of the stock, of information on the biology of the species (age and growth, reproduction, etc) and the gear effects, is making the introduction of management measures difficult. The *P. bogaraveo* gill net métier in the Ionian Sea has been studied during an EU funding project (00/046).

Fishing ground
The fishing grounds are rough rocky banks at depths from 300 to 600 m.
Fishing time over a year
Each trip lasts 2-4 days, due to the distance of the fishing grounds from the ports. The crew is consisted of 2 up to 3 persons. The average days at sea used to be 156.4 in the past and only 57.3 nowadays.

Deck layout and machinery involved
All the vessels have a hydraulic winch for hauling the nets.

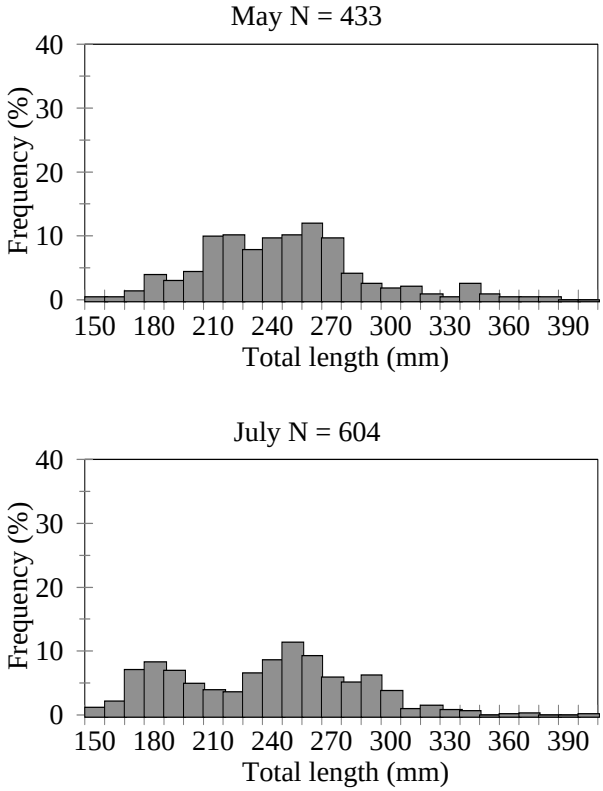
Fleet
The mean length of the vessels fishing the species was 11.2 m and the mean horsepower 134.3 HP. According to the fishermen, their average daily production of the fishery was 65 kg and the average annual production 7,800 kg. The majority of the vessels used to work targeting the species, shifted to other species because the catch declined. During summer 2001 only two vessels were working intensive on *P. bogaraveo*.

Fishing equipment
The fishing practice was to detect the fishing ground using the depth recorder and after to shoot 3-4 pieces of net. Small bags made from net of small mesh size with bait inside, were tied in every 10 m on the footline, in order to attract the fish. The bait was *Sardina pilchardus*.
As the distance from the surface to the bottom is quite long, the fishermen have to estimate the currents in order the nets to arrive at the bottom at the place that they want. This was very difficult. By shooting 4-5 pieces the probability that one of them will fish on the proper ground is increasing. According to this practice, for each piece of net two long pieces of rope (300 m to 700 m) are needed, in order to tie the ends of the net to the buoy. The practical problem that arises is that significant space for storing these ropes is needed. Hauling of the nets took place 4-5 hours later. The length of the nets used per day ranged between 900 and 2,000 fathoms.

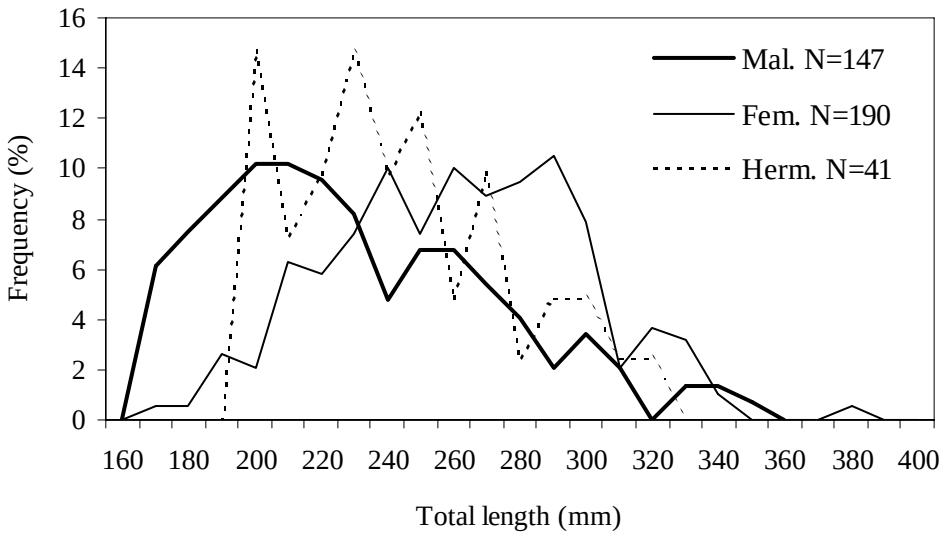
Electronic equipment
All of the vessels practicing *P. bogaraveo* fishery, were equipped with depth recording devices, 57.1% of them with radar and 42.9% with plotter.

Data on catches
The mesh size of the gillnets used ranged from 80-90 mm (full mesh) and the depth of the fishing grounds from 300-600 m. *P. bogaraveo* consisted 76.53% of the catch, in terms of number and 47.06% in terms of weight. Most important by-catch species was *S. blainvillei* (12.69% by number and 19.95% by weight). *C. granulosus*, *L. budegassa* and *P. americanus*

consisted more than 20% of the catch in terms of weight (8.77%, 6.46% and 5.92%, respectively). The lengths of *P. bogaraveo* ranged from 150-410 mm. The bulk of the catch was between 200 and 280 mm. The majority of the fish were 3-6 years old. The length frequency by sex shows that the smaller individuals were male and the bigger female but there was also a small amount of hermaphrodites ranged from 200 to 300 mm



Length frequency distribution of P. bogaraveo in Ionian Sea



Length frequency distribution of P. bogaraveo per sex.

Selectivity experiments have been done to estimate the selectivity of gillnets with mesh sizes 60, 68, 80, 88, 90 and 100 mm (full mesh). The optimum length to be caught was found 207, 235, 276, 304, 311 and 345 mm, respectively. (Petrakis *et al., 2001b*).

Special features

Fishing is taken place in very rough substrate. The possibility to loose part of nets is very high. The proportion of the damaged nets (when only part of the netting is destroyed but the headline and the lead line are not broken) according to the fishermen's estimations was 25.5% and the proportion of the entirely lost nets 12.3%. We have to notice that the lost nets continue to fish until they will get stuck on the bottom. The lost pieces of net without the floats cover the sea bottom and they obstruct the access of the fish to their food.

Recommendations

The fishery could be regulated quite easily, because of the high species selectivity. Furthermore, the species appears very rare as by-catch in other métiers (with the exception of the juveniles that are caught by bottom trawl and set nets). A minimum mesh size should be applied for that fishery. Sampling took place out of the reproduction period, so the estimation of L_{50} (length at first maturity) was not possible. However, a minimum mesh size of 90 mm (full mesh) should be appropriate for this species.

Reproduction is taking place in winter. A measurement to protect the spawning stock could be applied and the fishery could close from November to April. Such a suggestion would not create strong reaction because the fishing effort is restricted and the prices very low. During summer fishing is easier and less dangerous because the weather is better and the price of the species is higher because the demand for fresh fish is higher (bottom trawl fishery is closed and the demand of the market high due to the tourism).

The minimum landing (MLS) size for the species has been defined at 12 cm, which is the same for all *Pagellus* spp. species. This length is considered too small for *P. bogaraveo* and it has no practical meaning since at least in Greece all the specimens up to 14-15 cm are discarded. A larger minimum landing size should be introduced. However the majority of the catch ranges between 200 – 300 mm and it should be also be under consideration in the introduction of the MLS.

Technical interaction with other fisheries

There were a lot of complaints against the sport fishermen. How much the professional fishermen were objective and the sport fishing is a real problem for the stock, is under examination.

The juveniles of the species are concentrated in shallow waters. A non assessed amount of them is caught by bottom trawl and in lower extent by fixed nets. These specimens usually are discarded.

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SECTION B - RESOURCES

CAP.1 - SUMMARY OF BIOLOGICAL CHARACTERISTICS

SPAIN

GSA 1 – ALBORAN SEA

1 - Mullus barbatus

1.1 - Length at age

Von Bertalanffy parameters and growth parameters have been determined in SAMED for the Alboran Sea. No other parameters have been calculated for the area, although growth studies were carried out in the Western Mediterranean by several authors.

Von Bertalanffy parameters

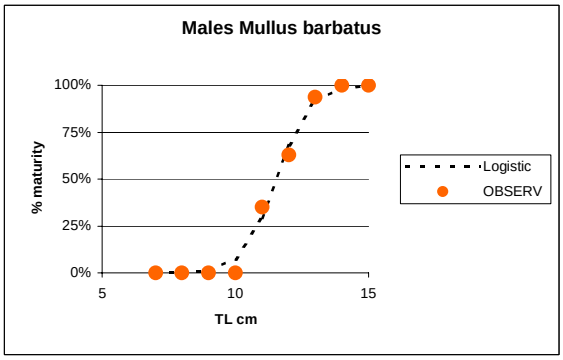
Author	Area	Sex	L_∞	k	t_0	a	b	M	F	Z
SAMED 2002	Albora Sea	M	21	0.62	-0.74			0.93	1.67	2.6
		F	24.5	0.6	-0.74			0.92	1.01	1.93
Del Arbol et al., 2003	Alboran Sea	M	21.56	0.69	-0.29	0.013	2.913			
		F	26.38	0.46	-0.45	0.007	3.143			

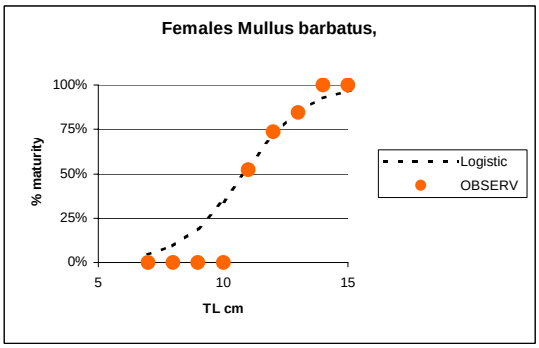
Total length (cm) and age (years) (SAMED project 2002 by MEDITS)

	Age	0.6	1	2	3
SAMED 2002	M		13.9	17.2	
Alboran Sea	F	13.2	15.8	19.6	22.1

1.2 - Maturity and spawning season

MEDITS and MERSEL projects in 2001 and 2002 captured mature males and females in every survey. It offers first results on first maturity in the area.





First maturity for males and females for Mullus barbatus in GSA 1

	Males	**Females**
L_{25}	10.87	9.43
L_{50}	**11.53**	**10.81**
L_{75}	12.19	12.19
R	0.97	0.99

The size at first maturity of the red mullet in GSA 1 is smaller than results in other areas of western Mediterranean.
Matures males and females are present in every season in the area, although in every autumns we find a high proportion of young individuals.

2 - Engraulis encrasicolus

2.1 - Length at age

Von Bertalanffy parameters and growth parameters were not determined for the Alboran Sea. Length weight parameters have been calculated for the area, although growth studies were carried out in the Western Mediterranean by several authors.

Von Bertalanffy parameters

Author	Area	Sex	L_∞	k	t_0	a	b	M	F	Z
Giraldez & Abad, 1995	Malaga, 1990	M				0.00396	3.2297			
		F				0.00400	3.2279			
		M+F				0.00317	3.3179			
	Malaga, 1991	M				0.00545	3.0692			
		F				0.00393	3.2037			
		M+F				0.00417	3.1797			

2.2 - Maturity and spawning season

Author	Sex	1990			1991		
		L_{50} cm	n	r	L_{50} cm	n	r
Giraldez & Abad, 1995	M	11.4	309	0.93	10.3	366	0.90
	F	11.1	401	0.90	10.8	431	0.96
	Total	11.1	710	0.96	10.5	797	0.99

3 - Sardina pilchardus

3.1 - Length at age

Von Bertalanffy parameters and growth parameters have been not determined for the Alboran Sea. Length weight parameters have not been calculated for the area, although growth studies were carried out in the Western Mediterranean by several authors.

Von Bertalanffy Parameters

Author	Area	Sex	L_∞	k	t_0	a	b	M	F	Z
Alemany et al. 1992	Alboran	M+F	20.148	0.861	-0.504					
	Gulf of Vera	M+F	19.921	0.836	-0.506					

3.2 - Maturity and spawning season

First maturity length Results L_{50} (cm)

Author	1989			1991		
	M	F	Total	M	F	Total
Abad & Giráldez, 1993	13.6	13.8	13.8	12.8	12.5	12.6

4 - Merluccius merluccius

4.1 - Length at age

Von Bertalanffy parameters have been determined by SAMED for the GSA 1. No other parameters have been calculated for the area, although growth studies were carried out in the western Mediterranean by several authors.

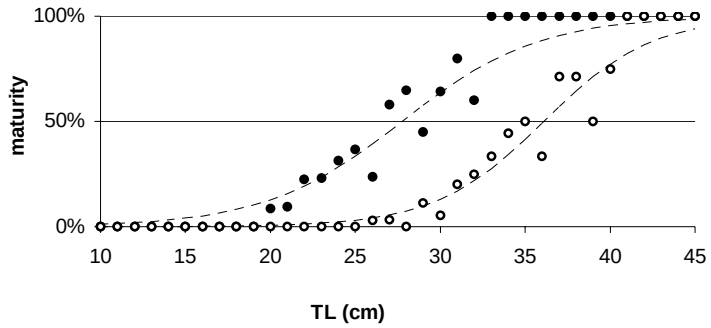
Von Bertalanffy parameters

Author	Area	Sex	L_∞	k	t_0	a	b	M	F	Z
SAMED	Alboran Sea	M F	57.3 80.9	0.23 0.163	-0.2 -0.2			0.48 0.34	1.33 1.2	1.81 1.54
Rey et al, 2003	Alboran Sea	M F				0.00620 .0059	3.04 3.06			

4.2 - Maturity and spawning season (source: IEO)

Sizes at first maturity in Alboran hake agree with results in other areas of western Mediterranean. Sizes at first maturity of 28.8 and 38 cm for males and females respectively were cited by Recasens et al., 1998.

Matures males and females are present in each season in the area, although in a low proportion. Adults individuals are not well represented in the survey samples so data are still scarce to locate spawning peaks in the Alboran Sea.



First maturity curves for males and females for Merluccius merluccius in GSA 1

First maturity values for Merluccius merluccius in GSA 1.

	MALES	FEMALES
L_{25}	23.33	32.57
L_{50}	**27.75**	**36.10**
L_{75}	32.17	39.63
R	0.88	0.93

5 - Pagellus acarne

5.1 - Length at age

Von Bertalanffy parameters have been determined as well as Length-weight relationship parameters.

Von Bertalanffy parameters

Author	Area	Sex	L_∞	k	t_0	a	b	M	F	Z
Baro, 2000	Alboran Sea	F+M M F	29.62	0.27	-1.36	0.0129 0.0166 0.0102	3.021 2.939 3.096	0.35		

5.2 - Maturity and spawning season

Sizes at first maturity for Spanish sea bream in Alboran agree with results in other areas of western Mediterranean. Sizes at first maturity of 19 cm for male sand females, despite to be protrandics, with an sexual inversion length of 21 cm. Matures males and females are present from May to October, locating two spawning peaks in the Alboran Sea.

6 - Aristeus antennatus

The red shrimp *(Aristeus antennatus)* is one of the most important resources of bottom trawling in Alboran Sea. It is fished on the slope between 400 and 800 m depth. Landings in the period 1976-2001 were about 300t with a maximum of 517 t in 1991 and a minimum of 115 t in 2001. Mean size in landings was 27 mm CL and the catches in the last three years have decreased since the most recent peaks by about 50%.

6.1 - Length at age

Von Bertalanffy parameters

Author	Area	Sex	L_∞	k	t_0	a	b	M	F	Z
García-Rodriguez, 2002	Gulf of Vera	M F	55.0 75.0	0.36 0.40	-0.33 -0.23	0.00529 0.00281	2.2594 2.4587	0.46 0.47		

6.2 - Maturity and spawning season

The percentages of maturity (immature-mature) for males showed a high ratio of mature individuals throughout the year, with the immature ratios decreasing from March to June and increasing from September to November. In the case of females, the ratios of mated females (that showed spermatophora) started to increase in spring, reached the maximum during the summer (July-September) and decreased in autumn. The spawning period was clearly shown by the percentages of spawning, active or inactive females throughout the studied period. This occurred between May and October, but was especially intense in July and August

First maturity length Results, 50% matures, for males and females of A. antennatus in three different areas (García-Rodriguez, 2002)

	Generalized Logistic		Simetrical Logistic		Gompertz	
Area	males	females	males	females	males	females
Gulf of Vera	17.55	21.40	17,15	22,41	17.15	21.73

GSA 5 - BALEARIC ISLANDS

1 - Merluccius merluccius

1.1 - Length at age

Von Bertalanffy parameters

Author	Area	Sex	L_∞	k	t_0	a	b	M	F	Z
Oliver, P., 1991	Balearic	M+F	94.24	0.086	-0.59	0.004298	3.1524			
Alemany & Oliver, 1995	Balearic	M+F	126.9	0.184	0.035					

1.2 - Maturity and spawning season

Author	Sex	L_{50} (cm)
Oliver, P., 1991	M	27.6
	F	36.3

2 - Mullus surmuletus

2.1 - Length at age

Von Bertalanffy parameters

Author	Area	Sex	L_∞	k	t_0	a	b	M	F	Z
Morales-Nin, B., 1991	Balearic	M	23.29	0.288	-3.3250	0.03174	2.668			
		F	34.53	0.136	-3.8210	0.01601	2.925			
		M+F	29.76	0.237	-2.0649	0.01600	2.913			
Reñones et al., 1995	Balearic	M	25.54	0.273	-2.450	0.01045	3.067			
		F	31.90	0.205	-2.605	0.00951	3.109			
		M+F	31.28	0.211	-2.348	0.00910	3.120			

2.2 - Maturity and spawning season

Author	Sex	L_{50} (cm)
Morales-Nin, B., 1991	M	15.0
	F	15.0
Reñones et al., 1995	M	15.0
	F	16.8

3 - Aristeus antennatus

The red shrimp is one of the most important resources of bottom trawling in the Balearic Islands. It is fished on the slope between 400 and 800 m depth. In biomass, it represents an average of 5% of the overall catches, but its economic value is 30% of the total earnings of the fishery. The trawl yields varied between 3 and 14 kg/h. The highest yields occurred in winter and spring. The decline of the sizes at first capture in 1997 and the increase of juveniles in the catches can be interpreted as a change in the fishery strategy, which has increased the exploitation effort on the small sizes. The average landings in the last three years has been 170 t. Mean CPUE varied from 25 to 45 kg per vessel and day. Mean size in landings was 29 mm CL.

3.1 - Length at age

Von Bertalanffy parameters

Author	Area	Sex	L_∞	k	t_0	a	b	M	F	Z
Carbonell, 2000	Balearic	M F	44.0 76.0	0.380 0.426	-0.80 0.1669	0.00318 0.00246	2.386 2.463	0.5 0.452	2 2	
Carbonell, 2001	Balearic	M F	44.0 76.0	0.380 0.363	-0.7105 0.2667	0.00326 0.00283	2.375 2.427	0.49 0.479	2 2	

GSA 6 - NORTHERN SPAIN

1 - Engraulis encrasicolus

1.1 - Length at age

Von Bertalanffy parameters and growth parameters have been determinate in the area, although growth studies were carried out in the Western Mediterranean by several authors.

Von Bertalanffy parameters

Author	Area	Sex	L_∞	k	t_0	a	b	M	F	Z
Pertierra, 1992	Catalonia	M+F	17.6	0.39	-1.6000					
Morales-Nin & Pertierra, 1990	Catalonia	M+F	19.1	0.35	-1.4499					
Morales-Nin & Pertierra, 1990	Catalonia	M+F	19.1	0.34	-2.1400					

2 - Sardina pilchardus

2.1 - Length at age

Von Bertalanffy parameters

Author	Area	Sex	L_∞	k	t_0	a	b	M	F	Z
Alemany et al., 1992	Alicante	M+F	18.102	0.611	-1.119					
	Valencia	M+F	18.932	0.446	-1.409					
	Gulf of Lions	M+F	18.121	0.752	-0.731					

3 - Mullus barbatus

3.1 - Length at age

Von Bertalanffy parameters and growth parameters have been determinate in the area, although growth studies were carried out in the Western Mediterranean by several authors.

Von Bertalanffy parameters

Author	Area	Sex	L_∞	k	t_0	a	b	M	F	Z
Morales-Nin, B., 1986	Catalonia	M+F	24.32	0.1468	-3.312					
Demestre et al., 1997	Span.E.Medit.	M+F	33.13	0.34	-0.32	0.008	3.14	0.41	0.2	

3.2 - Maturity and spawning season

The size at first maturity of the red mullet is Males: 12.5 cm, Females: 13.0 (*Lleonart and Martín*, 1986, Catalan Coast).

4 - Merluccius merluccius

4.1 - Length at age

Von Bertalanffy parameters have been determined by several authors in the western Mediterranean.

Von Bertalanffy parameters

Author	Area	Sex	L_∞	k	t_0	a	b	M	F	Z
Recasens, 1992	Catalonia	M F M+F	72.1 116.0 111.5	0.200 0.140 0.146	-0.25 -0.06 -0.06	0.00571 0.00598 0.00446	3.06 3.05 3.13			
García-Rodriguez & Esteban, 1995	Gulf of Alicante	M F M+F	90 105 106	0.19 0.20 0.20	0.24 0.39 0.40	0.006 0.0048 0.0048	3.05 3.12 3.12	0.34 0.29 0.32		
Aldebert & Recasens, 1996	Gulf of Lions	M F	72.8 100.7	0.149 0.124	-0.383 -0.35	0.0069 0.0069	3.03 3.03	0.22 0.18	0.4 0.4	0.620 .58
García-Rodriguez & Esteban, 1998	Gulf of Alicante	M F M+F	73.3 99.7 113.2	0.172 0.155 0.123	-0.108 0.264 0.138					
García-Rodriguez & Esteban, 2002	Gulf of Alicante	F M+F	103.9 106.8	0.212 0.20	0.031 0.003					

4.2 - Sizes at first maturity

Sizes at first maturity of 28.8 and 38 cm for males and females respectively were cited by Recasens et al. (1998). Matures males and females are present in every season in the area, although in a low proportion.

Author	Sex	L_{50} (cm)
Recasens, 1992	M F	28.4 37.0
García-Rodríguez et al, 1995	M F	25.0 31.0
Recasens et al, 1998	M F	28.8 38.0

5 - Aristeus antennatus

The red shrimp is one of the most important resources of bottom trawling in this Sub Area. It is fished on the slope between 400 and 800 m depth. Recent average annual landings were 114 t. Mean size in the landings was 26 mm CL.

5.1 - Length at age

Von Bertalanffy parameters have been determined by several authors in the western Mediterranean, as well as length-weight relationship parameters.

Von Bertalanffy parameters

Author	Area	Sex	L_∞	k	t_0	a	b	M	F	Z
García-Rodriguez & Esteban, 2001	Gulf of Alicante	M F	51.0 77.0	0.360 0.380	-0.520 -0.065	0.0021 0.00188	2.532 2.562	0.44 0.43		
García-Rodriguez, 2002	Ibiza Channel	M F	55.0 73.0	0.380 0.363	-0.430 -0.406	0.00316 0.00243	2.4023 2.4836	0.47 0.47		

5.2 - Maturity and spawning season

The percentages of maturity (immature-mature) for males showed a high ratio of mature individuals throughout the year, with the immature ratios decreasing from March to June and increasing from September to November. In the case of females, the ratios of mated females (that showed spermatophora) started to increase in spring, reached the maximum during the summer (July-September) and decreased in the autumn.

The spawning period was clearly shown by the percentages of spawning, active or inactive females throughout the studied period. This occurred between May and October, but was especially intense in July and August.

The percentages of maturity by size class for determination of the 50% size at first maturity showed differences in the results according to where the used data come from.

First maturity length Results, 50% matures, for males and females of A. antennatus in three different areas (García-Rodriguez, 2002)

	Generalized Logistic		Simetrical Logistic		Gompertz	
Area	males	females	males	females	males	females
Alicante Gulf	16.75	21.15	16.75	23.45	17.78	21.85
Ibiza Channel	16.65	21.20	15.75	21.15	15.73	20.75

6 - Palinurus elephas

Information on settlement season and habitat

The settlement characteristics (season, timing, depth, microhabitat, densities, sizes, etc.) of the European spiny lobster *Palinurus elephas* are being investigated regularly in the Medes Islands Marine Reserve (NW Mediterranean) since 1998. The main results of interest to management are the following:

- the settlement season of pueruli (post-larvae) is centered in June-July;
- the size at settlement is 7.5-8 mm carapace length (CL);
- the preferred settlement habitat is empty date mussel *Lithophaga lithophaga* holes;
- as individuals grow, they increasingly are located in crevices;
- settlement has been detected at depths between 5 and 40 m, but highest densities clearly located between 10 and 15 m depth;
- high differences in post-settled juveniles are found in different areas depending on their geological characteristics, with highest densities being found in limestone (calcareous) rocky areas, in accordance with the occurrence of date mussel holes, which are only found in calcareous rock;
- interannual differences in settlement strength take place, with a decreasing trend being found from 1998 to 2001 which slightly recovered in the 2002 season;
- sizes of 18-19 mm CL are reached in October, before the start of water temperature decrease;
- sizes of around 30 mm CL are reached one year after settlement.

FRANCE

GSA 7 - GULF OF LIONS

In the Gulf of Lions the demersal fishery is highly multispecific. Thinking of catch abundance, it appears that there is no real « target species ». Nevertheless, from the point of view of the commercial value and market demand it can be said that a very important group of species is represented by hake, sea bass and sea bream, sole, monkfish and red mullet.

1- Merluccius merluccius

The species is widely distributed on the continental shelf and on the slope of the Gulf of Lions. Juveniles live mainly in the shallow waters and it seems that the spawning grounds are situated offshore, at the beginning of the slope, where the main part of the adult population live. The older individuals live in deeper waters, particularly in the underwater canyons existing at the edge of the Gulf.

See B-4 for more information on fisheries and catches.

1.1 - Length at age

	Females	Males	All
L_∞ (Von Bertalanffy)	100.7 cm	72.8 cm	
K (Von Bertalanffy)	0.124 years^{-1}	0.149 years^{-1}	
t_0 (Von Bertalanffy)	-0.350 years	-0.383 years	
a (length-weight)			0.0069
b (length-weight)			3.03
M	0.18	0.22	
maturity size (L_{50})	43cm	27 cm	

1.2 - Reproduction

Spawning season	All around the year but mainly concentrated in winter
Spawning areas	Continental shelf and upper slope
Nursery areas	Continental shelf

2 - Dicentrarchus labrax

The individuals of this species are caught both by the trawlers operating on the continental shelf and by the small scale fleet in the coastal zone and in the lagoons where they spend part of they life cycle.

The trawlers catch sea bass essentially in winter, during the spawning mass migrations of the species from the lagoons to the open sea. The small scale fisherman catch this species mainly during the late summer (august september).

L_∞ (Von Bertalanffy)	85.51
K (Von Bertalanffy)	0.1818
t_0 (Von Bertalanffy)	-0.223
a (length-weight)	0.00961
b (length-weight)	3.02
M	0.320
maturity size (L50)	30 cm (age 2)

Spawning season : September to December

3 -Sparus aurata

The individuals of this species are caught both by the trawlers operating on the continental shelf and by the small scale fleet in the coastal zone and in the lagoons where they spend part of they life cycle.

The sea bream is an hermaphrodite fish: the individuals are males until age 3, then they transform in females. Very large amounts of fingerlings are caught in some lagoons to be exported for aquaculture. The trawlers catch the sea bream essentially in winter, during the spawning mass migrations of the species from the lagoons to the open sea, but also during the spring (April, May). About 40% of the catch is got by the small scale fishery mainly in August and September.

L_∞ (Von Bertalanffy)	75.97
K (Von Bertalanffy)	0.1310
t_0 (Von Bertalanffy)	1.216
a (length-weight)	0.0448
b (length-weight)	2.65
M	0.397
maturity size (L50)	27 cm

Reproduction

Spawning season: mainly in December.

4 - Solea vulgaris

The individuals of this species are caught both by the trawlers operating on the continental shelf and by the small scale fleet in the coastal zone and in the lagoons where they spend part of they life cycle. Large quantities of fry born at sea enter the coastal lagoons from May to June. It seems that spend a maximum of two years in the lagoons, then migrate at sea and extend their habitat on the continental shelf, farer from the coast older they are. About 60% of the catch is done by the trawlers mainly during the last quarter of the year. The main part of the small scale fishery catch of sole is done from August to October and from December to April.

4.1 - Length at age

L_∞ (Von Bertalanffy)	50.53
K (Von Bertalanffy)	0.243
t_0 (Von Bertalanffy)	-1.065
a (length-weight)	0.0039
b (length-weight)	3.22
M	0.32
maturity size (L_{50})	30 cm

5- Other demersal species

Other economically important demersal species caught by the French fleet in the Gulf of Lions are the red mullet (*Mullus barbatus*) and the monkfish *(Lophius piscatorius)* but no regional specific studies exist about the biological parameters and the ecology of these fishes.

According to the growth parameters existing for these species in other Mediterranean areas, the data available on the small sizes of the monkfishes and red mullet landed in the Gulf of Lions ports show that their catch is mainly based on the juvenile parts of theses populations, so that increasing overfishing seems an evidence.

6 - Engraulis encrasicolus

Anchovy is an important commercial pelagic species in the Gulf of Lions, mainly caught by pelagic trawlers. The French annual catch is between 5000 and 6000 t. The production, however,

is regulated by the market demand. When market prices are low, pelagic trawlers shift their activities toward demersal resources.
Even if the GFCM Gulf of Lions and north Catalonia are different management units, many arguments support the concept of a shared stock of anchovy between France and Spain. They are mainly the continuous distribution of the adults, eggs, larvae and juveniles all over this area.
It seems that there is a close relationship between the environmental factors and the recruitment of the anchovy that can result in important natural fluctuations in the abundance of the stock.
The maximum observed size was 18 cm and the recruitment size 9 cm.

6.1 – Length/weight parameters

Year	1999	2000	2001	2002
a	0.00290	0.0034	0.0039	0.0040
b	3.3080	3.2596	3.2006	3.1920

6.2 - Reproduction

maturity size (L_{50})	10 cm
Reproduction season	summer
Nursery areas	Coastal zone, lagoons, offshore

7- Sardina pilchardus

This species represents between 40 and 45% of the total landings (demersals + small pelagics) of the French trawlers operating in the Gulf of Lions.
The spawning areas of sardine are situated offshore, near the edge of the continental shelf of the Gulf of Lions. Spawning occurs during the winter, generally from December to march. Post-larvae and juveniles come to the coast during spring and summer. Some of them enter the coastal lagoons.
Until age 2, the sardines stay mainly in shallow waters near the coast. As for the adults, important migrations occur between the deeper (in autumn, winter) and the shallower (spring, summer) areas of the Gulf.

7.1 - Age and growth parameters

	Male	Female
L_∞ (Von Bertalanffy)	18.9	20.4
K (Von Bertalanffy)	0.34	0.31
t_0 (Von Bertalanffy)	-1.047	-1.158

7.2 - Length-weight parameters

Year	2000	2001	2002
a	0.003	0.0064	0.0033
b	3.3576	3.075	3.324

<u>Reproduction</u>

Maximum size observed	22 cm
maturity size (L_{50})	13 – 14 cm
Recruitment size	7 cm
Reproduction season	winter
Reproduction areas	Gulf of Lions
Nursery areas	Coastal zone, lagoons

ITALY

GSA 16 –STRAIT OF SICILY

1 - Main demersal resources

1.1 - length at age

Parameters used in female assessments are listed below.

Population parameters in females used in stock assessment in middle-late nineties
Length as TL (cm) in fish and *CL(mm); weight (g) (from IRMA-CNR, 1999)

Parameters	*M.merluccius*	*M. barbatus*	*M. surmuletus*	*A.foliacea*	*P. longirostris*	*N.norvegicus*
L_∞	70.54	23.20	29.29	69.5*	40.93*	54.81*
K	0.18	0.64	0.48	0.46	0.71	0.13
M	0.3	1.1	0.8	0.4	1.3	0.2
a	0.0056	0.0104	0.0111	0.01298	0.0029	0.0006
b	3.0831	3.0444	3.0461	2.642	2.4961	3.0566

1.2 - Length at maturity

Estimates of the length at maturity for the main demersal resources in the Strait of Sicily are reported in the following table.

Length at 50% maturity (L_{50}) by sex of main target species in the Strait of Sicily

Species	Sex	L_{50}	References
M. merluccius	F	33.5 *TL (cm)*	SAMED, 2002
	M	21.5-28 *TL (cm)*	Boulhlal,1973; Bouaziz et al.,1998
M. barbatus	F	15-16 *TL (cm)*	Gharbi e Ktari, 1981
	M	14 *TL (cm)*	Gharbi e Ktari, 1981
P. erythrinus	F	12-13 *TL (cm)*	Fiorentino et al., 2002a
	M	16-17 *TL (cm)*	Unpublished data
A. foliacea	F	42 *CL (mm)*	Ragonese & Bianchini, 1995
	M	30-33 *CL(mm)*	Ragonese & Bianchini, 1995
P. longirostris	F	24 *CL (mm)*	Fiorentino et al., 2002b
	M	n.a.	----
N. norvegicus	F	30-32 *CL (mm)*	Bianchini et al., 1998
	M	n.a.	----

(n.a.–not available)

GSA 17 - NORTHERN AND CENTRAL ADRIATIC SEA

1 – Solea vulgaris

Common sole, *Solea vulgaris*, is a very important resource in the northern and central Adriatic sea which represents the main spawning and nursery area as well as the area of highest concentration for this species in the whole Adriatic sea.

In this sub-area the common sole stock is shared among Italy, Slovenia and Croatia. This depends on the fact that its distribution is age-dependent, being the adults mainly concentrated off the Istrian coasts (on dirty bottoms and residual sands) and the juveniles on the sandy or muddy bottoms along the Italian side (*Froglia, 1984; Giovanardi, 1984; Piccinetti and Giovanardi, 1984; Pagotto and Piccinetti, 1988; Froglia, 1993*).

Besides to be included in the mixed-species catches of bottom trawl nets, common sole is the main target species of rapido trawls and gillnets for soles, whose employment has noticeably increased in the last few years either as number of fishing vessels and in spatial (greater diffusion of the gears and enlargement of the fishing areas) and temporal (protraction of these fishing activities to most of year or all year round) terms.

Ghirardelli (1959) studied the growth of common sole in the central Adriatic Sea by using scale readings. He referred a mean length of 16.8 cm at the first year of age, 21.4 cm at the second year, 23.9 cm at the third year, 25.6 cm at the fourth year and 33.1 cm at the fifth year. Further studies were done in 1980's in the same area using different methods (see table below). In particular, *Froglia and Giannetti* (1986) evidenced a different growth rate between males and females, being the growth of the latter ones faster.

1.1 - Length at age

Von Bertalanffy parameters of S. vulgaris in the Adriatic sea

Author	Method	Sex	L_∞ (cm)	K	t_0
Piccinetti and Giovanardi (1984)	Otoliths	Total	40.10	0.679	
Froglia and Giannetti (1986)	Otoliths	M	32.20	0.069*	-1.66*
		F	37.87	0.042*	-5.36*
		Total	38.25	0.041*	-3.574*

* K and T_0 calculated by month

1.2 - Length at maturity

Sexual maturity is reached at a total length of 25 cm (*Fisher et al*., 1987).

1.3 - Length/weight parameters

The parameters of the length/weight relationship computed on specimens collected during sampling carried out in 2000-2002 are reported in the table below.

	a	b	N	LT range (cm)
Males	0.0058	3.1329	819	11.5 - 31.0
Females	0.0048	3.1964	1240	13.0 - 38.0
Total	0.005	3.1858	2062	11.5 – 38.0

GREECE

GSA 20, 22 – IONIAN AND AEGEAN SEA

1 – Main exploited species

1.1 - Size at first maturity

There are several reports on length at first maturity of exploited species in Greek waters, which are listed in the following table.

Length at first maturity in GSA 20 and 22

Species	L_{50} (mm)	GSA Area	Reference
S. pilchardus	F: 115	20, 22	**Anon., 2001**
E. encrasicolus	F: 105	20, 22	**Anon., 2000**
*M. barbatus***	F: 111 M: 106	22	**Papaconstantinou et al., 1998**
*P. erythrinus***	F: 150 M: 160	22	**Mytilineou, 1989; Papaconstantinou et al., 1998**
*P. acarne***	F: 134 M: 134	22	**Papaconstantinou et al., 1989**
M. merluccius	F: 360 M: 310	20	**Mytilineou & Vassilopoulou, 1988**
N. norvegicus	F: 26-34*	22	**Mytilineou et al. 1993; 1995; Orsi Relini et al., 1998**
*A. foliacea**	F: 38	20	**Kapiris & Thessalou-Legaki, 2001**
*A. antennatus**	F: 29	20	**Kapiris & Thessalou-Legaki, 2002**

*CL: Carapace Length, **FL: Fork Length

1.2 - Size at sexual inversion

Reports of the size at sexual reversion are summarized in the table. These estimates derived from samples collected in the central Aegean Sea (GSA 22).

Size at sexual inversion

Species	Size (fork length, mm) at sexual inversion	FL range	Reference
Pagellus erythrinus	250	120-300	**Mytilineou, 1989**
Pagellus acarne	150-160	120-200	**Papaconstantinou et al., 1989**

CAP. 2 - STATUS OF FISHING STOCKS AND MANAGEMENT ADVICES

SPAIN

WESTERN MEDITERRANEAN

1 - Merluccius merluccius

Hake (*Merluccius merluccius*) is caught all over the Mediterranean and is the most important commercially exploited demersal resource in the area. Hake is caught both in multi-species bottom trawl fisheries and set gears such as: trammel nets, gillnets, bottom long lines. The fishing gears are extremely diversified and the artisanal fleets are unevenly distributed over the Mediterranean Basin and composed mainly of low tonnage boats based in a multitude of ports. A significant proportion of the bottom trawl landings of hake in the Mediterranean is below the minimum legal landing size (20 cm). Over 1996 to 1998, reported landings, excluding Black Sea, for the species have averaged 30,000t. The majority of the catch is taken by vessels from EU Member States 96 % of the total caught.Hake is one of the most important demersal species of commercial fisheries in the Gulf of Lions (GS 7). In 2001 it was exploited by 113 French trawlers, 95 French gillnetters, 26 Spanish trawlers and 20 Spanish longliners.

The catches of the trawlers are mainly composed of juveniles living on the continental shelf, while gillnetters and longliners are exploiting the adult part of the stock (spawners) living on the slope and in non trawlable areas. 80% of the landings are done by the trawlers; the total landings remained quite stable during the period 1988 (2941 t) to 2001 (2693 t).

During the same period, the total number of trawlers decreased from 196 to 139, while the number of gillnetters increased from 20 to 95 and the longliners fleet increased from 13 to 20 boats. During some periods, discards can represent a significant part of the total European hake catch, both in weight and in number

Discard of undersized individuals of the species has been assessed for particular sub-areas and can be considered important. However, in some areas, a reduction of discards and of landings of undersized individuals did recently occur due to enforcement of controls.

There is a risk of recruitment overexploitation. Spawning females in the current stock have been estimated around one million of individuals, in comparison to 20 millions of individuals in the virgin stock. It seems that the spawning stock is decreasing in comparison to previous analysis (1988-91).

GSA 1 – ALBORAN SEA

1 -Engraulis encrasicolus

Anchovy and Sardine are the main target species of the purse seine fleet in the Northern Alboran Sea. Other accompanying species with lower economical importance are also caught such as: Horse mackerel *(Trachurus* spp), mackerel (*Scomber spp),* Atlantic saury *(Scomberesox saurus)* and gilt sardine *(Sardinella aurita).* In the South-Mediterranean Region (from Gibraltar Strait to Cape of Gata) the fleet continuously decreased in the last two decades, from more 230 vessels in 1980 to 120 in 2001. The present fleet has a mean GRT of 17.2. Only Malaga Bay fishing area, which represents 85% of total landings, has been considered by the WG. After 1993 minimum a slight recovery of landings was observed in 1996, but a new diminution occurred in the following years, reaching a minimum in 2000. Finally, a strong increment of landings was recorded in 2001, together with an increase of CPUE values, which reached this year the highest level since

1995, despite the autolimitations in the volume of landings decided by the fishermen in order to maintain the market prices.
Biomass estimation for Malaga Bay (GSA 1) in 2001 survey (13210 t) represented an important increment respect to the previous year situation (1716 t). Since most of the stock is concentrated in Malaga Bay this estimation can be considered as representative of the whole northern Alboran area.

2 - Sardina pilchardus
A peak of landings of around 6000 t was found in 1991-1992, but then decreased to an overall mean value of 1000-2000 t during 1994-1998. From 1998 onwards, both landings and CPUE showed an increasing trend, reaching in 2000 and 2001 CPUE values higher than those observed in previous years

3 - Aristeus antennatus
The red shrimp (Aristeus antennatus) is one of the most important resources of bottom trawling in Alboran Sea. It is fished on the slope between depths of 400 to 800 m. Landings in the period 1976-2001 were around 300 with a maximum of 517 t in 1991 and a minimum of 115 t in 2001. Mean size in the landings was 27 mm CL and the catches in the last three years have decreased since the most recent peaks by about 50%.
Results showed a stable fishery based on adults specimens. The VPA revealed that the mean age of the catch was greater than the mean age of the stock, however, the Y/R curves in all areas pointed to an overfishing scenario. Moreover, a very high fishing effort on the spawning stock biomass was detected. The SAC Subcommittee on Stock Assessment notes the state of full exploitation and that the current Biomass is about 13% of the Virgin Biomass.

GSA 5– BALEARIC ISLANDS

1 - Aristeus antennatus
The red shrimp is one of the most important resources of bottom trawling in the Balearic Islands. It is fished on the slope between depths of 400 to 800 m. In biomass, it represents an average of 5% of the overall catches, but its economic value is 30% of the total earnings of the fishery. The trawl yields varied between 3 and 14 kg/h. The highest yields occurred in winter and spring. The decline of the sizes at first capture in 1997 and the increase of juveniles in the catches can be interpreted as a change in the fishery strategy, which has increased the exploitation effort on the small sizes. The average landings in the last three years has been 170 t Mean CPUE varied from 25 to 45 kg per vessel and day. Mean size in landings was 29 mm CL.
The VPA revealed that the mean age of the catch was greater than the mean age of the stock, however, the Y/R curves in all areas pointed to an overfishing scenario. Moreover, a very high fishing effort on the spawning stock biomass was detected. The SAC Subcommittee on Stock Assessment notes the state of full exploitation and that the current Biomass is about 16% of the Virgin Biomass.

GSA 6 – NORTHERN SPAIN

1 - Engraulis encrasicolus

Anchovy and sardine are the main target species of the purse seine fleet in the Northern Spain. Sardine is the species with the highest amount of catch; on the other hand, anchovy is the most sought due to its economical value. The present fleet has 191 purse seiners, a 12% smaller than the previous year, with a mean GRT of 32.60. A peak of landings of around 22000 tonnes was found in 1994, but then decreased to an overall value of 6000 tonnes in year 2000; this value is the lowest for the last fifteen years. The anchovy landings represent 80% of the total catch anchovy in Spanish Mediterranean.

The period in which the surveys were carried out corresponds to the recruitment season of the species. The most important recruitment area is located between Barcelona and the south of the Ebro River Delta. For this area, the surveys suggested that the recruitment was very low from 1996 to 2000, but the population appeared to have recovered in 2001 to amounts close to the half of those found in 1992, when the highest value was estimated. The estimated biomass for the whole area in 2001 (27000 tonnes) was two times higher than that in 2000.

The minimum legal landing size of small pelagic should be set to the length of first maturity. Taking into account the important fluctuations observed in the recruitment, which have a direct effect on the total biomass of the stock, it s recommended that current levels of fishing effort should be maintained.

2 - Sardina pilchardus

Sardine is the species with the highest amount of catch; on the other hand, anchovy is the most sought due to its economical value. The present fleet has 191 purse seiners, a 12% smaller than the previous year, with a mean GRT of 32.60. Sardina landings have increased from 70"s, reaching a maximum of 53000 t in 1994. For the last years there was a decrease reaching 38000 tonnes in year 2000.

From 1990 to 2001, the estimated biomass fluctuated from 200000 t in 1992 to 50000 t in 2000. The estimation for 2001 was 97000 tomes, which was double than in the previous year. The most important recruitment corresponded to the years 1991 and 1992, whereas the lower values were found in 2000 and 2001.

Taking into account the present level of biomass and catches, as well as the low level of recruitment detected in the two last years, it would be recommended not to increase the current level of fishing effort.

3 -Aristeus antennatus

The red shrimp is one of the most important resources of bottom trawling in this sub area It is fished on the slope between depths of 400 to 800 m Recent average annual landings were 114 t. Mean size in the landings was 26 mm CL.

The VPA revealed that the mean age of the catch was greater than the mean age of the stock, however, the Y/R curves in all areas pointed to an overfishing scenario. Moreover, a very high fishing effort on the spawning stock biomass was detected. The SAC Subcommittee on Stock Assessment notes the state of full exploitation and that the current Biomass is about 12% of the Virgin Biomass.

A 25% reduction of the effort could bring the biomass of the stock up to 36% higher than the current value in 3 years The GFCM Working Group recommends keeping the current level of effort and if possible to reduce it as indicated by the analysis.

FRANCE

GSA 7 – GULF OF LIONS

1 - Merluccius merluccius

The stock of hake of the Gulf of Lions is exploited mainly by a large French trawler fleet and a smaller Spanish trawler fleet, and also by small-scale fleets using steady gear, i.e. gillnets used by French fishermen and longlines operated by Spanish fishermen.

The two trawler fleets catch fish of all sizes but mostly small immature individuals, whereas gillnets and longlines only catch essentially adults. Several studies on the stock and on biology of hake have been carried out over the past few years, in particular in the frame of GFCM sub committee on stock assessment. They consisted mainly of virtual population analysis (VPA) based on length pseudocohorts and an estimation of the impact of variations in fishing mortality for each type of gear on catches and on yield-per-recruit (Y/R).

VPA Main results for the 1998-2001 period

	units	females		males		Total	
		age	length	age	length	age	length
Landings	tons	1291	1307	1194	1210	2485	2516
Total biomass (TB)	tons	2053	2059	2043	2071	4096	4129
Spawning Stock Biomass (SSB)	tons	1045	1046	1323	1353	2369	2399
Virgin biomass (VB)	tons	125716	127460	47365	47877	173081	175337
% TB/VB	%	1.63	1.62	4.31	4.32	2.37	2.36
recruits (initial N first class)	million	16.66	17.21	20.54	21.23	37.19	38.44
Overall F (weighted by N)	$years^{-1}$	0.5790	0.5080	0.4090	0.3730		
Overall F (weighted by t)	$years^{-1}$	0.8108	0.5574	0.4664	0.4056		

(N number of fish, t = time)

Juvenile females are mainly fished by French trawlers and adult females are more exclusively caught by Spanish longliners. Juvenile males are mainly fished by French trawlers and adult males are partly caught by French gillnet.

Reference points

Criterion	Value	units	trend	Comments
B_{now} (= $B_{current}$)	4096	tons	Stable	1988-91: 4214; 1998-00 : 4089
SSB	2369	tons	Decreasing	1988-91: 3106; 1998-00 : 2508
B_{virgin}	173081	tons		1998-00 : 161800 tons

General state of resource: Growth overexploitation

Decreasing trend of spawning stock biomass from 1988-91 to 1998-01 periods, but stable from 1998-00 to 1998-01.

Current biomass is 2.37% of virgin biomass

For females, if $F_{current}$ is reduced by 82%, Y/R_{max} would be 3.3 times higher than the current value

For males, if $F_{current}$ is reduced by 68%, Y/R_{max} would be 1.6 times higher than the current value.

Risk of recruitment overexploitation. Spawning females in the current stock have been estimated around one million of individuals, in comparison to 20 millions of individuals in the virgin stock. It seems that spawning stock is decreasing in comparison to previous analysis (1988-91).

TRANSITION ANALYSIS

Five simulations of different management strategies have been performed:

Simulation 1: decrease the trawl effort to 80% of their current value. Maintain the effort of the other gears.

Simulation 2: decrease the trawl effort to 90% of their current value. Maintain the effort of the other gears.

Simulation 3: decrease the effort to 80% of their current value for all gears.

Simulation 4: decrease the effort to 90% of their current value for all gears.

Simulation 5: modify the selectivity of trawl in order to enforce the 20 cm minimum legal size. It has been considered none catches in age 0 and 50% of catches in age 1 for females and 0.75% of catches in age 1 for males

Results:

In all cases (simulations and gears) there are losses at short term and gains at medium term

In 3-4 years (in the worst case) the initial production should be recovered

Improving trawl selectivity is more efficient than reduce effort (considering the parameters used)

Even taking into account a high level of recruitment uncertainty the all management measures tested have positive results.

Considering only the effort reduction, the simulation 3 (reduction of 20% of effort for all gears) appears to be the most effective

The following table shows the relative gains after 15 years maintaining the management measures. The initial values are 1 in all cases.

Scenario	Biomass	SSB	Total yield	French trawl	French gillnet	Spanish trawl	Spanish longline
1	1.48	1.63	1.24	1.09	1.63	1.08	1.83
2	1.20	1.27	1.11	1.04	1.27	1.04	1.35
3	1.64	1.92	1.26	1.12	1.44	1.11	2.18
4	1.26	1.37	1.11	1.05	1.20	1.04	1.47
5	2.11	2.23	1.82	1.68	2.26	1.53	2.35

2 - Other demersal species

The sea bass (*Dicentrarchus labrax*), the sea bream (*Sparus aurata*) and the sole (*Solea vulgaris*) are three of the main target species of the French trawlers, small-scale coastal marine and lagunar fleets in the Gulf of Lions. The last analysis on these species has used a 1986-1996 sampling series. Using the virtual population and yield per recruit analysis methods and the techniques which allow the simulation of the fisheries resources exploitation, it has been possible to build a diagnosis on the stocks of the three species, their current status and the possible effects of an hypothetic new distribution of the ratios of fishing power of the three fleets.

The results show that the three stocks can be considered as biologically heavily exploited. They stay at low biomass levels but their demography is very sensitive to any variation of the fishing effort. However, the overall yield per recruit of the 3 species have not varied significantly during the 10 years covered by the study. For the 3 species, the Y/R of the trawlers have slightly increased (maybe due to an improvement of the selectivity of the modern trawl nets?).

The most important part of the mortality rates are due to the trawling, which interact heavily on the small-scale fishery scores; simulating increases or decreases of the trawlers effort results in significant corresponding losses or gains in spawning stock biomasses and in yield for the two other fleets.

3 - Engraulis encrasicolus

Echo-integration methodology is used annually since 1993 in the Gulf of Lions, during summer, in order to estimate the importance and the variations of resources of anchovy, sardine and other commercial pelagic species. The state of the anchovy population in the Gulf of Lions appears to improve, since in the recent years an increase in the reproductive biomass has been observed. On the other hand, for sardine, the biomass seems to be stable.

Fleets from both France and Spain are sharing the anchovy stock of the Gulf of Lions. The French fleet is composed of mid-water trawlers fishing during the daytime. Spanish purse seiners fish at night with lights.

During the very last years not any important modifications in the level of catch of anchovy of this stock have been observed. Considering also the last biomass values which can be estimated at the moment by direct methods, it has been suggested to maintain the effort to the current level.

PELMED Surveys results (biomass in tons)

Pelmed	1993	1995	1996	1997	1998	1999	2000	2001
Inshore	2019	24895	6659	9293	7091	9748		49710
Offshore	25823	5562	28069	31888	50929	74215		62308
Total	27841	30457	34728	41181	58019	83963	65918	112018

Reference points

Criterion	value	units	Trend	Comments
B_{now}	87299	MT	increase	Period average 1999-2001
Y_{now}	5200	MT	stable	Period average 1999-2001. 6069 MT (2002)*

4 - Sardina pilchardus

The sardine catch in the Gulf of Lions is about 11000 t., on the average, for the last ten years. The landings and the fishing effort are monitored since 1985. Although the production of sardine is less regulated by fishing market than that of anchovy, as mentioned before when the market prices are low, pelagic trawlers shift toward demersal resources.

Echo-integration methodology is used annually since 1993 in the Gulf of Lions, during summer, in order to estimate the importance and the variations of resources in anchovy, sardine and other commercial pelagic species. For sardine, the biomass is stable from a decade, around 76000 t.

The resource is considered as moderately exploited, and there is no need of new regulations for its exploitation.

PELMED Surveys results (biomass in tons)

	1993	1995	1996	1997	1998	1999	2000	2001
Inshore	126483	68620	39852	4397	38462	48515		22703
Offshore	7664	14723	11684	21658	13744	27856		47844
Total	134147	83343	51536	26054	52206	76371	81634	70547

Reference points

B_{now}	76184	MT	increase	Period average 1999-2001
Y_{now}	11324	MT	increase	Period average 1999-2001. 7725 MT (2002)

(for further information see CADDY, 1996, *FAO Fish. Tecn. Pap.*, 347)

ITALY

GSA9 – LIGURIAN SEA

1 - Nephrops norvegicus

The Norway lobster is one of the most valuable resources in the area exploited by the fishery that operates on the upper portion of the continental shelf slope. It is considered fully exploited in most of the grounds of the area and lightly exploited in the southern Ligurian Sea grounds, even though an increase in fishing pressure on this stock is also observed in the grounds traditionally exploited by the Viareggio fleet.

The current length of first capture can be considered as adequate under a yield-per-recruit point of view over all the Sub-Area and it is likely that at the current rate of fishing mortality the stock self-renewal can be still guaranteed on all the GSA9. The fishery that involve the species in question is exclusively targeted to Norway lobster. The other more abundant species that constitute the by-catch (*Micromesistius poutassou* and *Phycis blennoides*) are only partially vulnerable to the traditional bottom trawl net used characterized by a very low vertical aperture (of around 1 m) and hence, can be considered only lightly exploited. Most of the individuals of both species (almost all the juveniles) are discarded at sea.

2 - Merluccius merluccius

The European hake is exploited by several fisheries in which the species is the target or makes part of a fish mixture of species that constitutes the target of the fishery. A modest number of hakes with a size range 12-20 cm is landed by the fleets exploiting the grounds close to the coast. In the continental shelf, from 50 to 150 m depth, the species is caught as a part of the species assemblage and their size rage is similar to that observed in shallower waters. The fishery with trawl nets operating on these grounds lands a relatively modest quantitative of hake with size in general larger than 12 cm. The vessels using the wide opening trawl net may land a higher quantitative of the species. In the border of the continental shelf (from 150 to 250 m depth) the species constitute an important portion of the by-catch of the pink shrimp fishery. The catch is mainly composed by juveniles in a size range 8-15 cm. The activity of this fishery combined with the important removals of adults due to the artisanal fisheries are those that have the major responsibility of the current very high level of exploitation rate of the species and of the drastic reduction of the survival rates for spawners. This suggest a high risk of recruitment overfishing and a real danger of collapse for the stock. The situation is not homogeneous inside the GSA9. For instance, the Viareggio fleet produce a relatively light fishing pressure on the areas where small hakes are concentrated (nursery areas) and this fact allows to a major survival rate and a likely increase of number of adults. Moreover, in the mentioned area, artisanal fishery targeting bigger hakes can be considered negligible. Nursery areas of relatively high importance were already identified. These areas have a quite stable allocation even though some seasonal spatial shift do exist.

In order to reduce the high fishing pressure on juveniles, results of simulations made with different assumptions suggest that is better to be oriented towards operational measures as a reduction of fishing effort that technical measures as changes in selection of gears. A closure for fishing of the nursery areas should be an alternative measure in order to reduce fishing pressure and protect these highly concentrated and vulnerable individuals.

The mesh size currently in use define a too small size of first capture (8-9 cm), that is much lower than the legal size of the species (20 cm). It is practically impossible to impose a new mesh size that shifts the probability of selection defining an L50% compatible with the legal minimum size for the species. The adoption of a bigger mesh size (about 55 mm) should

produce a light improvement in Y/R for hake (results obtained with the size variable M assumption) but contemporarily important losses as regards to the catch of several other species that make part of the commercial assemblages. An alternative way in order to increase the size of first capture can be done by means of the self-regulation of the fleet by avoiding the fishing grounds where small hakes are concentrated or by enforcement of temporal or total closures of defined areas. The first of these two options apply now (even if not legally regulated) in the Viareggio fishing area.

3 - Parapeneus longirostris

The pink shrimp is exploited by the vessels that use the volantina and tartana trawl nets operating on the border of the continental shelf (from 150 to 250 m depth). No assessments on the stock status have been performed for the species in the whole sub-area. Catch trends does not furnish any signal of recruitment overfishing for the species. The size of first capture (12.4 mm) can be considered too low if compared with that corresponding to the size at first maturity (22mm). An increase in selectivity should produce a better exploitation of the species.

4 - Mullus barbatus

Red mullet is one of the species of major commercial interest. It is mainly exploited by the trawling fleets (volantina, wide opening net and tartana) operating on the coastal grounds. This species make part of an assemblage of species that constitute the target. Mullus barbatus is in most of the fleets of the sub-area the major component of the landings in late summer-beginnings of autumn due to the massive settlement of recruits near shore. The species is also caught with other gears, in particular with trammel nets. The species can be considered heavily exploited and the size of first capture is considered too low in order to optimize the exploitation of the stock. Trends of catches and catch rates do not suggest any real danger of recruitment overfishing for the stock.

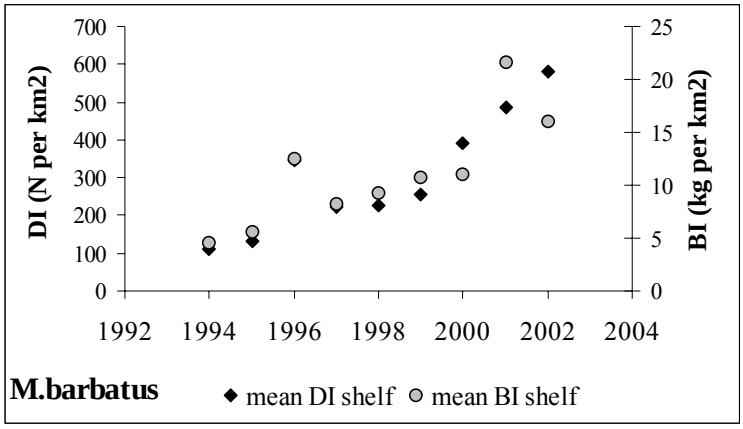
The in force total closure of the three miles coastal stripe is considered useful for the protection of the juveniles immediately after recruitment. A seasonal closure during the period of post-recruitment could be theoretically efficient in order to delay the catch of new settled individuals, even if no assessment have been done related to this matter. Moreover, this measure contributes to a reduction in overall fishing effort.

GSA 16 – SICILIAN STRAIT

1 - Mullus barbatus

Later, *Levi et al.* (1993) assessed exploitation state of Mullus barbatus of Sicilian side of Strait of Sicily, by using analytical monospecific model based on trawl surveys data. According to the *Beverton and Holt* relative yield per recruit model, the exploitation rate (E=F/Z) in 1985/87, ranging between 0.66 and 0.73, was higher than E_{max} (=0.59). The stock simulation according to a Thompson and Bell model, varying F from 0.5 to 2 times the current value and keeping gear selectivity constant, showed that the long term yield does not vary significantly. However the picture is different in terms of economic gain, resulting the potential income doubled if fishing mortality was reduced to a 40% of current value. Further increase of yield and economic value in long-term scenario could derive by changing from 30 to 40 mm. Similar findings were more recently given by stock assessment carried out in the framework of the GRUND (Italian group on evaluation of demersal resources) analyses (IRMA-CNR, 1999).

Although the above simulations suggested that the red mullet stock is not fished in optimal way, the time series of the biomass indices derived from the trawl surveys in GSA 16 show an increasing trend in the recent years.
Many experiences of reduction of fishing pressure on juveniles of red mullet have produce good result in terms of increasing in fishing rate. This increase are likely imputable not only to an increase of Y/R but also to a higher number of fish attaining the mature phase (increase of recruitment) (*Relini et al*.,1999; *Pipitone et al*., 2000).
Since 1965, trawling is prohibited within three nautical miles from the coast (law 14 July 1965, No.963). This measure, if respected, should protect young red mullets in their first months of benthic life, i.e during Summer. Given that the young red mullet go deeper as the growth, if an obligatory trawling ban of 45 days were imposed during following autumn, an evident increase of catches would be expected. While most of the red mullet nurseries in the northern side of the Strait of Sicily are in coastal bottoms, the existence of off-shore nurseries should be verified on the whole area.

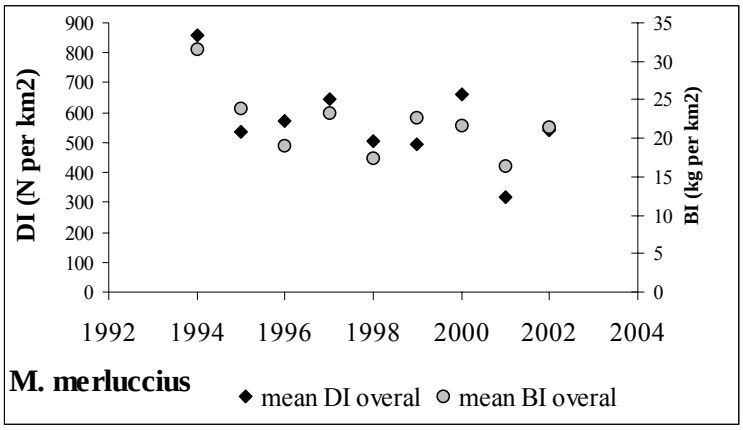


Time series of indices of red mullet abundance (Density;DI and Biomass;BI) in the bottoms within the middle line (*MEDITS – provisional data for 2002****).***

2 - Merluccius merluccius

Trawl surveys abundance indices remained quite stable from 1994 to 2002. According to current assessment based on analytical models, the exploitation ratio (E=F/Z) generally indicate an overexploitation condition for hake (0.6<E<0.8) in the Italian side of the area and international waters (IRMA,1999). On the basis of Thompson and Bell predictive model, the increase of mesh size from 30 to 40 mm opening should improve both yield and income per recruit of about 10-20 % according to the different areas.
Assessments carried out for hake inhabiting the Tunisian coasts (MU 12,13 and 14), based on surplus production models and yield per recruit analysis, evidenced a similar status of over-fishing (*Ben Mariem & Gharbi,* 1996). According to the production models, the MSY (680-750 t) was attained in early eighties (1983-1985), and a gradual reducing of trawling effort and an increase of mesh size from 38 to 60 mm was proposed to obtain long term gain in spawning biomass and yield (mainly for artisanal fisheries).
In order to limit the over-capacity of fishing fleet, the Italian fishing licenses are fixed since the early nineties. Since 2000 the legal minimum mesh for Sicilian trawlers should be 40 mm opening in the cod-end, due to the end of the UE derogation, allowing a minimum size of 28 mm for Sicily and Greece. However up to now this measure was not enforced. Another problem concerning technical measures is the incongruence between the minimum marketable size of hake (20 cm total length - Regulation 27 June 1994 n°1626 of the European Union) and the adopted minimum mesh size of 40 mm opening, whose corresponding size at 50% capture is around 13 cm total length (*Fiorentino et al.,* 1998). The adoption of a size at 50% capture

compatible with the 20 cm TL (about 55-60 mm opening) should have as consequence an important short term decrease in yield of small sized species that are very appreciated in the Mediterranean countries (Gruppo Metodologie Statistiche, 1998). An effective improve of hake fishing pattern might be obtained through an alternative technical measure having a similar effect to the increasing of mesh size, i.e. the protection of hake nurseries. Differently from Red mullet, whose nurseries are in the already protected bottoms within three nautical miles from the coast, the location of hake nurseries on discrete off-shore areas on the outer shelf (100-200 m) makes more complex and not enforced at now the measure of nursery protection.

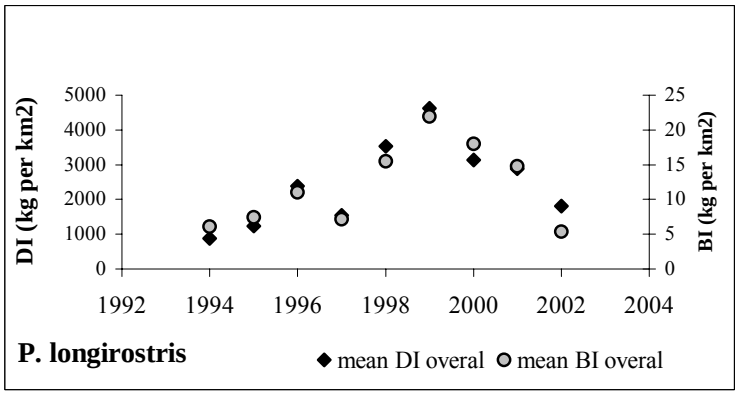


Time series of indices of hake abundance (Density DI and Biomass BI) in the bottoms within the middle line (MEDITS – provisional data for 2002).

3 – Parapeneus longirostris

According to *Levi et al.* (1995), the deep water pink shrimp presented a current exploitation rate (E=0.8) higher than the optimal one since the late eighties. Simulation with the Thompson Bell predictive model have predicted an more efficient exploitation of the resource in long time reducing of about 20% the fishing mortality or increasing from 30 to 40 mm mesh size opening. Similar analyses carried out in late nineties, confirmed overfishing (0.5<E<0.6) and assessed an increase of 4-6 % in yield per recruit and of 25-30% of income per recruit if the 40 mm mesh size in the cod end was adopted (IRMA-CNR, 1999).

The abundance indices from trawl surveys showed an increasing trend in last years up to 1999, followed by a decreasing up to now.

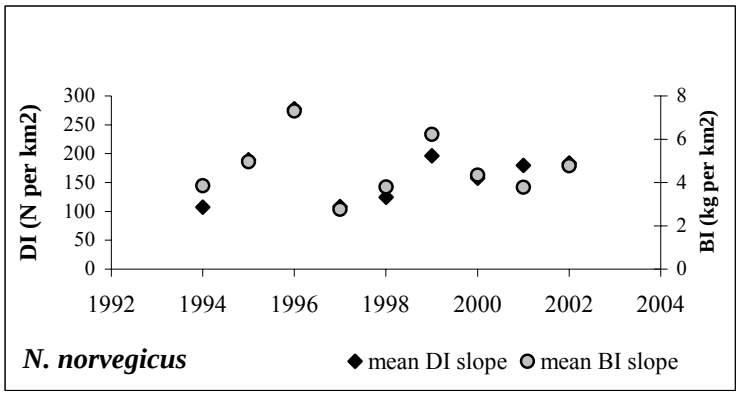


Time series of indices of deep water pink shrimp abundance (Density DI and Biomass BI) in the bottoms within the middle line (*MEDITS – provisional data for 2002****).***

A decrease of fishing effort, limiting the reduction of fleet capacity, might be obtained through the reduction of fishing activities. A technical stop of trawling 2 days a week (for example on Saturday and Sunday) could be established for 1 day trip trawlers, while a corresponding inactivity of 4-5 days could be fixed for long distant trawlers in function of the lasting of the trip (15-20 days). This measure could produce a decreasing of fishing effort corresponding to 20-25% of the current level. To make effective the measure, trawling technical stop should be effected regardless the weather conditions. Another measure having an effect similar to mesh size increase could be the trawling prohibition on nurseries. Preliminary information on nurseries position in the Strait of Sicily are available; a mapping of the areas is in progress (*Fiorentino et al.,* 2002).

4 – Nephrops norvegicus

Trawl surveys abundance indices fluctuated erratically from 1994 to 2002. A preliminary assessment carried out in late nineties, suggested an overfishing status (0.7<E<0.8) and assessed a light increase in yield and income per recruit if the 40mm mesh size in the cod end was adopted (IRMA-CNR, 1999).

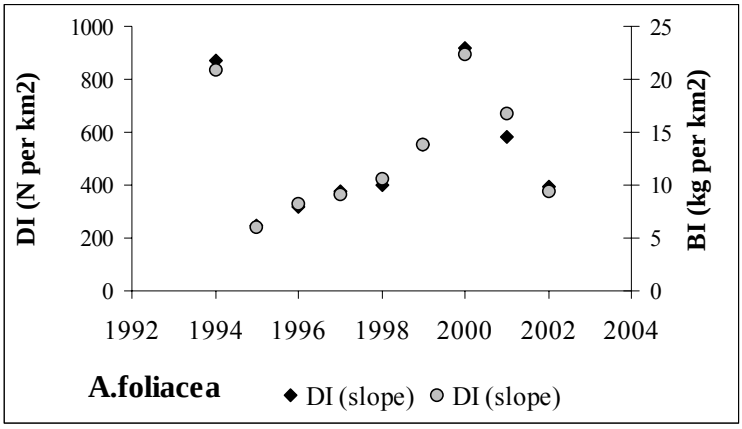


Time series of indices of Norway lobster abundance (Density DI and Biomass ;BI) in the bottoms within the middle line (*MEDITS – provisional data for 2002****).***

Taking into account of the over-fishing for most of the demersal resources of the Strait of Sicily, technical measures similar to those suggested for *M. merluccius*, *P. longirostris* and *A. foliacea* could be useful. A technical stop of trawling 2 days a week (for example on Saturday and Sunday) could be established for 1 day trip trawlers, while a corresponding inactivity of 4-5 days could be fixed for long distant trawlers in function of the lasting of the trip (15-20 days). To make effective the measure, trawling technical stop should be effected regardless the weather conditions. However, the prolonged maturity and spawning period, could reduce the effectiveness of the fishing ban. As a consequence, technological improvement aimed to protect the integrity of bottom and improve the selectivity properties of the gear should be sought (*Bianchini et al.,* 1998).

5 – Aristeomorpha foliacea

According to *Ragonese (*1989), a decreasing of catch rate in main red shrimps' fishing grounds occurred from the sixties onwards. The abundance indices from trawl surveys in the last 9 years showed an increasing trend in last years up to 2000, followed by a decreasing up to now.



Time series of indices of red giant shrimp abundance (Density DI and Biomass BI) in the bottoms within the middle line (*MEDITS – provisional data for 2002****).***

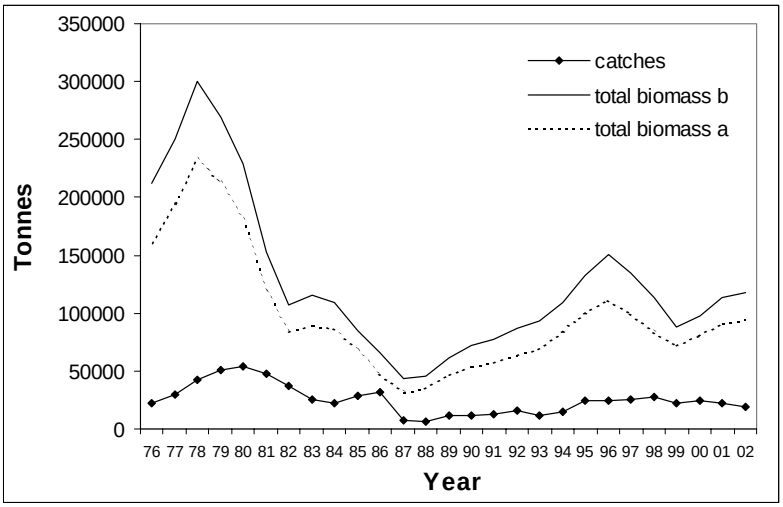
As indicated by IRMA-CNR (1999), in the late nineties the deep water red shrimp presented a current exploitation rate (0.6<E<0.7) higher than the optimal one. Simulation with the Thompson Bell predictive model predicted an increase of 9-13 % in yield per recruit and of 11-17% of income per recruit if the 40mm mesh size in the cod end was adopted (IRMA-CNR, 1999).
Differently to Red Mullet, Hake and Deep water pink shrimp, no evident nurseries were identified up now in red shrimps. Since the recruitment of is a discrete event, with a well defined peak in Spring, ad "hoc" fishing ban in this period could contribute to better the exploitation pattern of *A. foliacea* (*Ragonese,* 1989)

GSA 17 – NORTHERN AND MIDDLE ADRIATIC

1 - Engraulis encrasicolus

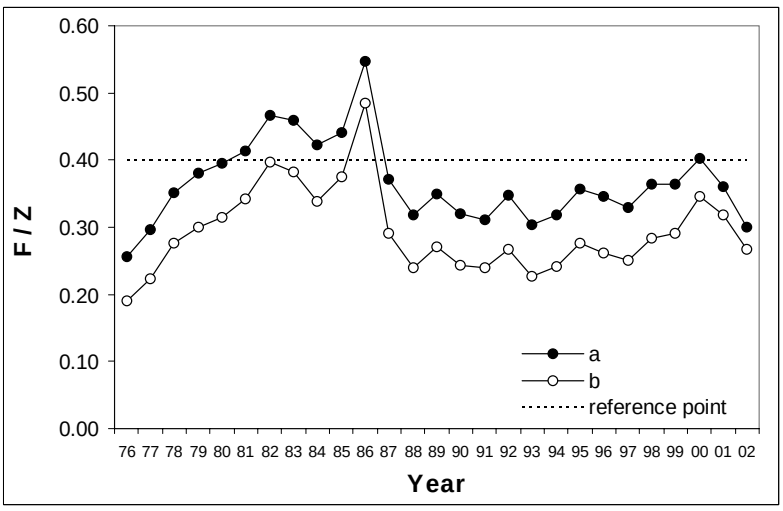
The figure shows the estimated biomass of anchovy stock obtained from VPA[1] (*Cingolani et al.*, 2003a) comparing only the biomass estimated under the two hypothesis[2] (a) and (b) concerning the annual fishing mortality rate for the oldest age class.
The average value of catches in the last three years 2000-2002 is equal to 22150 t, while the corresponding average of mid-year total (=stock) biomass is equal to 88764 and 109377 t, under the hypothesis a and b, respectively.

[1] Since the reproduction of the Adriatic anchovy is particularly relevant in spring-summer and a conventional birthday on the first of June is more coherent with the biology of the species, assessment was carried out taking into account a birthday date. Hence, on split year basis, the time series analysed was since 1976 up to 2002.
[2] Two hypothesis were made to estimate values of F: (1) the first one, more conservative, uses the standardised effort of 2002, the second one, less conservative, uses the mean value of standardised effort over the whole split year period 1976-2002 (Cingolani *et al* , 2003a).



Anchovy annual catches and mid-year total (=stock) biomass at sea derived from VPA, since 1976 up to 2002

The minimum value of both catch and biomass at sea were estimated in 1987, when a strong drop in the catch and crisis of the anchovy fishery took place. Even if high values of both fishing effort and fishing mortality rate were obtained for some years before 1987, very low levels of recruitment in 1986 and 1987 seems to be mainly responsible for the collapse of the stock. Since current biomass seems not have risen to the values observed before collapse, it would be unwise for fishing effort to be allowed to rise. Finally, on the basis of the VPA results, unweighted mean values of the fishing mortality rate over the age class range 0-3 were calculated for each split year since 1976 up to 2002. On the basis of these estimated averages over age and the mentioned value of M, the annual exploitation rates, i.e. the ratios between F and Z = F + M, were obtained.
These ratios were compared with the value 0.4, which was suggested by Patterson (1992) to be taken as a reference point for small pelagic stocks, with the values higher than this threshold being associated to high probability of stock decline.

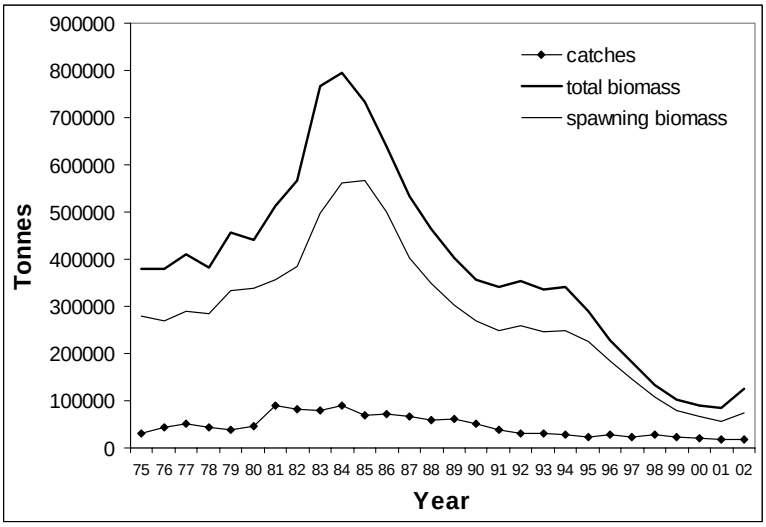


Anchovy annual exploitation rate (F/Z) since 1976 up to 2002. The annual value of F is the unweighted mean over the age class range 0-3 obtained from VPA and reported in the table 1;VPA was carried out under the hypothesis (a) and (b) about the annual fishing mortality rate for the oldest age class. In this plot, we also reported the threshold 0.4 which should not be exceeded as suggested by Patterson (1992)

2 – Sardina pilchardus

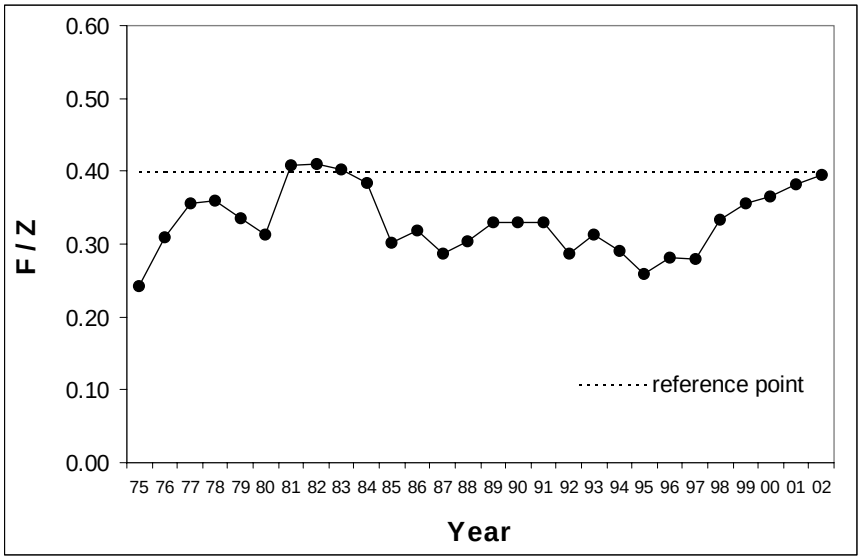
Estimated biomass of sardine stock obtained from VPA (*Cingolani et al.*, 2003b) is shown below. The average value of catches in the last three years 2000-2002 is equal to 19292 t, while the corresponding average of mid-year total (=stock) biomass is equal to 99410 t.

Since decline of stock biomass is observed after the peak in the first half of 1980s, and lowest values of this series correspond just to recent years, it would be unwise for fishing effort to be allowed to rise. An apparent increase in estimated biomass is observed in the last year, 2002: caution has to be taken when considering this, as VPA may have difficulties with incomplete cohorts; in addition, change in discarding phenomenon (particularly for small size sardines) could play a role in such an apparent increase. So, monitoring of discarded quantities as well as pattern as a function of sardine size is also suggested.



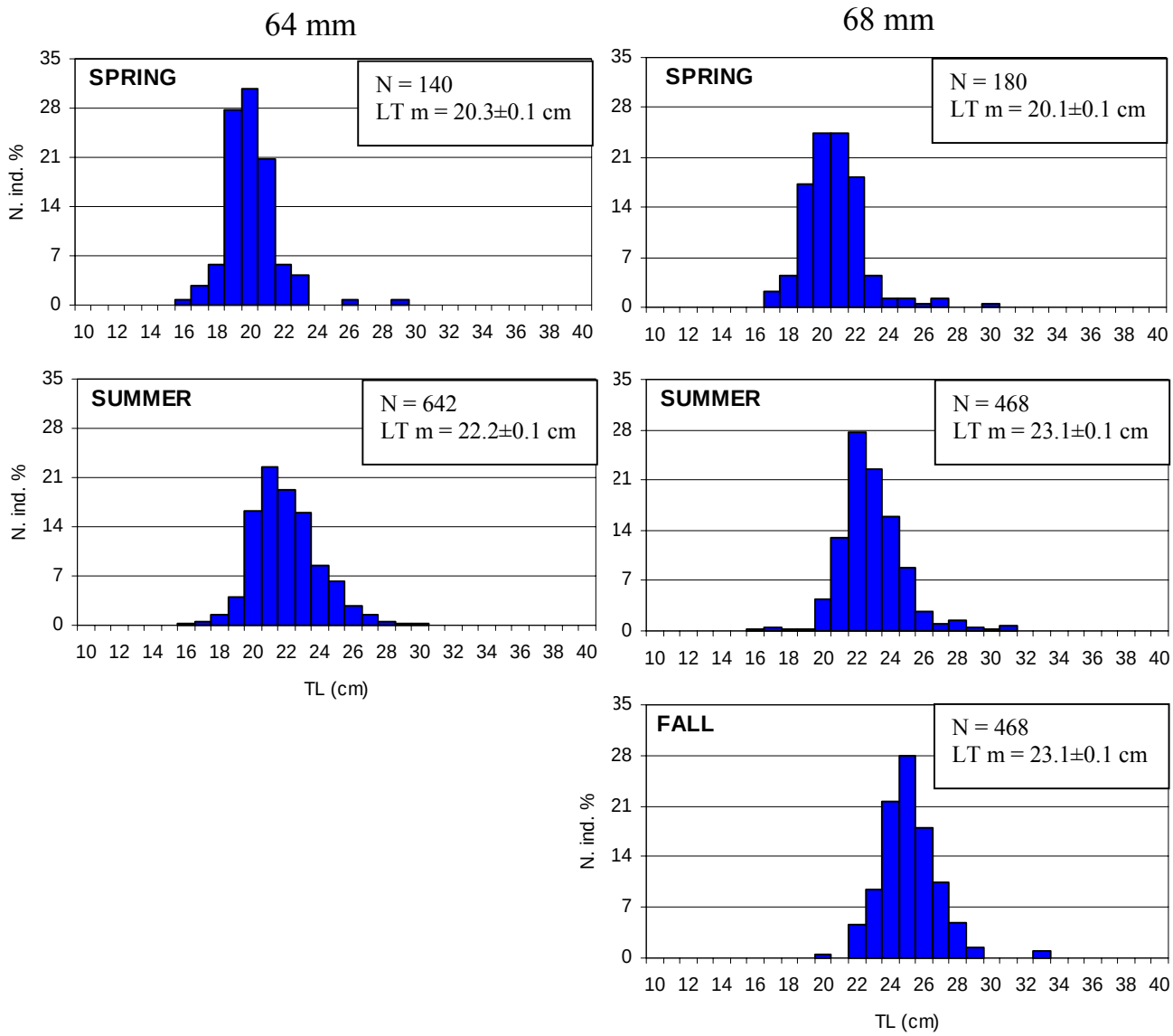
Sardine annual catches, mid-year total (=stock) biomass and mid-year spawning biomass at sea derived from VPA, since 1975 up to 2002

Finally, on the basis of the VPA results, unweighted mean values of the fishing mortality rate over the age class range 0-5 were calculated for each year since 1975 up to 2002. On the basis of these estimated averages over age and the mentioned value of M, the annual exploitation rates, i.e. the ratios between F and Z = F + M, were obtained. These ratios were compared with the value 0.4, which was suggested by Patterson (1992) to be taken as a reference point for small pelagic stocks, with the values higher than this threshold being associated to high probability of stock decline.

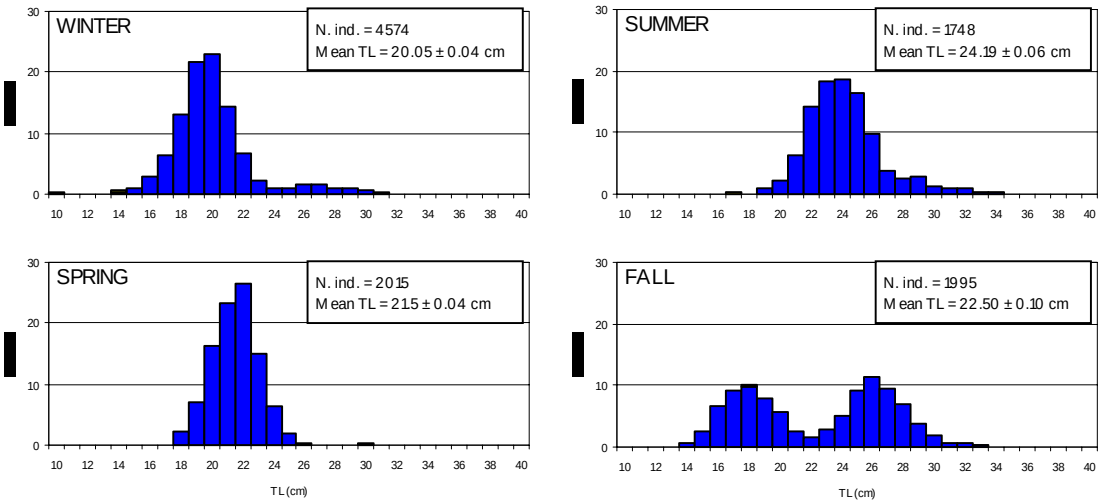


Sardine annual exploitation rate (F/Z) since 1975 up to 2002. The annual value of F is the unweighted mean over the age class range 0-5 obtained from VPA and reported in the table 1. In this plot, we also reported the threshold 0.4 which should not be exceeded as suggested by Patterson (1992)

3 – Solea vulgaris



Northern Adriatic Sea. Demographic structure of the seasonal catches of common sole obtained by three small scale fishing fleets of the Ancona department with gillnets for sole (1999-2000).



Northern Adriatic sea. Demographic structure of the seasonal catches of common sole obtained by the Ancona rapido trawl fleet (2000-2002).

Data on stock assessment of common sole are not available in GSA17, as well as in the other Italian geographical sub-areas. In fact, the survey programs currently aimed to assess demersal species are carried out with bottom trawl nets which are unsuitable gears to catch flat fishes and, hence, cannot give realistic estimations of their stocks. Neither, assessments based on VPA tuned by effort data from commercial fleets have been never considered until now.
Nevertheless, total catch and landing data are available for the last years for a few rapido trawl fleets and small-scale fleets operating with gillnets for sole in the northern and central Adriatic sea (Fabi and Sartor, 2002; Fabi *et al*., 2002; Grati *et al*., 2002). These data show that trends of the landed catches and LPUE of *S. vulgaris* are either constant or increasing, despite the fishing effort remained constant or slightly increased.
On the other hand, the analysis of the catch demography shows that the catches of both types of fisheries mainly consist of juveniles belonging to the age-classes 0 and 1.

GREECE

GSA 20,22,23 – IONIAN, AEGEAN AND CRETAN SEA

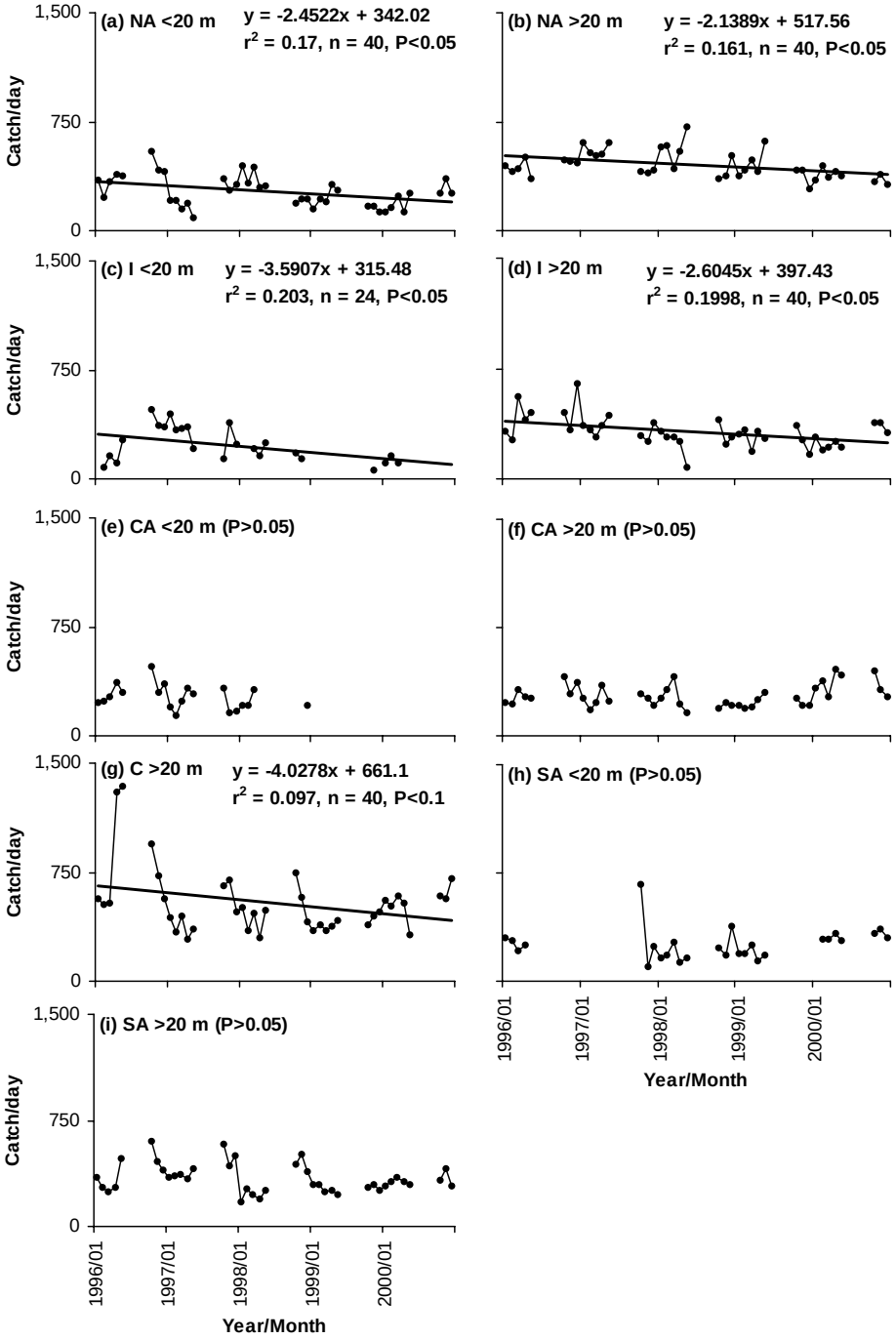
1 – Status of the fishing stocks and management advice

The accuracy of available data and respective time series, which could be used in obtaining a reliable picture of the state of the fishing stocks, is generally low. However, landings per unit effort data from the IMBC database and data from the MEDITS surveys could be used to examine trends of LPUE and abundance.

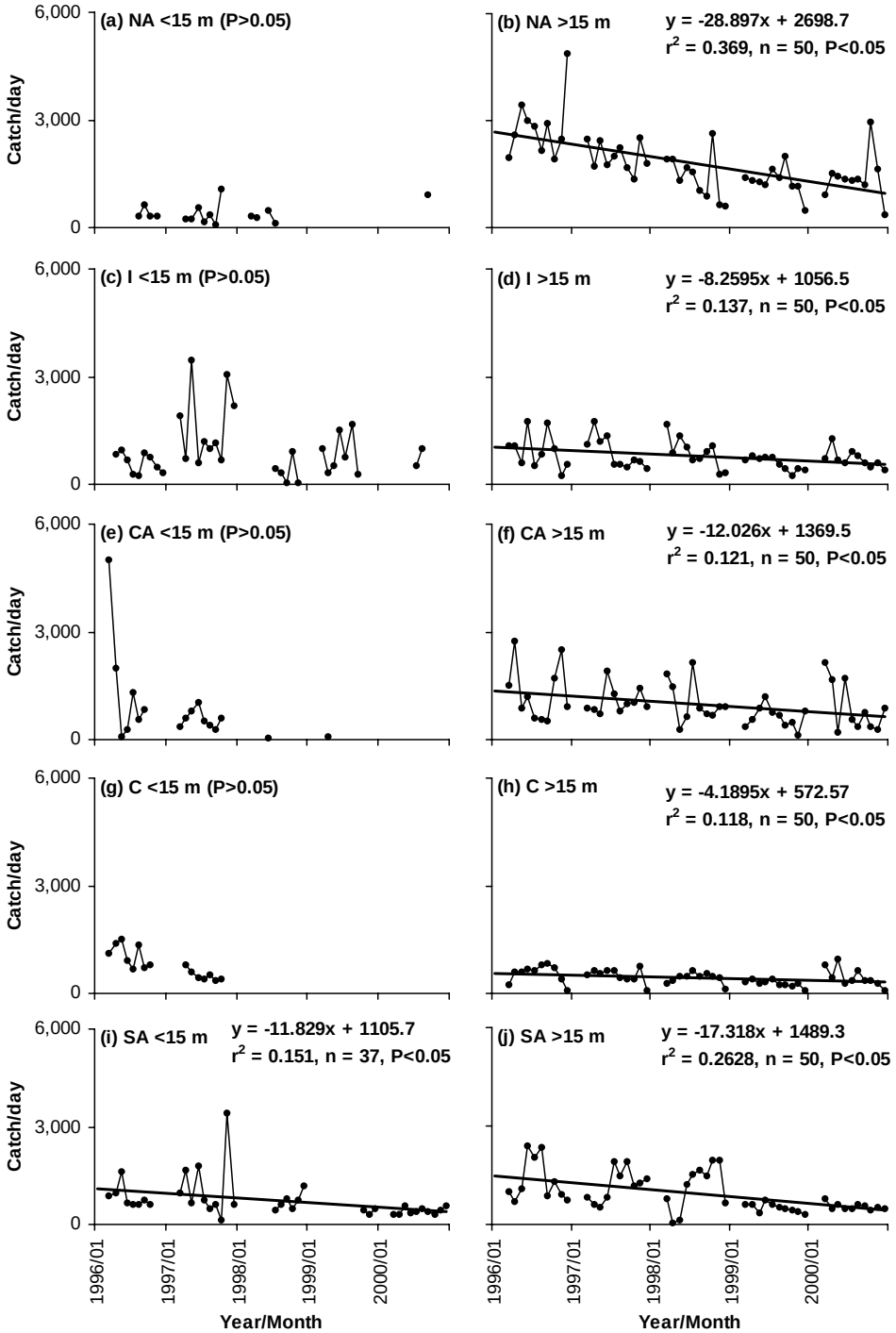
2 - Landings per unit effort trends from the IMBC database (1996-2000)

An analysis of the monthly landings per day trends (1996-2000) per fishing gear, geographical region and target species (DGXIV Project 00/018) of the data kept in the IMBC database showed some interesting features, which are summarized below. Yet, any conclusions drawn must be considered with caution because of the shortness of the available time series.

- The mean trawl catch/day in the N. Aegean and Ionian Seas, two of the most important Greek fishing grounds, as well as in Cretan waters declined significantly with time. Such a decline in catch/day is an indication that demersal resources are declining in these areas.
- Purse seine catch/day time series and especially those referring to vessels larger than 15 m, which account for the major part of the small pelagic catch, exhibited a declining trend.
- The catch/day data for small-scale vessels showed a variable pattern which did not allow the extraction of conclusions.
- Most of the examined target species were fished by more than one gear and eventually comprised important catch/day for two or three gears. Although the analysis of all complete time series of catch/day showed mixed trends, generally most target species exhibited negative trends in the catch/day of the main gear in their main fishing grounds. Thus, the purse seine catch/day of anchovy generally decreased in the main fishing grounds (North and Central Aegean and Ionian Seas). The purse seine catch/day of sardine decreased in the Ionian Sea and Cretan waters, whereas it did not change with time in one of the most important fishing ground, the N. Aegean Sea. The trawl, purse seine and small-scale catch/day of *Trachurus* spp. and *Boops boops*, both of which are important in southern Greek waters, generally exhibited a decreasing trend in the S. Aegean and Cretan waters. For hake, mainly caught by trawlers and longliners, the catch/day showed decreasing trends in the same areas. The trawl and net catch/day of *Mullus barbatus* and the trawl catch/day of *Nephrops norvegicus* exhibited decreasing trends in various subareas. The trawl catch/day of *Mullus surmuletus*, an important part of the trawl catch in southern waters, showed declining trends in the S. Aegean and Cretan waters. The trawl catch/day of *Pagellus erythrinus*, which was highest by one order of magnitude in Cretan waters, exhibited a decreasing trend in that area. The beach seine catch/day of *Spicara smaris*, one of the main species targeted by beach seiners, showed negative trend in all sub-areas.



Mean monthly catch per day of trawlers. Greek waters, 1996-2000. (a) North GSA 22, NA, vessels <20 m; (b) North GSA 22, vessels >20 m; (c) GSA 20, I, vessels <20 m; (d) GSA 20, vessels >20 m; (e) Central GSA 22, CA, vessels <20 m; (f) Central GSA 22, vessels >20 m; (g) GSA 23, C, vessels >20 m; (h) South GSA 22, SA, vessels <20 m; and (i) South GSA 22, vessels >20 m. Trend lines with slope significantly (P<0.05) different from zero are also shown.



Mean monthly catch per day of purse seiners. Greek waters, 1996-2000. (a) GSA 22, NA, vessels <15 m; (b) North GSA 22, vessels >15 m; (c) GSA 20, I, vessels <15 m; (d) GSA 20, vessels >15 m; (e) GSA 22, CA, vessels <15 m; (f) GSA 22, vessels >15 m; (g) GSA 23, C, vessels <15 m; (h) GSA 23, vessels >15 m; (i) South GSA 22, SA, vessels <15 m; and (j) South GSA 22, vessels >15 m. Trend lines with slope significantly (P<0.05) different from zero are also shown.

3 - Abundance indices and population parameters from the MEDITS surveys

The results of the analysis of abundance indices obtained from the MEDITS surveys, carried out in the framework of SAMED Project, are summarized in the following table:

Linear trends of the MEDITS abundance index (kg/km^2) in the Greek Seas (1994-1999). The ranges of the index mean values are given in brackets

Species	GSA		
	20	22	23
Merluccius merluccius	No trend (24.2-84)	Significantly increasing trend for slope waters (18.2-48.8)	Significantly decreasing trend (10.3-53.5)
Mullus barbatus	Non-significant increasing trend (14.3-56.2)	No trend (5.8-13.1)	Non-significant increasing trend (19.2-149.4)
Pagellus erythrinus	No trend (24.2-34.7)	No trend (6.1-14.4)	No trend (15.8-62.2)
Nephrops norvegicus	Negative non-significant trend (5.3-11.9)	No trend (6.2-9.3)	No trend (0.7-6.7)
Parapenaeus longirostris	No trend (3.1-13)	Increasing trend significant for slope (1.2-19.8)	No trend (1.7-36.9)
Aristaeomorpha foliacea	No trend (0-7.3)	No trend (0-5.7)	-
Aristeus antennatus	No trend (0-1.7)	No trend (0-0.2)	-

Any conclusions drawn from the MEDITS series must also be considered with caution because of the shortness of the respective time series.

4 - Population parameters

The following Tables summarize population parameter (L_∞, k, Z, F, M, E) estimates for *Merluccius merluccius*, *Mullus barbatus* and *Nephrops norvegicus, Parapenaeus longirostris* and *Pagellus erythrinus* based on data from the MEDITS surveys.

Merluccius merluccius

Year	**Aegean Sea**						
	L_∞ (cm)	k	Z	F	M	E	Source
1994	72.5	0.098	0.5933	0.3831	0.2103	0.65	Labropoulou et al., 2001
1995	69.1	0.121	0.6852	0.4750	″	0.69	Labropoulou et al., 2001
1996	97.1	0.086	0.8702	0.6600	″	0.76	Labropoulou et al., 2001
1997	95.4	0.118	0.6264	0.4161	″	0.66	Labropoulou et al., 2001
1998	87.0	0.076	0.8552	0.6450	″	0.75	Labropoulou et al., 2001
1999	78.5	0.091	0.7274	0.5172	″	0.71	Labropoulou et al., 2001
1994-2000	F: 88.4 M: 58.6	F: 0.147 M: 0.26	F: 0.82 M: 1.33	F: 0.51 M: 0.91	F: 0.31 M: 0.42	F: 0.62 M: 0.68	Anon., 2002

	Ionian Sea						
1994	52.4	0.131					Labropoulou et al., 2001
1995	83.8	0.086	0.7403	0.5212	0.2191	0.70	Labropoulou et al., 2001
1996	88.6	0.092	0.8457	0.6266	″	0.74	Labropoulou et al., 2001
1997	68.7	0.129	0.9378	0.7187	″	0.77	Labropoulou et al., 2001
1998	70.2	0.079	0.6608	0.4417	″	0.67	Labropoulou et al., 2001
1999	68.6	0.119	0.8205	0.6014	″	0.73	Labropoulou et al., 2001
1994-2000	F: 85.7 M: 56.1	F: 0.14 M: 0.21	F: 1.34 M: 1.20	F: 1.05 M: 0.82	F: 0.29 M: 0.38	F: 0.78 M: 0.68	Anon., 2002

	Cretan Sea						
1994	59.5	0.145	0.7283	0.5136	0.2147	0.71	Labropoulou et al., 2001
1995	41.0	0.133	0.6970	0.4823	″	0.69	Labropoulou et al., 2001
1996	59.3	0.103	0.8262	0.6115	″	0.74	Labropoulou et al., 2001
1997	60.3	0.157					Labropoulou et al., 2001
1998	53.7	0.092					Labropoulou et al., 2001
1999	51.3	0.152					Labropoulou et al., 2001
1994-2000	F: 60.8 M: 54.6	F: 0.2 M: 0.22	F: 0.95 M: 0.75	F: 0.63 M: 0.40	F: 0.32 M: 0.35	F: 0.66 M: 0.53	Anon., 2002

Mullus barbatus

Year	**Aegean Sea**						
	L_∞ (cm)	k	Z	F	M	E	Source
1998			0.93	0.63	0.3	0.68	Labropoulou et al., 2001
1999			0.95	0.65	0.3	0.68	Labropoulou et al., 2001
1994-2000	F: 30.3 M: 23.8	F: 0.292 M: 0.405	F: 1.73 M: 1.93	F: 1.12 M: 1.28	F: 0.61 M: 0.65	F: 0.65 M: 0.66	Anon., 2002
	Ionian Sea						
1994-2000	F: 27 M: 23.1	F: 0.424 M: 0.474	F: 2.02 M: 2.48	F: 1.34 M: 1.72	F: 0.68 M: 0.76	F: 0.66 M: 0.69	Anon., 2002
	Cretan Sea						
1998			0.93	0.63	0.3	0.68	Labropoulou et al., 2001
1999			0.99	0.69	0.3	0.70	Labropoulou et al., 2001
1994-2000	F: 26.2 M: 21	F: 0.469 M: 0.574	F: 1.65 M: 1.90	F: 0.81 M: 0.98	F: 0.84 M: 0.92	F: 0.49 M: 0.52	Anon., 2002

Nephrops norvegicus

Year	**Aegean Sea**						
	CL_∞ (mm)	k	Z	F	M	E	Source
1994-2000	F: 63 M: 75	F: 0.19 M: 0.15	F: 0.64 M: 0.45	F: 0.35 M: 0.22	F: 0.29 M: 0.23	F: 0.55 M: 0.49	Anon., 2002
	Ionian Sea						
1994-2000	F: 57 M: 71	F: 0.23 M: 0.17	F: 0.74 M: 0.64	F: 0.39 M: 0.38	F: 0.35 M: 0.26	F: 0.53 M: 0.59	Anon., 2002

Parapenaeus longirostris

Year	Aegean Sea						
	CL_∞ (mm)	k	Z	F	M	E	Source
1994-2000	F: 42 M: 38	F: 0.72 M: 0.83	F: 2.24 M: 4.04	F: 1.14 M: 2.77	F: 1.1 M: 1.27	F: 0.5 M: 0.69	Anon., 2002
	Ionian Sea						
1994-2000	F: 43 M: 38	F: 0.69 M: 0.71	F: 2.45 M: 3.12	F: 1.49 M: 2.03	F: 1.06 M: 1.09	F: 0.58 M: 0.65	Anon., 2002
	Cretan Sea						
1994-2000	F: 41 M: 35	F: 0.76 M: 0.91	F: 3.8 M: 4.06	F: 2.63 M: 2.66	F: 1.17 M: 1.4	F: 0.69 M: 0.66	Anon., 2002

Pagellus erythrinus

Year	Ionian Sea						
	L_∞ (cm)	k	Z	F	M	E	Source
1994-2000	37.64	0.17	1.02	0.71	0.31	0.70	Anon., 2002
	Cretan Sea						
1994-2000	35.5	0.156	0.86	0.53	0.33	0.61	Anon., 2002

From these tables, it seems that the most heavily exploited stock is hake in the Ionian Sea, followed by the stock of red pandora and red mullet in the same area (GSA 20). The lowest exploitation level was estimated for Norway lobster both in the Ionian and the Aegean Sea, and its stocks could be characterized fully exploited. Concerning the rest of the studied stocks they were found to be in an intermediate state of exploitation.

CAP. 3 - MAPPING THE NURSERY AREAS BY SPECIES AND BY GEOGRAPHICAL SUB-AREAS

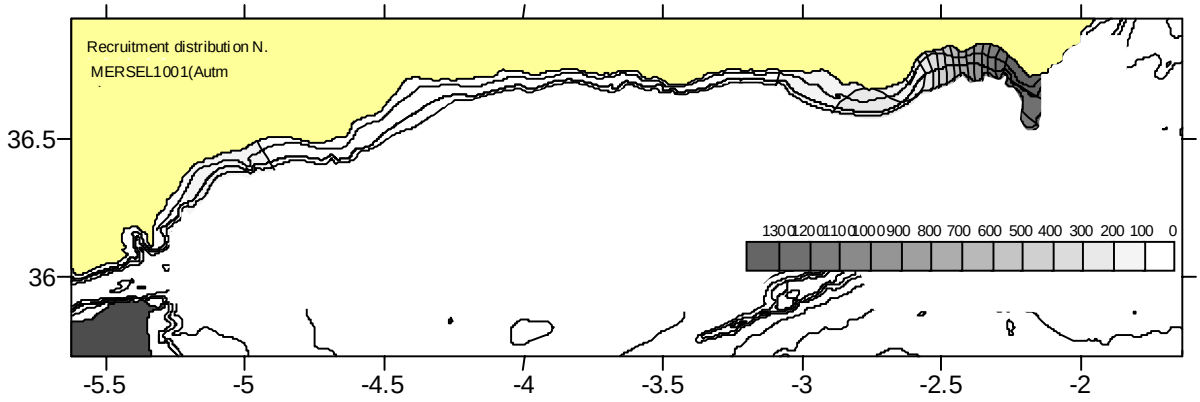
SPAIN

GSA 1 - ALBORAN SEA

Nurseries areas boundaries have been well defined in the Alboran unit. The target species like hake and red mullet showed a very constant geometry and geographical allocation in time.

1 - Mullus barbatus

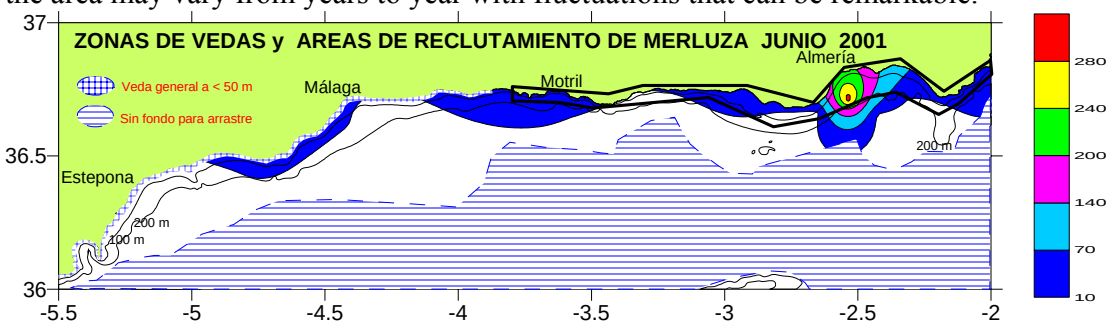
All coastal sandy and muddy bottoms within 50 m depth constitute nursery areas for red mullet in autumn (October-November) at the time of recruitment to the bottom in the GSA 1.
Recruitment appear mainly in the eastern area (Almería province) due to abundance of sandy and muddy bottoms and, probably, upwelling success related to a great canyon present in this area.

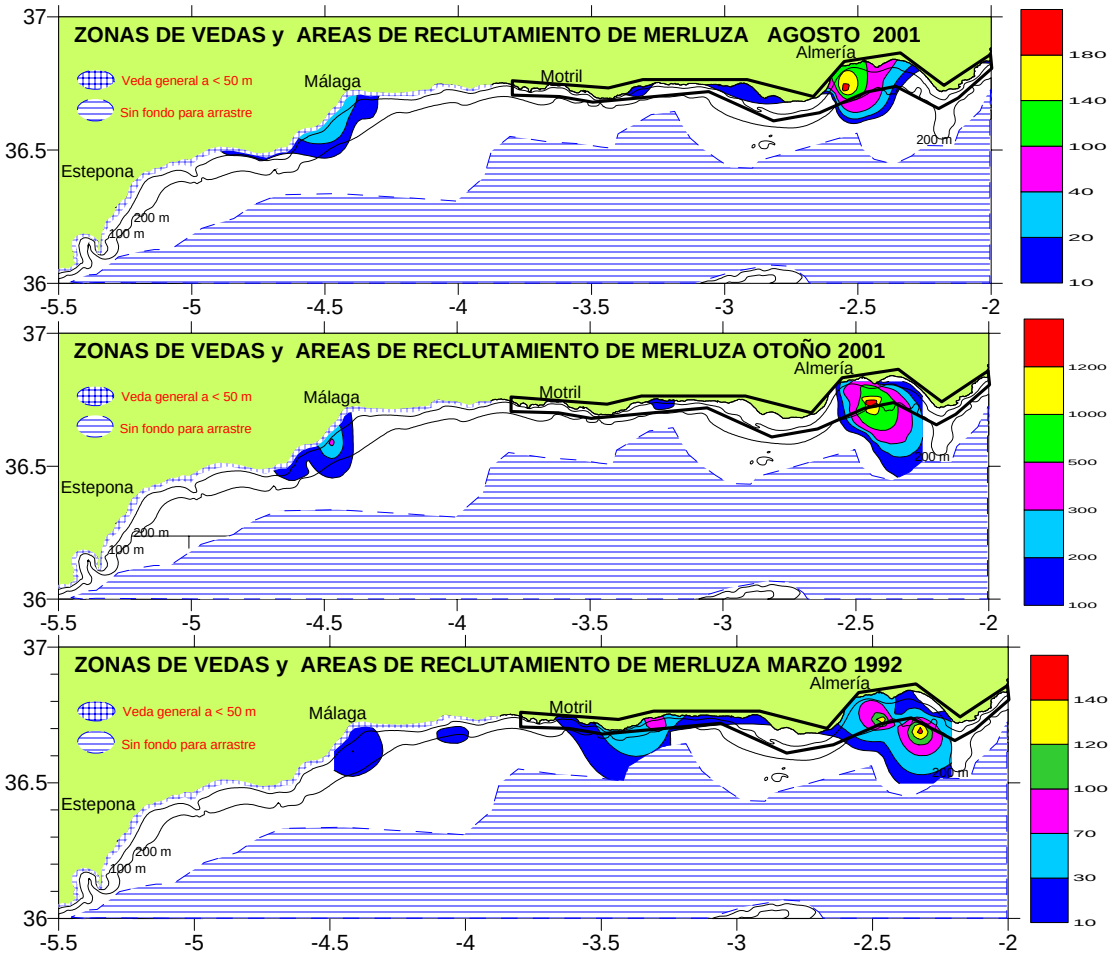


Abundance recruits distribution (individuals/hour) in autumn of 2001. (MERSEL 1001). (Source I.E.O.)

2 - Merluccius merluccius

They are located in the 50-180 m bathymetric range. The abundance of juveniles (< 17 cm LT) in the area may vary from years to year with fluctuations that can be remarkable.



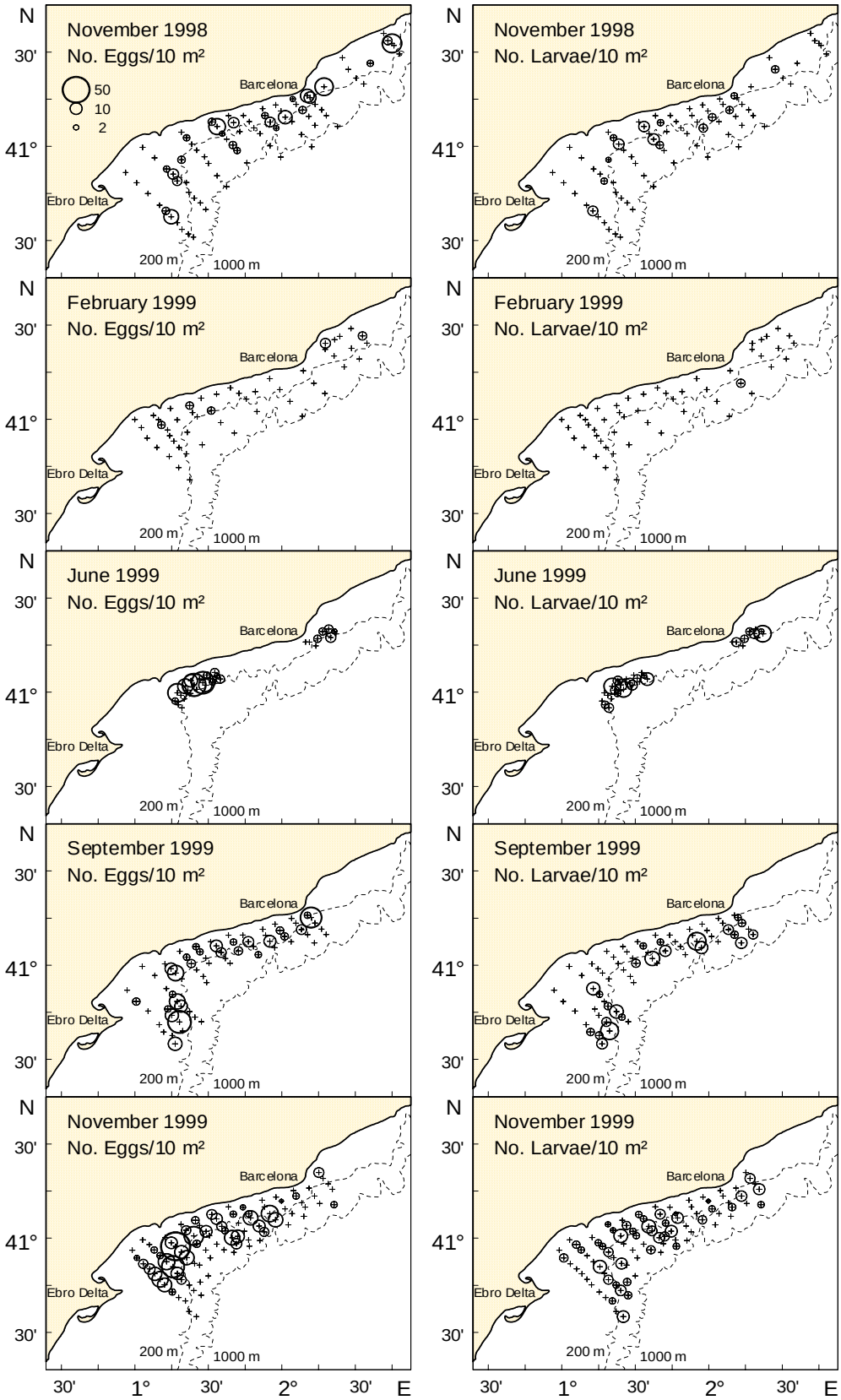


Distribution patterns of eggs and larval stages of hake in the Catalan coast (GSA 6)

The abundance (n/h) of hake recruits (< 17 cm LT) along Alboran coast showed a great concentration in the Bay of Almeria during all the seasons. The most important recruitment appears in autumn with 1300 n/h in front of Roquetas (west side Bay of Almeria).

Based on gonadal studies (*Recasens et al*., 1998) and the egg and larval distribution (*Olivar et al.*, 2003), it can be concluded that *Merluccius merluccius* has a protracted spawning period in the Catalan Sea (NW Mediterranean sea). Eggs and larvae appeared mainly in late spring, summer and autumn surveys and were very scarce in winter. *Merluccius merluccius* egg and larvae were mainly distributed over the continental shelf, with peak abundance between the 100 m isobath and the edge of the shelf. Winter can be regarded as a resting period for a large proportion of the population.

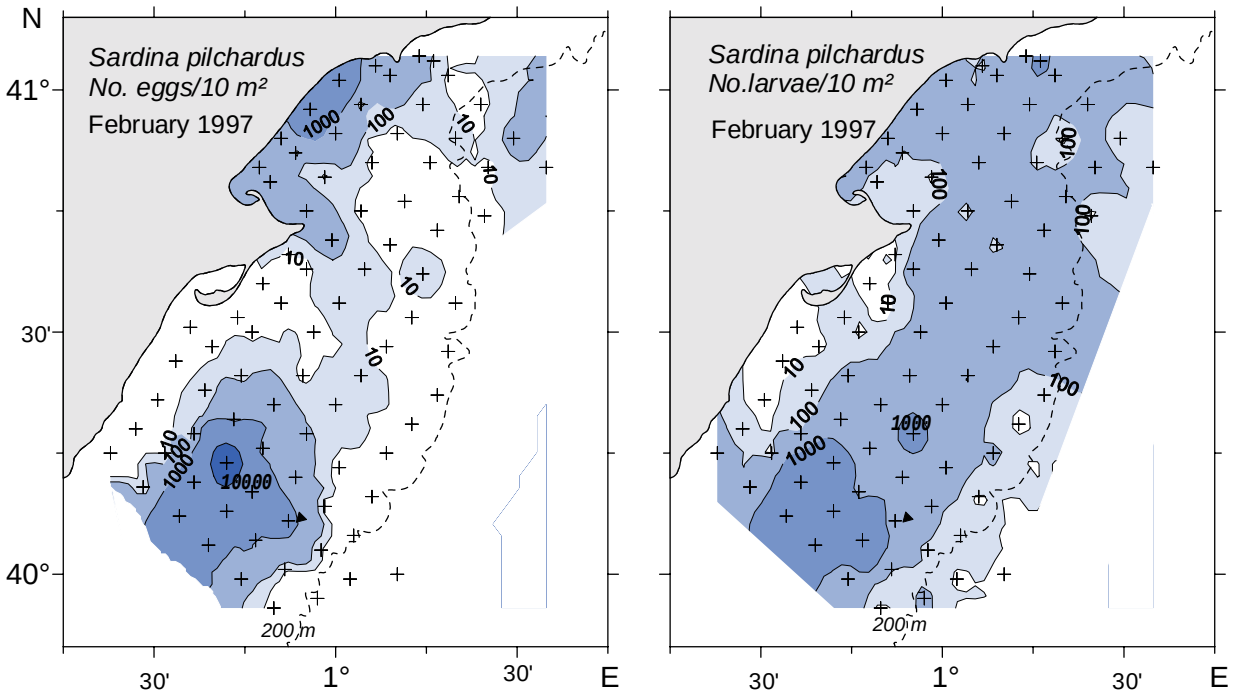
Merluccius merluccius



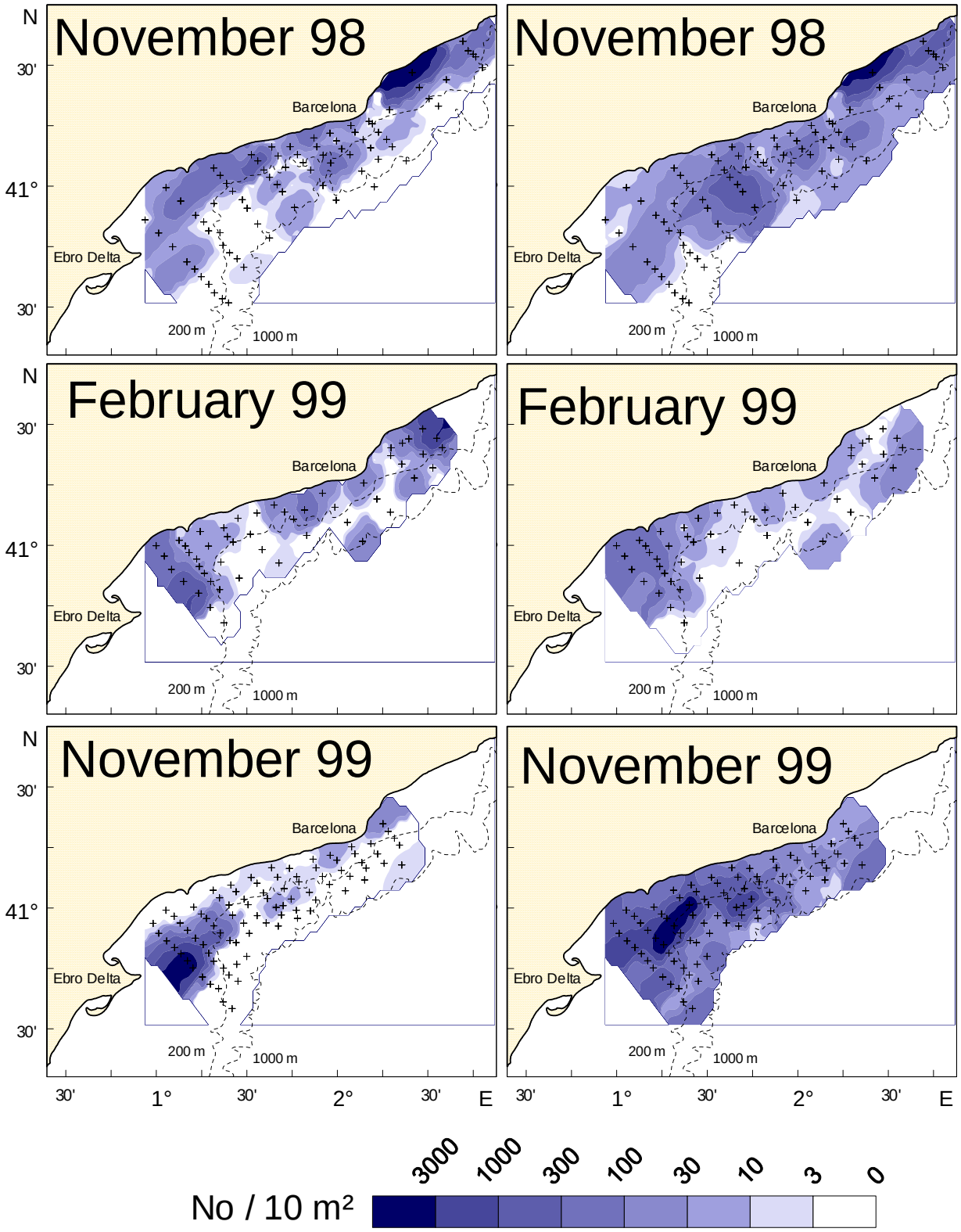
Distribution patterns of eggs and larval stages of pilchard in the Catalan coast

3 - Sardina pilchardus

Eggs and larvae of *Sardina pilchardus* appeared from October to May (*Palomera and Olivar*, 1996). As a general rule, pilchard eggs were collected on the continental shelf, while larvae displayed a wider cross-shelf distribution (*Olivar et al.* 2001).



EGGS *Sardina pilchardus* LARVAE



FRANCE

GSA 7 - GULF OF LIONS

Using the data from trawl surveys, sampling activities in the landing ports, observations on board of professional trawlers and on the beach seines catches, and experimental catches with a small meshsize trawl, it is possible to have an idea of the seasonal distribution and abundance of the juveniles (ages 0 and 1) of several species of commercial importance in the Gulf of Lions.
The 3 miles coastal zone has often been considered as a nursery area for the juveniles of the various fish species of the Gulf of Lions. However the data available for several of these species show that their juveniles can be concentrated in more offshore areas, or migrate seasonally from the coast to the edge of the continental shelf.

1 - Merluccius merluccius
The hake is very large spread on the continental shelf and slope of the Gulf of Lions. All age classes can be observed from the coast to 800 m depth. Age 0 group is particularly abundant in the catches from June to November, 80% of this catches coming from areas 100 to 150m depth (i.e. outside the 12 miles zone under national jurisdiction). Age 1 group is also dominant in the same area, but it exists also within the 3 miles coastal zone.

2 - Mullus barbatus and M. surmuletus
Age group 0 of these two species is very abundant within the 3 miles coastal zone. Young *Mullus barbatus* live essentially in the western part of the Gulf of Lions, while young *Mullus surmuletus* can be found all along the coastline.

3 - Lophius budegassa and L. piscatorius
L. budegassa juveniles (age 0) can be found on the 80 to 150 m depth bottoms and their density seems to be uniform all over the continental shelf.
L. piscatorius is less abundant than *L. budegassa*. Some juveniles of this species (age groups 0 and 1) can be found in the area situated between 6 and 12 miles from the seashore.

4 - Eutrigla gurnardus
Young individuals of this species (age 0) are especially abundant during the fall, from 6 miles from the coast to the edge of the shelf. Age 1 is caught regularly by the trawlers from 12 miles up to the continental slope of the Gulf of Lions.

5 - Zeus faber
Age 0 individuals of this species are generally caught only in the very offshore parts of the Gulf. Age 1 and 2 fishes are widespread all over the shelf and the edge of the slope.

6 - Pagellus acarne and P. erythrinus
Age 0 and 1 individuals of these two species live essentially in the very coastal area, within the 3 miles zone, all along the coastline of the Gulf.

7 - Solea vulgaris
Age 0 young sole live essentially in the areas very close to the shore (until 10-15m depth) and in the coastal lagoons. Small individuals of this species have never been found farer than 3 miles from the coast. Age 1 fishes are more widespread and can be found until 12 miles offshore, but this group is mainly abundant within the 3 miles, all over the year.

8 - Dicentrarchus labrax
Age 0 and 1 of sea bass are essentially present on the very narrow coastal area, within the 3 miles zone, and in the coastal lagoons

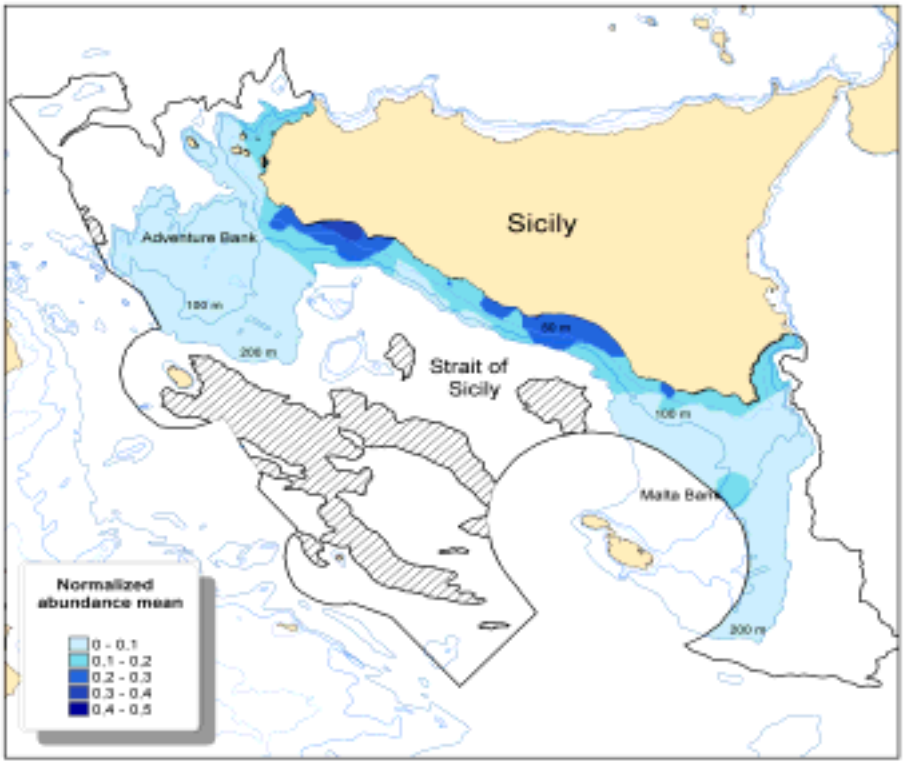
9 - Sparus aurata
Age 0 sea breams live in the coastal lagoons and in the very inshore waters of the Gulf of Lions. From the landings of the trawlers and the small scale boats, it seems that the young sea breams are never encountered offshore. High catches of age 1 group occur in the 3 miles zone in autumn during the spawning migrations from the lagoon to the open sea, and in spring during the trophic migration from sea to lagoons.

ITALY

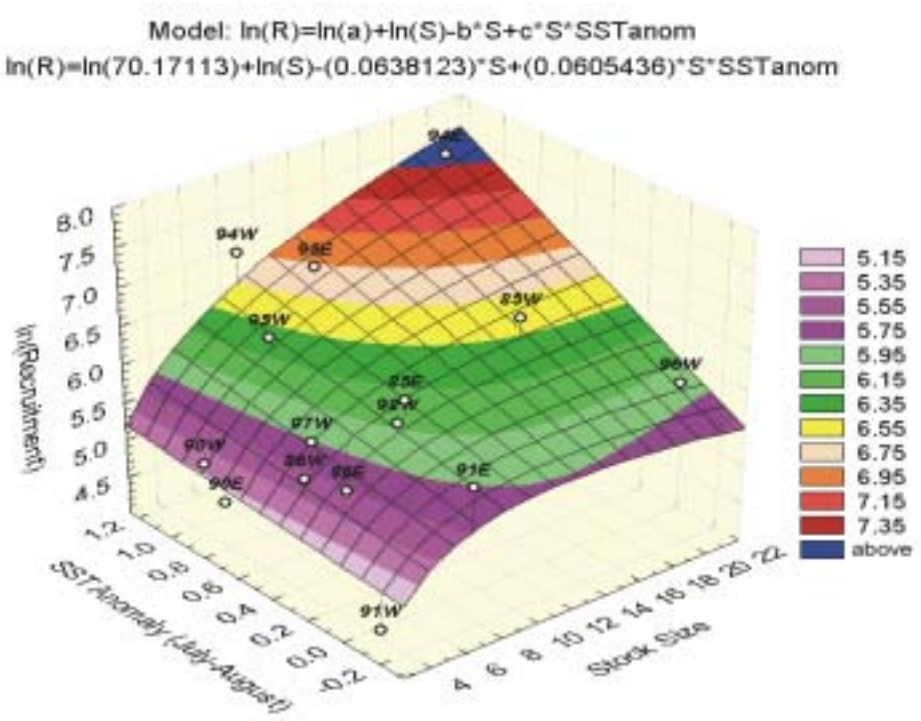
GSA 16 – STRAIT OF SICILY

1 - Mullus barbatus

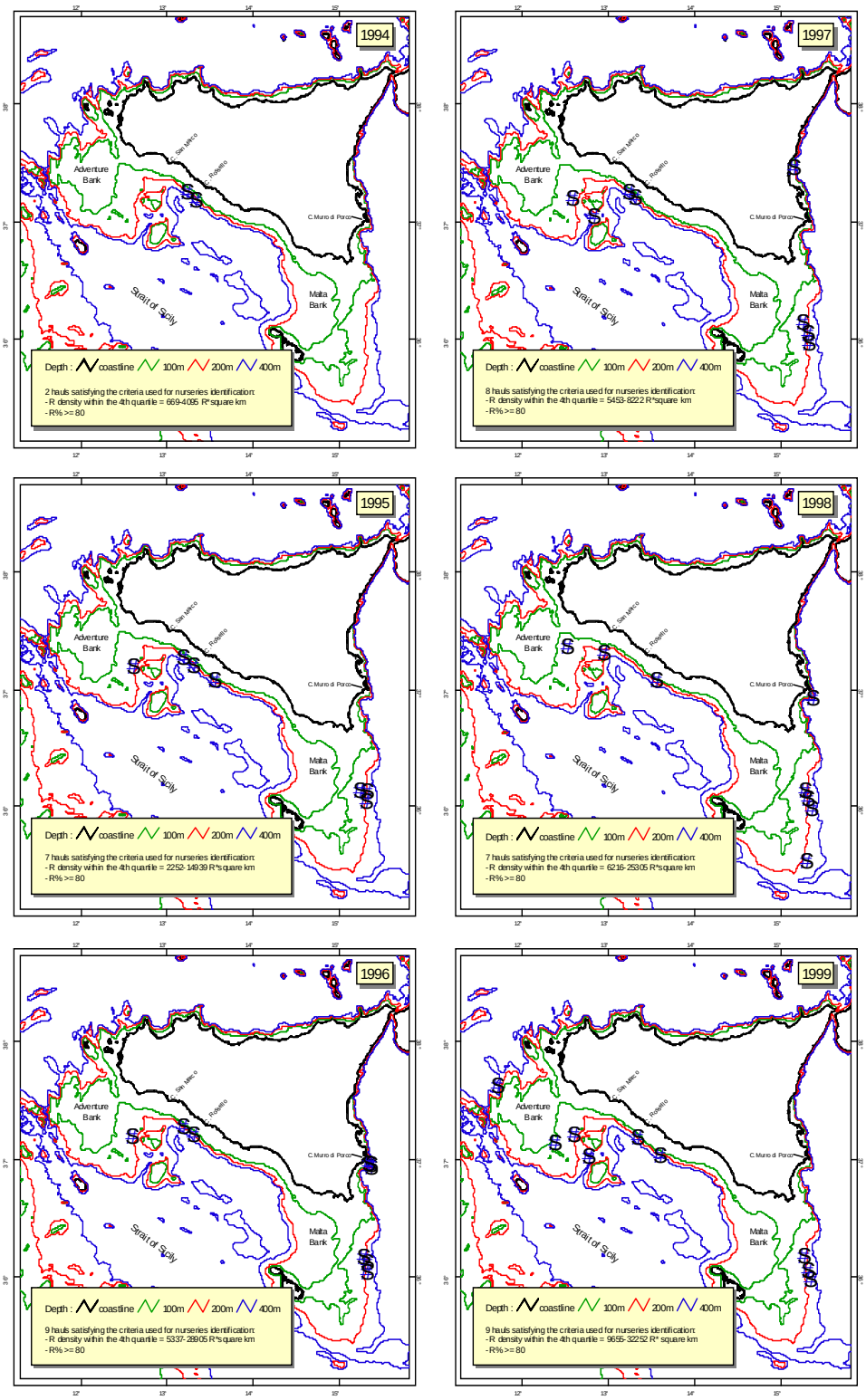
The spatio-temporal distribution and abundance of Red mullet recruits (0 group) in the Strait of Sicily was studied, on the basis of autumn GRUND trawl surveys (*Garofalo et al.,* 2002).
Although recruits exhibited a widespread distribution throughout the coastal waters, 4 main areas showing high abundance and almost exclusively presence of recruits was found within GSA 15 (Southern coast of Sicily), between 20 and 50 m depth.
Recently Levi et al. (2003) investigated the stock-recruitment relationship for Red mullet (*Mullus barbatus*) in the Strait of Sicily, including environmental information in terms of sea surface temperature (SST) anomaly as a proxy for oceanographic processes affecting recruitment. Results showed that, for a given level of spawning stock, higher level of recruitment corresponded to warmer than average SST during the early life stages.



Map of the average distribution pattern of Mullus barbatus recruits. The contour of the overall study area and the water depth of more than 800 m (black shaded) are also shown (mainly GSA16) (*from Garofalo et al., 2002****).***



Stock-recruitment relationship including surface sea water anomalies of Mullus barbatus in the Strait of Sicily (*from Levi et al., 2003****).***



Areas showing presence of recruits of P.longirostris throughout the 1994-1999 period (*from Fiorentino et al., 2002****).***

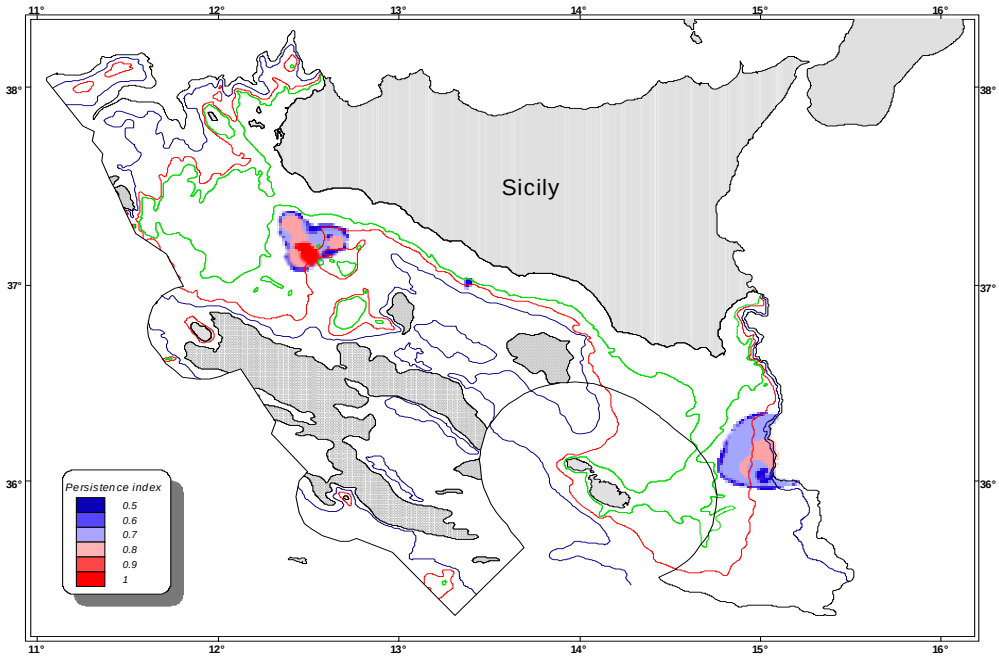
2 –Parapenaeus longirostris

A preliminary geographical representation of nurseries in the northern side of the Strait was given by *Fiorentino et al.* (2002), within the MEDITS framework. The hauls characterized by the co-occurrence of high density (density index of recruits belonging to the 4th quantile) and exclusive presence (i.e. recruits were equal or higher than 80%.of *P. longirostris* number per km^2) of recruits in the GSA 16 (Sicilian side of the Strait of Sicily) by year are shown in figure.

Over the whole period (1994-1999), 43 over 336 hauls satisfied the co-occurrence criterion. The variability among years in position of nurseries was low. One important nursery was located off Capo Rossetto, in the western-central part of the area, another in the Eastern side of the Malta Bank, close to 200 m depth.

3 – Merluccius merluccius

Recently studies aimed to identify areas in which hake recruits (0 group) were exclusively and consistently found in a time series of 6 years (*Fiorentino et al.*, 2002).



Areas showing stable presence of recruits of M. merluccius, between 1994 and 1999. The index of persistence ranges between 0 and 1, where 1 indicates stable nursery and 0 complete lack of nursery. Visualization was restricted to persistence index of 0.5 or more (GSA 15 and 16) (*from Fiorentino et al., 2002****).***

Although some inter-annual variability in the nurseries distribution was evident, two stable areas for M. merluccius could be identified, which are probably connected with the presence

of meso-scale oceanographical processes (*Garcia la Fuente et al.,* 2002). These nurseries were located on the eastern side of the Adventure and Malta banks, between 100 and 200m depth. It is noteworthy that hake recruitment resulted significantly correlated with that of Greater fork beard (*Phycis blennoides*), the strongest recruitment of both species occurring in 1998 and 1999.

GSA 17 – NORTHERN AND CENTRAL ADRIATIC SEA

The Northern Adriatic sea (North of Rimini) is the main spawning area of the species. Spawning occurs in winter months, from November until March (*Piccinetti and Giovanardi,* 1984). In spring, recruits concentrate inside the coastal areas and lagoons of the northern Adriatic. They grow there until the end of summer, when a consistent migration occurs from the North to the South of the western Adriatic coast inside an area extending until 5-6 miles offshore. In fall, when the coastal water temperature decreases, soles migrate towards the deeper and warmer waters offshore (*Froglia,* 1984; *Giovanardi,* 1984; *Piccinetti and Giovanardi,* 1984; *Pagotto and Piccinetti*, 1988; *Froglia,* 1993).

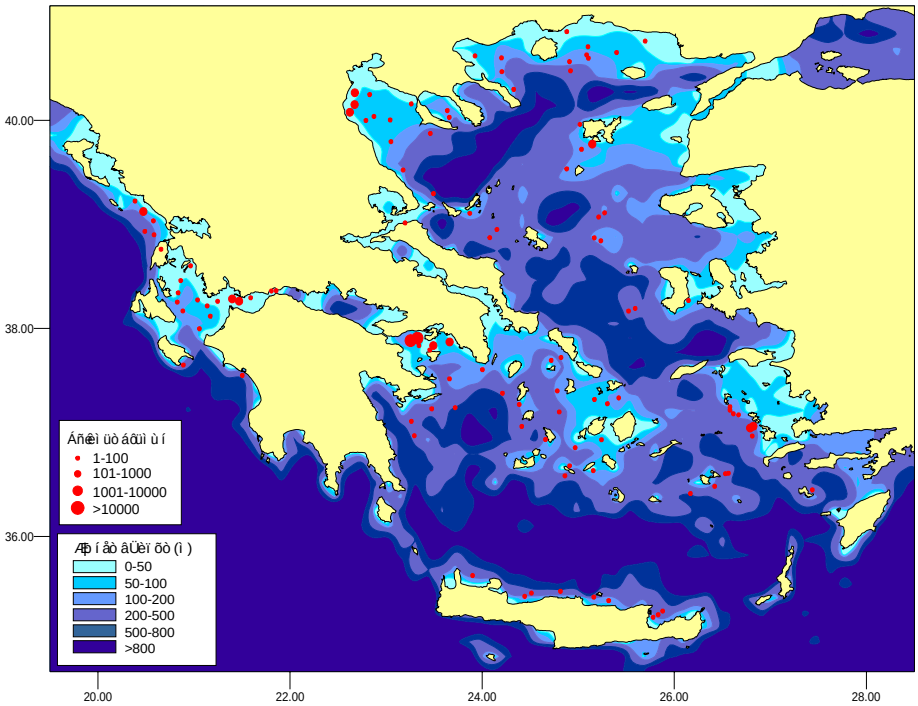
GREECE

Information on the nursery grounds of certain demersal species is available from the MEDITS surveys as well as from other trawl surveys conducted in the past in the Aegean and Ionian Seas. However, the results presented here should be considered with caution because factors such as timing and frequency of surveys, spatial sampling design and gear/mesh size used may affect the outcome and subsequent interpretations. There is a general impression that juvenile specimens of most exploited species do no have (or have very few) consistent, spatially localized spawning grounds. The juveniles tend to occur in almost all areas where adults are distributed, but their bathymetric range lies in the shallower range of the species distribution.

GSA 20, 22, 23 – IONIAN, AEGEAN AND CRETAN SEA

1 - Merluccius merluccius

The following map exemplifies the concentration of hake smaller than the minimum landing size (MLS = 20cm) during the MEDITS surveys (GFCM 20, 22, 23). Hake juveniles were found in almost all areas in depths shallower than 500 m with an among-year consistent spot of relatively high concentration in the inner part of Saronikos Gulf, mainly between 50 and 200 m ($23^0$18', $37^0$52').



Map exemplifying areas of increased concentration of Merluccius merluccius juveniles based on the survey MEDITS 2000.

2 - Parapenaeus longirostris

Data from the MEDITS surveys indicate that at least 4 main areas with high and exclusive presence of recruits can consistently be identified in the Greek waters (Fiorentino et al., 2001). The main "nucleus" of hauls was located in the North Aegean, in the Strimonikos Gulf ($24^0$12', $40^0$33') and between Thasos and Samothrace Islands ($25^0$90', $40^0$34'), followed by those placed in the South-eastern Aegean, north of Samos Island (Kusodasi Gulf) ($27^0$10', $37^0$49') and north-westward the Rodes Island ($27^0$33', $36^0$30'). The nurseries were located in a relatively wide depth range from about 50 to 200m.

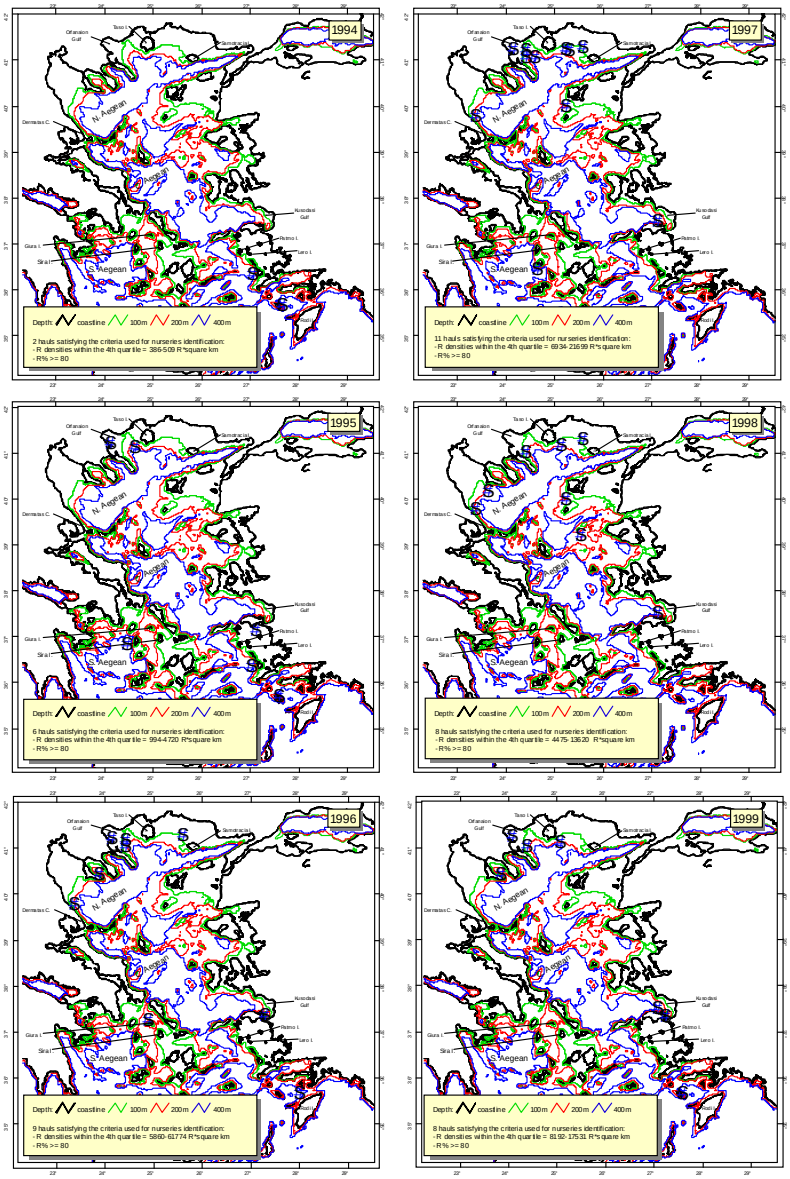


Figure 21 - Nursery location of Deep water rose shrimp in the Management Unit 3.1.a according to the co-occurrence criterion of highest density and exclusive presence of recruits.

3 - Mullus barbatus

Data from the MEDITS project and other national trawl survey projects of short duration were analysed in order to identify the areas of high red mullet juvenile concentrations (Politou et al., 2000). The specimens of size lower than the MLS (11 cm) were considered as juveniles. Overall, the results indicated a high variability among years in the recruitment of red mullet. A common result from all the programs concerned the bathymetric distribution of red mullet juveniles, which were always concentrated in the shallowest waters (mainly <50 m). In the MEDITS project their abundance was underestimated, since summer (when the MEDITS surveys are carried out) was found to be the season with the lowest abundance of juveniles in all areas. Probably, this applies less for the Southern Aegean and mainly the Cretan Sea, where recruitment takes place earlier (July, Tserpes 1996) than in the other areas (autumn). A map with the most important stations (CPUE>30 ind./h) of all projects is given below.

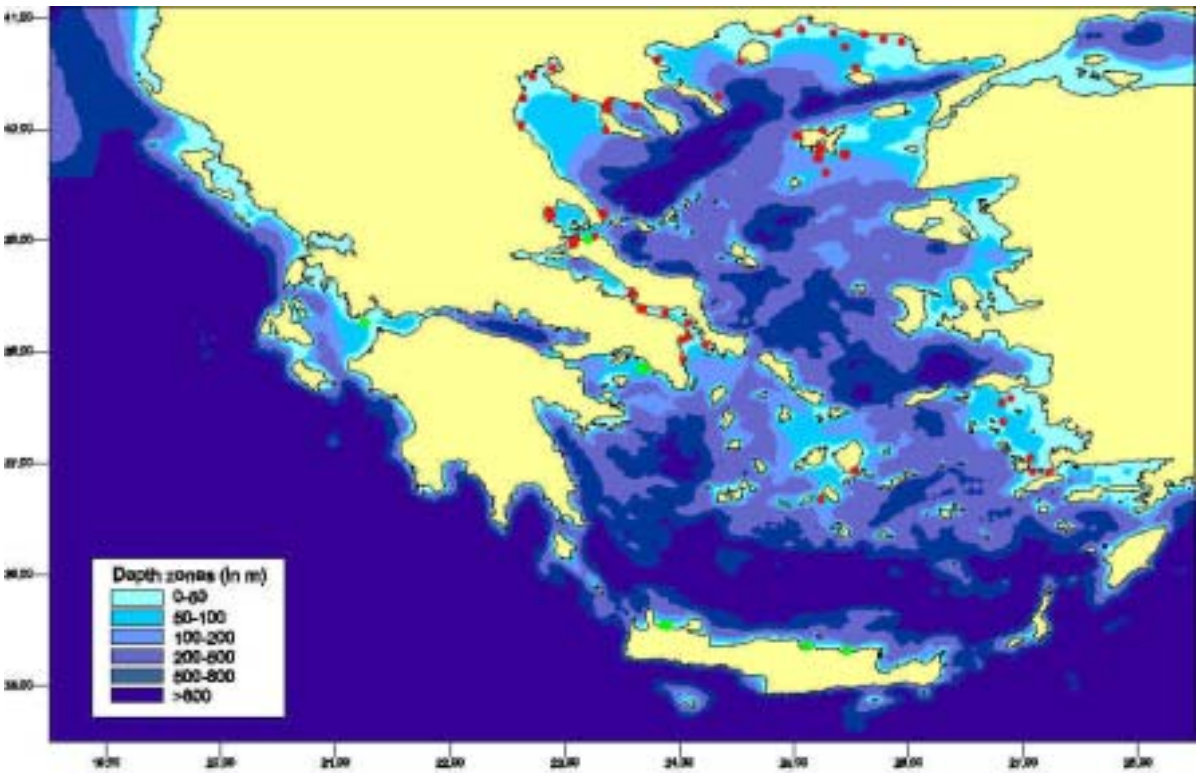


Fig. 6. Map showing the most important stations (CPUE>30 ind./h) of red mullet juveniles concentration from the different projects.
● MEDITS project ● Other projects

4 - Pagellus erythrinus

Data from the MEDITS project and other national trawl survey projects show that undersized specimens of red pandora occur in depths <50 m in most areas and almost all over the year.

CAP. 4 - INTEGRATED VIEW BY FISHERY

FRANCE

It can be said that more or less 90% of the total Mediterranean French catch of fishes come from the fishing activity in the Gulf of Lions. This is due to the presence of a large and soft continental shelf in this area, which allow in particular the practice of bottom trawling, this activity being impossible to do along the eastern half of the French coast, which is very rocky and rapidly very deep. A small scale fishery exist too, which exploit the coastal zone and the coastal lagoons bordering the Gulf.

As shown in the previous sections, some indication exists about the status of the resources of the Gulf of Lions.

About the demersal stocks, the available scientific data on the trawl fishery suggest that Maximum Sustainable Yield conditions had probably been passed in 1991 for most demersal species. In general diagnoses of biological full exploitation, or even overexploitation have been obtained and confirmed in an obvious way by the evolution of the rates of production.

In most of the cases a decreasing trend in individual lengths of the fish caught and in the catches per unit of effort of the trawlers can be observed. Generally, the juveniles are under the most important fishing pressure. This results essentially from the fact that the sizes at first catch by trawl are very often similar to those at which fishes recruit in the fishery. The artisanal fleets affect more the adult population, even though there is some degree of overlap.

However, in most of the cases if growth overfishing is an evidence, it seems that up to now the resources are not affected by recruitment overfishing. In fact we have to recognize the durability of several stocks which exploitation is essentially based on massive catches of juveniles from many years. This situation could be explained with an hypothesis of a good stock-recruitment relationship for low levels of spawning stock biomasses. Another hypothesis is that some large adults seem to be spared from fishing activities because they are suspected to live within local ‘refugia’ away from the traditional fishing areas, at least during a large part of the year, which protect a small proportion of the spawning stocks.

Regarding the small pelagics, it seems that there is a unique anchovy stock for the French Gulf of Lions and the Spanish Catalunya. Biomass and abundance data obtained by direct methods from French and Spanish surveys have to be analysed jointly. The biomass of anchovy of this stock has shown an increasing trend during the recent years. The catchability of the species varies in time, as well as the size of the recruitment, which seems to be extremely variable from one year to another. Taking into account the high level of biomass available at this time and the relatively low catches on this stock, no diminution of fishing effort has to be recommended.

For the sardine stock of the Gulf of Lions, the results of the acoustic surveys have shown a decreasing trend of the biomass available during the summer. However, the catch of sardine of the French fleet is estimated to be not greater than 50% of the biomass available to the exploitation. The status of the sardine stock is considered as good, even if a decrease in the average size of the fish landed during the recent years let think about some possible growth overfishing

ITALY

GSA 16 – SICILIAN STRAIT

Levi (1990) applied a surplus production model to the aggregate of demersal species of Sicily Strait and adjacent areas. Data consisted of the Italian official statistics, from 1959 to 1983. Since catch data are given without distinguishing fishing gear, catches were obtained summing all species vulnerable to trawling. Effort was expressed as fleet capacity in overall gross tonnage of trawlers in the area, since no effective measures of fishing time were available. Results showed that capacity of fleet fishing in the Strait of Sicily, corresponding to the maximum sustainable yield for all demersal species, was overcome during the late seventies – early eighties. A first evident sign of sufferance of the demersal resources on the northern side of the Strait of Sicily resulted from the analysis of the catch rate of commercial species from seventies onwards. Considering the aggregate of demersal resources, which deep water shrimps represent the main fraction of, catch per hour trawling along the upper slope decreased from about 30-40 kg in early seventies to 10-20 kg in late nineties (*Levi et al*., 2001). A further signal of over-fishing could arise from the analyses of the discard practices in the Mazara fleet. During the last ten years many species once discarded, such as *Chlorophtalmus agassizi*, *Argentina sphyraena* and the small sized shrimp of genus *Plesionika,* are now landed (Anon., 2000). More in detail from 1996 to 2000, the percentage of the total catch of Mazara trawlers, which was discarded, decreased from 50 % to 20 %. This trend became more relevant considering that in middle eighties discard in the area consisted of about 60-70 % of the trawler catches (*Levi et al.,* 2001).

Although the overall picture of sufferance of the demersal resources, it must be stated the existence of areas positioned in the offshore western (GSA 16) and easternmost sector (GSA 15). According to recent data, the indices of abundance derived from these areas resulted remarkably higher than the zones closest to the coast and the central ones. The area sited in the easternmost sector (south-eastern part of Malta Bank) could be positively affected by the existence of the large Maltese Exclusive Fishing Zone (MEFZ), in which the trawling is very limited in effort (only 12 trawlers in about 35000 km^2) and target almost exclusively red shrimp.

Concerning the area placed on the westernmost sector (South western part of Adventure Bank), it is worth noting a progressive reduction of fishing effort in the last 10 years, due to both the reduction of capacity policy, followed by the Italian Government and to the displacement towards more distant fishing-grounds of Mazara trawlers.

Other and highly productive areas could be identified in the other GSA exploited by the Mazara trawlers (GSA 12, 13,14 and 21). The fishing pressure on these bottoms is increased in the last years. The importance of monitoring the change in fish assemblages and demography on these areas have to be stressed.

GSA 17 – NOTHERN AND CENTRAL ADRIATIC SEA

1 – Engraulis encrasicolus and Sardina pilchardus

Although overfishing is thought not to be the primary cause of the anchovy collapse of 1987, it remains true that the levels of recruitment following the 1987 have not yet risen to the previous higher levels. Given this situation and considering also the current levels of catches (around 20%

of biomass) and the slight increase of the biomass in 2000-2002, it would be unwise for fishing effort to be allowed to rise.
About sardine, since decline of stock biomass is observed after the peak in the first half of 1980s, and the lowest values of this series correspond just to recent years, it would be unwise for fishing effort to be allowed to rise. An apparent increase in estimated biomass is observed in the last year, 2002: caution has to be taken when considering this, as VPA may have difficulties with incomplete cohorts; in addition, change in discarding phenomenon (particularly for small size sardines) could play a role in such an apparent increase. So, monitoring of discarded quantities as well as pattern as a function of sardine size is also suggested.
Because the fish market preference is opposite in the two Adriatic coastline (e.g. anchovies are more appreciate in Italy, while sardines are more requested in eastern Adriatic countries, market strategies it is recommended to increase the human consumption of sardine and to reduce both the discards of sardine at sea.

2 - Solea vulgaris

In Italy, management rules for gillnet fishery targeting common sole are the same applied to all the set nets and concern height and length of the net (EC reg. 1626/94), while rapido trawl fishery is managed by the same national rules applied to bottom and pelagic trawling and concerning spatial limitations (fishery is banned inside the 3 miles offshore or 50 m depth), time limitations (fishing ban on Saturday and Sunday and fishing ban for about 45 days in summer), as well as codend minimum mesh size (40 mm). As concerns this latter fishery, no specific rules exist regarding, for example, size and number of rapido as well as the number of vessels devoted to this fishing activity, even though the two former aspects are sometimes regulated at local level through agreements among fishermen. In spite of this and of the increment of the applied fishing effort occurred in the last decade, total landings and LPUEs of sole do not show, at present, decreasing trends, so allowing to think that the resource is not particularly suffering for the current exploitation level. On the other hand, it is necessary to take into account that in the GSA17 the Italian catches include large portions of juveniles and, hence, are strictly dependent on the annual recruitment. This can be mainly a consequence of the distribution of the species in the area where adults are mainly concentrated on the eastern side and juveniles on the western one. Therefore, the current situation of the Italian Adriatic fisheries might be likely due to the occurrence of adults in a few unexploited grounds, as well as to the relatively low fishing effort applied by the eastern countries. Nevertheless, on the basis of these considerations and of the lack of data stock assessment, attention should be suggested in order to prevent negative consequences which might be derive from a further increase of the fishing effort, both by Italy and by the other countries, either in terms of fleets, gears and exploited fishing grounds.

GREECE

1 - Bottom trawl fisheries

The continental shelf in Greece is generally narrow, except in the northern Aegean Sea, hence, bottom trawl fishing grounds are relatively restricted. The main target species are hake, red mullets, shrimps, nephrops, cephalopods etc. There are no reliable assessments for these species and there are concerns about the quality of catch statistics data. There is a general impression in both scientists and fishermen that the stocks of some target species (e.g. hake, nephrops) have declined. For example, the nephrops catches, during 1990-2000 have been reduced from 1606 tons to 265 tons (total Greek catch, according to the data of the National Statistical Service of Greece). However, this is not true for all the demersal stocks. For example, red mullet (a very important species for this fishery) is in a stable situation over the last 6 years.

According to data of the Ministry of Agriculture, there is a declining trend in the number of bottom trawlers (approximately 18% during 1991-2003). The main reason for such a reduction is the decrease of the catches (and income) that led many vessel owners to exploit the decommission scheme of the MAGP projects.

This fishing sector is expected to be under higher pressure because of the implementation of the measures of the 1626/94 Council Regulation and the enforcement of the VMS. The short term or long term effects of these measures have not been evaluated. There are serious concerns about the future of the sector in the capacity level that currently exists.

Mid-water trawling is forbidden in Greece. However, during the last years in the North Aegean Sea, bottom trawls are targeting to anchovy operating the gear in middle waters. This creates a conflict with purse seines and additional problems in the assessment of anchovy.

There is no TAC management in Greece and the managing of the fishery is directed to effort control (license system, closed seasons) and closed areas.

2 - Purse seine fisheries

The purse seine vessels in Greece are divided in two categories: Those that operate during the night and those that operate during the day.

The main target species of the purse seines operating during the night are the anchovy, sardine, chub mackerel, bogue and horse mackerels. The species that is mainly supporting the income of this sector is anchovy and its robustness depends on the state of the anchovy stocks. There are indications (scientific data, catch data) that the stock biomass of anchovy and sardine during the last years has been declining and the mean landing size is decreasing. However, maybe the anchovy stock is recovering. During 2003 the catches of the species were increased.

The main target species of the purse seines operating during the day are migratory pelagic species like *Sarda sarda, Caranx spp, Seriola dumerili, Argyrosomus regius*. There are no data available related to the operation of the gear, the catch composition, CPUE etc. Fishing is prohibited during July-August. There are many complains of the small scale fishermen for this kind of fishing. They consider the operation of the gear as harmful and they claim that operates in shallow waters targeting demersal species.

The number of vessels has been reduced approximately 12% during 1991-2003 according to the data of the Ministry of Agriculture for reasons similar to those of bottom trawl fleet.

There is no TAC management in Greece and the managing of the fishery is directed to effort control (license system, closed seasons).

3 - Small scale fisheries

The small scale fisheries sector in Greece is extremely large. The number of vessels is about 19000 (according to the data of the Ministry of Agriculture), representing 90% in terms of vessel number and 64% in terms of engine power of the total fleet.

Recorded information about the small scale métiers is extremely limited. With the exception of certain vessels involved in large pelagic fisheries on a regular basis, the remaining vessels use several gears, targeting different species. The common practice is to shift métiers in the course of the year depending on the availability of different species in each specific area. For some métiers there are no data at all. The strong local peculiarities of the practiced métiers complicate data collection on species composition, size composition, discarding practices and effort allocation to métiers and/or target species.

The small scale fisheries mainly target demersal species thus there is a strong competition with bottom trawling concerning the resources and fishing grounds. In some areas there is competition (much lower) with purse seining. No assessment exists on the fishing mortality that the small scale fishery activity is producing to the demersal stocks. For example, hake is fished by bottom trawls, gillnets and long lines. Each gear catches different size classes but there is no assessment of the mortality that each gear produce to the different age classes.

All small scale fisheries métiers are generally species and size selective, at least much more than bottom trawling. However, they can operate over any kind of substrate, so they leave no natural refuges for the target species. The technological improvement in electronic equipment and vessel capacity facilitated the detection of species-specific localized habitats, resulting in the intensive exploitation of certain species (e.g. wreckfish, blackspot seabream).

Many of the owners of the small scale fishery vessels have other professional activities (mainly in agriculture or in tourism). Thus, not all vessels display full fishing activity. This complicates the assessment of the fishery through a sampling scheme, because the parameter fishing activity has to be assessed.

4 - Large pelagic fisheries

The large pelagic fishery is controlled through a special licence system and, for the swordfish, it is closed by law from the 1st of October to the 31st of January. the fleets exploit mainly the Aegean, Ionian and Cretan seas but seasonally extend their activities to the levantine basin. information about the main large pelagic fisheries, such as bluefin tuna and swordfish, is gathered in the latest years in the frames of different european and/or national programs and the relative data have been made available to ICCAT for the needs of assessment studies.

MEDITERRANEAN LARGE PELAGIC SPECIES FISHERIES: GENERAL COMMENTS

As concerns the large pelagic species Mediterranean fisheries, the general overview are usually provided by ICCAT, where all the European scientists concerned provide their contribution, taking into account the fact that all the species included in this category (bluefin tuna, albacore, bullet tuna, bonito, swordfish, Mediterranean spearfish, etc.) are shared resources and have a large distribution.

All the recommendations and comments provided by SGMED in 2002 are still valid, but it is necessary to add something about the Mediterranean swordfish.

As stated by SGMED in 2002, the Joint Expert Group ICCAT/GFCM provided to carry on the stock assessment of the Mediterranean swordfish. The stock assessment, which included also the analysis of the Spanish data, confirmed the conclusions reported in the SGMED 2002 report. As

a matter of fact, the Mediterranean swordfish stock appears stable in the last 15 years, with strong a recruitment in several years. This doesn't necessary mean that the stock is healthy, because it was not possible to get the necessary data to define the pristine original population. As a consequence, all the previous recommendations remain valid and supported by ICCAT, particularly those targeting to protect the juveniles and including the time closure in autumn.
Following the last ICCAT overview of the Mediterranean large pelagic species, it is necessary to improve the data collection for several species (bullet tuna, Mediterranean spearfish and other minor species), currently not included in the samplings, with the purpose to try to understand the *status* of the populations.

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SECTION C - GEAR TECHNOLOGY AND SELECTIVITY

CAP.1 - OVERVIEW OF SELECTIVITY PROBLEMS IN MEDITERRANEAN

Mediterranean fisheries are notable for the large number and variety of commercially important species caught and the range of fishing methods employed (P.A.M Stewart, 2001). Juveniles capture, discards and incidental catches are problems of fishing gear selectivity and to a certain extent problems of effort. Juveniles catch concern mainly the hake trawling fishery, red mullet trawling, the bluefin tuna fishery, swordfish longlining, and for some part and some areas the *Sparidae* fishery (*Sparus aurata, Diplodus annularis, Pagellus bogoraveo* and small pelagic beach seining.

Protected species are: marine mammals, turtles, birds, some elasmobranchs, *Posidonia.*

Until recently, most of the selectivity studies were carried out rather for describing gear selectivity than for seeking solutions to improve the selectivity.

CAP.2 - SELECTIVITY REVIEW

This section presents a review, for each fishing method, of technical parameters and devices which can interfere with the selectivity process with reference to experimental results in Mediterranean and elsewhere.

2.1. Bottom trawling

In Mediterranean bottom trawling two main types of gears can be distinguished, i.e.:

Two-panel/face trawls designed for the capture of benthic animals living close to the bottom, such as flatfish, red mullet and shrimp in particular but also demersal fishes as hake. Most of the traditional Mediterranean trawls belong to this type, including the Italian "volantina" or the Spanish "huelvano", with a vertical opening which, in general, does not exceed 2 meters. New models of two-face trawls allow a higher vertical opening reaching up to 5 meters, often called "semi-pelagic" trawls or "rete francese";

Four-panel/faces trawls normally having a very high vertical opening commonly reaching up to 10m. These trawls are mostly used for catching mid-water/pelagic species but can also be applied close to the bottom for targeting demersal fish.

Bottom trawling is known for its high fishing capacity, in terms of number of fish species and quantities caught. In general this method has a lower selectivity compared to most other fishing gears. Bottom trawling is frequently blamed for being the main source of discards, having potential severe physical impact on the seabed, dramatically modifying the ecosystem.

Mediterranean bottom trawling is essentially used for a multi-specific production. Bottom trawl fisheries targeting only one species are very rare and, practically, limited to deep shrimp and scampi fisheries and perhaps since some years and in few areas to hake fisheries.

2.2 -Pelagic trawling

For pelagic trawling, a higher vertical opening is used compared to bottom trawling, i.e. 20 ÷25m. This type of trawl is rigged to operate in mid-water for the capture of small pelagic species (sardines, anchovy). This fishery can be carried out either during the day on pelagic schools often situated near to the bottom or during the night on surface schools (mainly in pair trawler configuration) or on scattered fish.

Pelagic trawl nets are mainly used in the Gulf of Lions by the French, in the Northern Adriatic by the Italians ("volanti") and in Tunisia. There is no detailed published or even non-published information available on by-catch in this fishery. Nevertheless, recent observations on commercial catches of French pelagic trawlers operating in the Gulf of Lions showed only

2,3 % of by-catch. On the other hand, since pelagic trawling generally targets small pelagic species, the small size of the mesh in the cod-end, can cause a considerable by-catch of undersized *Gadidae* if the pelagic trawl is towed close to the bottom.

2.2.1 - Trawl selectivity

Trawl selectivity is considered to be mainly determined by **cod-end mesh size**. But several recent studies and visual observations demonstrate that other parameters can be influence the selectivity. These pointed at following factors responsible for bias that can appear in the calculation of selectivity parameters:

- vessel type, hauling technique and towing speed,
- the hydrodynamic shape of trawls,
- filtration or obstruction of the meshes,
- number of meshes in the circumference of extension and cod-end,
- absence or presence of lastridge ropes and their characteristics,
- twine characteristics (material, knot type, twine construction, colour and thickness, single or double, etc.)
- the mesh shape (square, diamond mesh etc.),
- cod-end hanging ratio,
- number of panels for extension and cod-end,
- weight, nature and behaviour of catch itself.

Moreover, fishermen sometimes use different external devices for their fishing operations which may alter the selectivity given by the mesh size; for example round straps fixed transversally around the cod-end to limit its extension or various types of strengthening devices added to reduce risks of rupture of the cod-end as aprons placed under the cod-end or external protecting covers.

2.2.2 - Technical measures

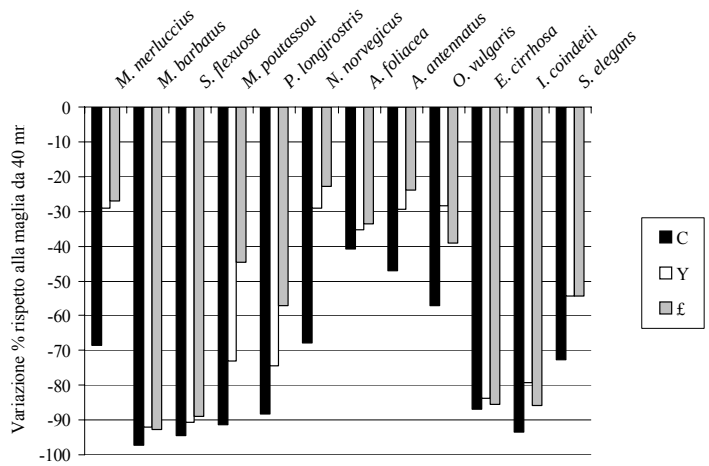
Different options exist to improve the selectivity of trawls. Increasing the **mesh size** has been the most common measure in the technical measures implemented within the CFP.

- Fiorentino and Ragonese (2000) prepared a review of trawl selectivity studies in the Mediterranean for 7 key species. The data presented in that report, giving relationships between and an overview of several selectivity parameters for several Mediterranean species, are given in appendix C-1. The conclusions of the report were:

*The trend of the selection factor in function of mesh size suggests to avoid the traditional relationship L50 = SF * MS for Merluccius merluccius and in Mullus barbatus. According to the results, it is better to use the linear regression calculated in this report for all aspects relative to simulation of mesh change on yield and the state of the stocks for these species. Although no analysis of the predictive power of these regressions were performed, considering that they were calculated on homogenous set of data, we retain them useful to describe or infer selection pattern for these species in the Mediterranean. The authors point out the incongruity between the minimum mesh size for trawling in Mediterranean and the minimum landing size of fish, i.e. 20 cm total length (UE Regulation n 1626 of 27/6/94). A previous minimum size, for example 11 cm TL, adopted by the Italian Republic (Regulation n°1639/68 in order to apply law n 963/65 of) was more coherent with the length of the capture at 25% of 40 mm mesh sized cod-end. To have a minimum length size in the catches for hake equal to 20 cm TL it would need to employ cod-end meshes of at least 60 mm. For other species taken into account in this paper, no clear empirical relationships between the opening of mesh in the cod-end (MS), considered as "control parameter" of technical characteristics of the net and the 50% retention length (L50), the selection range (SR) and*

selection factor (SF), thought as "answer parameters" in the stock. So waiting further studies, the classical assumption on the invariance of SF may be considered valid.

- Along the coasts of the Central Tyrrhenian Sea, *Lembo et al* (2001) carried out in three depth strata, selectivity experiments. The selectivity parameters estimated for *Merluccius merluccius, Mullus barbatus, Parapenaeus longirostris*, and *Octopus vulgaris*, for the 40 mm cod-end gave Lc (length a first capture) values of 79, 89, 14 and 65 mm, and for the 60 mm cod-end Lc values of 155, 132, 20 and 98 mm.
- Inside the GRU.N.D. project (Evaluation of Demersal Resources in the Italian Seas – IV Work programme on Fishery and Aquaculture, years: 1996-1999) a Working Group on Statistical Methods made a first evaluation on the introduction of the measures foreseen by the European regulation (Regulation n° 1626, June 27, 1994). This regulation introduced minimum landing sizes for some fish species, allowing the use of a trawl net with a 40 mm minimum mesh size. The minimum landing size of 200 mm TL for the hake seems, however, to be incompatible with the 40 mm mesh size. The legal mesh size in Italy is 40 mm. Recent selectivity experiments have shown that the size at first capture Lc (87.5 mm) is not suitable to comply with the minimum landing size of 200 mm TL for hake, the species taken as reference for this study. If the mesh size should be increased, the immediate loss and the expected long-term variations in yield have to be evaluated.

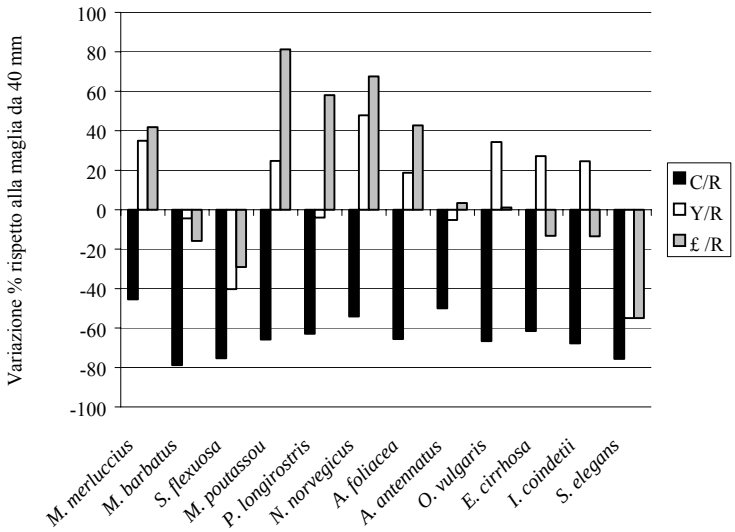


Short term percentage variations concerning the yield in number (C), in weight (Y) and in income (£) changing the mesh size from 40 to 66 mm.

A study was conducted related to this problem based on trawl survey data. It was acknowledged that the results could only give some general indications for the commercial fishery. First of all the theoretical mesh size corresponding to a length of first capture (Lc) of 200 mm was derived by selectivity parameters reported in literature, resulting in a new mesh of 66 mm. Taking this new mesh size as reference points, the Lc and the logistic curve were derived for 12 representative species of the trawl catch composition. Then the catch of 40 mm was corrected with the new probability of retention and the immediate loss in number (C), weight (Y) and value (£) computed. For the 12 considered species, results showed that the overall immediate loss in number (C), in weight (Y) and in income (£) were respectively in the ranges: 41%(*A. foliacea*)-97%(*M. barbatus*); 28% (*O. vulgaris*)-92% (*M. barbatus*); 23% (*N. norvegicus*)-93% (*M. barbatus*).

To estimate the long-term variations an age based forward predictive Thompson & Bell model was employed by using specific growth (constant) and mortality (variable) parameters. The variations were expressed as yield-per-recruit in number (C/R), weight (Y/R) and income

(£/R). As concerns the long term scenario, the variations resulted in a gain for some species such as *M. merluccius* (Y/R=+34.9%; £/R=+41.8%), *A.foliacea* (Y/R=+18.7%; £/R=+42.7%) and *N. norvegicus* (Y/R=+47.8%; £/R=+67.6%) and in a loss only for species such as *M. barbatus* (Y/R=-4.4%; £/R=-15.8%), *S. flexuosa* (Y/R=-40.2%; £/R=-29%) and *S. elegans* (C/R=-75.7%; Y/R=-55%; £/R=-55%).



Long term percentage variations concerning the yield-per-recruit in number (C/R), in weight (Y/R) and in income (£/R) referred to the mesh size of 40 mm.

It has to be stressed, though, that these results apply to the Italian situation and that extrapolation to other areas is speculative.

- An Italian study in the Strait of Sicily (*Ragonese et al*., 2001) compared the selective properties of 5 different cod-end mesh sizes, i.e. 32, 40, 48, 56 and 90mm with deep water red shrimps (*Aristaeomorpha folicea* and *Aristeus antennatus*) as target species. The authors state that the 32 and 40mm cod-ends were not selective at all. The 90 mm cod-end was considered too selective and the other two had intermediate selective properties. On the basis of selectivity experiments, *Ragonese et al.* (1994) reported that all individuals were retained by a 32 mm cod-end and no improvement was observed with a 40mm cod-end. The selectivity parameters for the larger mesh sizes are given in the following table.

Selectivity parameters of A. foliacea in the Strait of Sicily
(*from Ragonese et al., 1994****).***

Mesh opening (mm)	$L_{25\%}$	$L_{50\%}$	$L_{75\%}$	SR	SF
48	16.2	19.9	23.6	7.4	0.41
56	17.7	25.0	32.3	14.6	0.44
90	nc	53.1	nc	nc	nc

The short term economic losses were estimated to be < 3% for the 32, 40, 48mm cod-ends. The loss increased to 9.2% for the 56mm cod-end and reached 62.3% for the 90mm cod-end. The higher the mesh size, the higher the catch reductions observed for most of the by-catch species, although by-catch in weight in this fishery was considered rather low. The authors concluded that the 48 and 56 mm cod-ends had a minimal economic loss, an improved economic efficiency, a reduction in labour, a better catch quality and a substantial reduction

of by-catch. The 56 mm cod-end would allow the escapement of mainly small size and low value bony fish, crustaceans and cephalopods.

- For deep bottom trawling in Italian waters of the Ionian Sea, discard monitoring has been carried out (*Tursi A. et al. in Gordon et al.* 1998) on the red shrimp trawl fisheries *(Aristeomorpha foliacea* and *Aristeus antennatus)*. The percentage discards amounted on average to 66.6 % of the total catch when using a 40 mm cod-end so discard reduction seemed desirable. Increasing the cod-end mesh size to 50 mm, decreased the discards somewhat to 59.8%. To obtain significant reductions, however, a more drastic increase in mesh size seemed necessary.

Two selectivity experiments were carried out on French trawlers operating in the Gulf of Lions (*Dremiere P.Y.* 1982 and 1984) with the aim to evaluate the immediate losses caused by an increase of the cod-end mesh size. These studies particularly stressed the necessity to increase the cod-end mesh size from 40 mm to 70 mm (with a S.F. = 2.8) if an L50 of 20 cm for hake is to be reached.

- Experiments by *Petrakis and Stergiou*, 1997 showed that a 28mm cod-end is almost non-selective for any of the target species and the authors suggest to abandon this mesh size. A 40mm cod-end, be it diamond or square mesh, improved the situation for a number of species giving an L50 close to the length of 50% maturity. Also *Catalano and Smith* (1994) indicated an improved selectivity of a 40mm cod-end compared to a 26mm. Due to the multispecies character of the fishery, however, this mesh size was still not sufficiently high in relation to the biological characteristics of a number of other species (e.g. hake). The application of methods for species separation might improve the situation.

The effect of an increase in mesh size will differ from one area to another. As an example, for the deep water red shrimp fisheries, in some areas, an increase in mesh size would not affect the commercial catches (landings) at all but would still have positive effects on the stocks.

- According to Greek selectivity experiments (*Stergiou. et al.,* 1997), a mesh size of 40 mm does not appear sufficiently selective in most of the fisheries. An increase in mesh size could reduce the impact of fishing on the deep-water environment in limiting the amount of discards. However, the adoption of a greater mesh size seems to be difficult to apply when trawler activity is shared as along the Calabrian coast, both on deep-water shrimps beyond 400 m of depth and rose shrimp and hake (*Merluccius merluccius*) on the continental shelf edge and even red mullet in very shallow waters (*Tursi A. et al. in Gordon et al.* 1998).
- A Greek comparative selectivity study (*Mytilineou et al., 1988*) was carried out in the Eastern Mediterranean *Neprhops* fishery with 32, 40, 48 and 52 mm mesh cod-ends. The results indicated that the 32mm mesh was not selective. None of the mesh sizes, however, proved to be adequate for *Nephrops* selection, since all estimated L50 values were lower than the length at first maturity. All L25's were lower than the legal minimum landing size. The authors suggest a minimum mesh size much larger than the EU legal 40mm mesh size for the Mediterranean.
- *Gurbet et al.* (1997) determined that for red mullet and hake a 40 or 44 mm cod-end mesh is sufficiently high since the L50 values found were higher than the legal minimum landing size. *Metin et al. (*1997) came to a comparable conclusion for axillary sea bream, i.e. a 44mm cod-end mesh.

As a conclusion it could be stated that discarding is quite high in the Mediterranean, caused by the rather small minimum mesh sizes used. Most authors cited agree that a mesh size below 40mm is too small for a sustainable fishery. Even the legal 40mm minimum mesh size is often questioned. The observation that the length at 50% maturity differs from one area to another, complicates the situation. The problem with determining a suitable minimum mesh size in a mixed fishery gets, however, magnified in the Mediterranean because of the large number of species and different fisheries. An increase in mesh size to 60mm would certainly

improve the situation but will result in short time losses. It is, however, estimated that a long term gain can be expected for most commercial species. An extra problem exists with typical fisheries targeting species of a particular small size who will suffer from an increase in minimum mesh size.
Another option to improve selectivity would be the application of square meshes. Diamond meshes tend to reduce their opening when the speed or the weight in the cod-end increases. **Square meshes**, on the other hand, remain open while fishing and tend to catch considerably less small fish compared to a regular cod-end with diamond meshes of the same size.

- Underwater video observations and several experiments (*Stergiou. et al.,* 1997; *Petrakis and Stergiou,* 1997) (tested: 40mm) indicated the possible value of square meshes resulting in a higher selection factor and sharper selection range. Also *Tokac et al.* (1995) found better selectivity with square mesh cod-ends (tested: 36, 40, 44 and 48mm).
However there was no significant difference for annular sea bream, common pandora, poor cod and hake. This can be explained by the differences in body shape of the two species. *Gurbet et al. (*1997) (tested 40 and 44mm) found higher selection factors and sharper selection ranges for red mullet and hake if fished with square mesh cod-ends.
Mallol et al. (2001) found significant reductions in discards with a 40mm square mesh cod-end compared to a 40mm diamond mesh cod-end without affecting the commercial catch.

- Two pilot studies (*Massuti et al.,* 2003) on commercial trawl cod-end selectivity, using diamond and square meshes of 40 mm in the cod-end were carried out in Spanish waters (south of Mallorca – 54 to 726m deep - and off the coast of Alicante – 24 to 537m deep).
The objectives were to quantify the yields of the trawl target species in the area – i.e. stripped red mullet (*Mullus surmuletus*), red mullet (*Mullus barbatus*), hake (*Merluccius merluccius*), caramel (*Spicara smaris*), deep-water pink shrimp (*Parapenaeus longirostris*), Norway lobster (*Nephrops norvegicus*) and red shrimp (*Aristeus antennatus*)- and to calculate the selection ranges and the size at first catch for these species with both mesh types.
No differences were observed in the target species yields (kg/hour ± SD) resulting from the use of the two mesh types within each area (see table below).

Target species yields (kg/hour ± SD)

MALLORCA			ALICANTE		
<100 m	**Diamond**	**Square**	**< 100 m**	**Diamond**	**Square**
Caramel	226±116	41±22			
Striped red mullet	5.3±3.5	8.6±10.7	Striped red mullet	1.9±1.8	4.2±3.5
Red mullet			Red mullet	4.9±4.5	3.4±3.4
200-500 m			Hake	2.8±2.2	1.5±1.1
Hake	7.8±2.7	7.0±5.1	**100-200 m**		
Pink shrimp	4.2±3.1	3.8±1.9	Red mullet	0.1±0.1	0.1±0.1
Norway lobster	1.9±1.4	2.9±0.8	Hake	2.6±2.2	1.9±2.4
600-800 m					
Red shrimp	5.4±2.0	6.7±1.6			

In Mallorca, a decrease of discard rates has been observed for both commercial species and non-commercial species, with square mesh, especially in the slope species (600-800 m).
The estimated values of the size at first catch (L_{50}) with both mesh types for the target species are detailed in the following table; the minimum legal size and the size at first maturity (estimated by diverse authors) have been included to the table.

The selectivity parameters

Species	Sector	L50 diamond	L 50 square	1st maturity	Minimum
Caramel	Mallorca	10 cm LT	17 cm LT	11-13	9-11
Striped red mullet	Mallorca	7 cm LT	11 cm LT	15♂, 17♀	11
Striped red mullet	Alicante	8 cm LT	13 cm LT	15♂, 17♀	11
Red mullet	Alicante	7 cm LT	12 cm LT	13	11
Hake	Alicante	11 cm LT	14 cm LT	30	20
Pink shrimp	Mallorca	17 mm LC	20 mm LC	28♂, 24-26♀	
Norway lobster	Mallorca	15-19 mm LC	24 mm LC	30	20
Red shrimp	Mallorca	18 mm LC	21 mm LC	21-22♂,25-29♀	20

Although the results of the different studies do not all point in the same direction, there is little doubt that square meshes will offer a better cod-end selectivity for many species. Several studies have also shown, though, that square meshes do not improve the selectivity for some species like e.g. flatfish. It is quite likely that for certain fisheries, e.g. the hake fishery, the introduction of square meshes would lead to an overall gain for the stocks. Because of the complex mixture of species and fisheries in the Mediterranean, it is, however, advisable to introduce square meshes only after thorough evaluation of local conditions.
Besides changing the characteristics of the cod-end meshes, other by-catch reducing devices exist that can improve species and size selectivity such as **selective windows**, **separator panels** or **sorting grids**. Several designs have been tried in Atlantic and Mediterranean fisheries practically leading to reductions of discarding (to varying levels according to fisheries and specific local conditions).

- A **square mesh window** was tried out by Catalano and Smith (1994) in the southern Aegean Sea. None of the wide species variety caught seemed to be able to take advantage of the escape opportunity through the window. Metin et al. (1998) demonstrated that a square mesh window in a trawl was over selective for striped mullet and gave a lower selectivity for annular sea bream.

It is generally accepted that the positioning of a window is critical to its functioning. The poor results reported may have been caused by incorrect functioning of the window. Further research in this field is advisable.
Separator panels operate by segregating species entering into the trawl either according to their specific behavioural reactions to the gear or to their morphological differences. The typical design, as it may be found in many shrimp fisheries, consists of a single panel inserted horizontally, splitting the trawl totally or partially, in two levels. The degree of separation would also allow for the use of different mesh sizes in the separator trawl such as a smaller mesh size in the lower cod-end suitable for *Nephrops* and another in the upper cod-end large enough to allow for the escape of juvenile gadoids. The rigging and position of the panel is nevertheless critical to the success of gear. No reported results for the Mediterranean were found in the literature.
Selection sorting grids operate by physically restricting the passage of unwanted by-catch and guiding it out through some form of escape hole or exit. Research on the effectiveness of grids has been conducted in many parts of the world and demonstrated their positive effect on selectivity. As for example, the use of grids in deepwater shrimp fisheries led to a significant drop in by-catch, i.e. less than 3 % of the total.

- According to a recent study carried out in the Catalan Sea (*Sardà, et al., 2002*) the use of separator grids appears particularly efficient and useful for avoiding the capture and discarding of immature hake in bottom trawl fisheries operating at depths between 50 and

250m, where hake dwell all year round. A bar spacing of 2 cm yielded escape rates of between 50 % and 90 % for small hake less than 15 cm in total length (L50=18.8 cm). Positive results were also achieved for the escape of greater forkbeards -bròtola- (*Phycis blennoides*), horse mackerel -sorell- (*Trachurus trachurus*), red mullet -moll or roger- (*Mullus spp.*), gurnards -lluernes- (various species), and anchovy -seitó- (*Engraulis encrasicholus*). The grid may be inserted either inclining forwards or backwards with the escape hole inserted in the bottom or top of the netting depending on the configuration. Inclining grids with bottom escape holes have been found to be more efficient in releasing unwanted by-catch and debris, but the loss of commercial target species has been shown greater with this orientation.

- *Aydin et al.* (2001) tested sorting grids with a bar spacing of 15 and 20mm and an angle of attack of 60° and 120°. The grid with the 20mm bar spacing and 60° angle gave the best results with improved selectivity for red mullet and annular sea bream. The authors claim that the grid produces better results than alterations to mesh size and shape.

- Greek trials with sorting grids in the *Nephrops* fishery are reported in Anon., 1999. The aim was to guide *Nephrops* and shrimps to the lower cod-end and roundfish (especially hake) to the upper cod-end. The results from the trial with the (25mm/200mm) grid showed that 26.3% of the *Nephrops* entered the upper cod-end, and with the (30mm/150mm) grid 26.7% entered the upper cod-end. During the second trial a (35mm/200mm) grid was used in conjunction with a guiding panel and this resulted in 16.8% of the *Nephrops* entering the upper cod-end. However catch numbers for *Nephrops* were very low during this final trial. The results for shrimp (*Parapeneus longirostris*) showed a similar pattern to *Nephrops*. with the first two grids the proportion of the catch entering the upper cod-end was 48.6% and 51.9%. The 35mm/200mm grid used in conjunction with the guiding panel only retained 30% of the shrimp in the upper cod-end. During the first sea trial, the grids separated hake (*Merluccius merluccius*). The 25/200 grid guided 62.1% into the upper cod-end, and with the 30/150 grid 72.2% were retained in the upper cod-end. The second trial with the 35/200 grid and guiding panel appeared to show a different pattern in that hake, 200mm were entering the lower cod-end and hake>200mm were found in the upper cod-end, showing that size selection was taking place when the fish were deflected to the base of the grid by the guiding panel. 81% of the large hake were retained in the upper cod-end and only 31% of the smaller hake were retained.

There are several documented problems associated with the use of grids. It is not rare that a certain percentage of the target species is lost, due either to poor installation of the grid or if weed and debris mask a part of the grid. Large grids can cause practical handling problems, due to their physical size and weight and when using a net-drum for shooting and hauling the trawl. Semi-flexible materials for the construction of grids may, however, help in this case. Nevertheless, grid systems appear practical (although questionable in some cases), simple, and low in cost as compared to the total cost of the gear.

Lastridge ropes

A cod-end changes from a tubular to a bulbous shape because of water pressure on the catch. As the catch increases, a bulge forms and the meshes become more open. In this case, only a few meshes just in front of the accumulated catch are open enough to allow fish near the mean selection length to escape (Isaksen and Valdemarsen, 1986, 1990; Stewart and Galbraith, 1989). Size selection may be improved by changing cod-end design so that the meshes are kept more open in a larger area of the cod-end netting.

The idea of the **roped cod-end** is that the netting in the cylindrical part of the cod-end ahead of the catch takes very little load – the load is taken by the shortened lastridge ropes. A

comparable result may be reached with square mesh, short and narrow cod-ends (*Stewart and Galbraith,* 1989; *Isaksen and Valdemarsen* 1990; *Jacobsen,* 1991).

- The effect of narrow and shortened rope cod-ends on the size selectivity were studied for Turkish bottom trawls used in the Aegian Sea for red mullet (*Lök et al.,* 1997; *Tokac et al.,* 1995). The 50% retention lenghts and selection factors for red mullet were higher for the shortened lastridge rope case (hanging ratio 85%) and the narrow cod-end (120 meshes round) compared to the standard cod-end (150 meshes round). The authors claimed that a 44mm cod-end with shortened lastridge ropes would be an appropriate mesh size for the area.

The **trawl speed** is not only very important with respect to the efficiency of the fishing gear but also influences species and size selection by affecting the vertical opening of the trawl and the opening of the meshes in the cod-end. The towing speed is therefore a major factor affecting selectivity.

The **duration of the haul** is also important and affects the selectivity: Long tows normally result in lower selectivity (and, possibly, higher discard rates) because cod-end mesh opening may be hidden behind large quantity of fish, mesh can be progressively plugged up by enmeshed fishes, the fishes caught at the beginning of the haul are more or less crushed by the latest one. In certain areas, stone and gravel inside the cod-end will also affect the selectivity.
In the literature, however, the relation between catch size (haul duration) and selectivity differs. *Erickson et al.* (1996), *Hodder and May* (1964), *Madsen and Moth-Poulsen* (1994) found a negative correlation between the selection factor and the size of the catch for roundfish. *Dahm* (1991) *and Suuronen et al.* (1991) did not find a significant relationship between catch size and L50 for herring in pelagic trawls. *O'Neil and Kynoch* (1996), on the other hand, found that L50 increased with increasing catch size.
Some **characteristics of netting and twine** have a significant effect on selectivity. The effects are classified into three categories, i.e. hydrodynamic, behavioral and mechanical (*Ferro and O'Neil,* 1994). The table below gives a summary of different netting characteristics and their effect on selectivity:

	Hydrodynamics	Behaviour	Mechanics
Twine thickness	xx	xx	xx
Flexural rigidity			xx
Elongation			x
Twine surface roughness	x		
Twine construction	x		x
Twine colour		xx	
Twine torsional rigidity			x
Knot type	x	x	x
Mesh type	xx	xx	xx
Mesh size	xx	xx	xx
Solidity	xx	xx	

References to works in the Mediterranean in this field were not found.

2.3 - Beam trawl

Beam trawls used in the Mediterranean of the type gangui, rapido, etc. generally have horizontal and vertical openings which are fixed by a pole or frame, in wood or metal. Tickler chains are often fixed in front of the beam trawl across the entrance to prevent boulders entering the bag. There are different types of beam trawls used in Mediterranean Sea. They

are generally used in shallow waters by small units within some small-scale fisheries. "Gangui" (Provençal coast), "ganguils (Catalan coasts), Greek "kankava" for sponges, Italian "rapido" for sole and Sicilian "gangamo" for prawns and sea urchins are the most common examples.

- Because they are used in shallow waters, beam trawls are often blamed to provoke important perturbation on the seafloor of nurseries (rocks and seaweed meadows) and to catch young fish and coastal flatfish in important quantities (*Serena and Abella*, 1999).
- In the French Provencal fishery using the "gangui", the target species are *scorpaenidae*, red mullets and other high value species used in traditional dishes. Because the technique is practised on seabeds with *Posidonia*, its use is banned since 2002.
- In this type of fishery, commercial catches are generally in low proportion in weight and detritus (sediments, dead or spoiled shells and other invertebrates) may be higher than 75 % of the total catch. Pooled Italian catch data (in weight) for the rapido in the Ligurian, Tyrrhenian and northern Adriatic seas gave following results as to catch composition: landed target catch: 6%; landed by-catch: 26%; discarded commercial species: 15%; discarded non-commercial species: 28%; debris: 25%.
- For the Rapido targeting scallops, small undersized individuals can reach 59 % of the total catch (*Pranovi et al.,* 1999, 2000; *Giovanardi et al*., 1998).
- The improvement of selectivity of this type of trawl depends on the mesh of the net webbing and risk of mesh obstruction by the sediment (*Pranovi et al*., 1999a).
- Results of mesh selection experiments on rapido for common sole (*Ferretti et Froglia*, 1975) pointed out large fluctuations in selection factors and noted that gear performance and mesh opening could be greatly affected by the type of the sediments as well as quality and quantity of epifauna.

Results of mesh selection experiments for common sole (Ferretti and Froglia, 1975)

Method	Parallel hauls			
Depth (m)	**12-15**	**12-15**	**12-14**	**12-14**
N. hauls	**12**	**9**	**7**	**5**
Towing speed (Knots)	**4.6-5.8**	**5.3-5.9**	**5.0-5.8**	**5.0-6.3**
Haul duration (minutes)	**120**	**60**	**90**	**90**
Codend material	**PA knotless**	**PA knotless**	**PA knotless**	**PA knotless**
Mesh size (mm)	**43.0**	**42.5**	**41.6**	**41.5**
L (50%) (cm)	**17.2**	**14.6**	**16.2**	**15.5**
Selection range (25%-75%) (cm)	**15.4-19.1**	**13.7-15.5**	**14.9-17.6**	**12.9-18.1**
Selection Factor	**4.0**	**3.4**	**3.9**	**3.7**

Further studies would be needed on the selectivity of the rapido trawls as the increased power of the vessels and the technical changes carried out to the gear over time might have affected the selectivity of the rapido trawl.

2.4 -Dredge

The dredge is a fishing gear towed on the seafloor by boat or, for the smaller ones, by hand. They penetrate in the seabed for extracting certain organisms from sand or mud and are used

to target epi- or infaunal species such as scallops, clams and oysters. The dredges are of various types, from small to large (mechanised) but a common feature is the blade, with or without teeth, which helps digging the sediment, extracting and collecting molluscs. The catch is collected in a bag often made in metallic wire ("basket"). There are not a lot of differences between some types of beam trawl and dredges although the latter are designed to dig further into the substratum compared to beam trawls.
As for the rapido, the net webbing making the bag of the dredge 'cassa' type is, in many cases, quickly clogged and selection within the catch is often essentially limited to the sorting on board by fishermen. After sorting, the crew discards young scallops and snails of low commercial values.
Mechanised dredges have a blade for digging into the bottom and a mechanical system to allow the separation of molluscs from sand and mud. The main selection is made by the opening of metallic meshes which is fitted to the target species.

2.5 -Purse seining

Purse seining theoretically has the potential advantage to allow targeting particular recognized schools of species whereas a pelagic trawl may pass through several schools of different species. Consequently, the purse seine will theoretically have a more selective effect than a trawl. For pelagic fish, which have a tendency to school within similar-sized individuals, experienced fishermen are, in many cases and to a certain extent, able to know the average or the range of size of fish prior to initiating operations to catch them. Nevertheless other species may be also present within the targeted schools.
However, the pressure of the market may encourage the catching and retaining of juvenile bluefin tuna or occasional swordfish by tuna purse seining fleets. These illegal practices may sometimes result in important and non registered catches, mainly during summer and autumn, particularly for bluefin tuna. .
The selectivity mainly depends on the skipper's ability to avoid juvenile school. Nevertheless recent studies have demonstrated the interest of the use of selective panels rigged closed to the bunt and the float line to allow for juvenile escapement.

2.6 - Beach seine

The beach seine is a term designing a type of coastal fishing gears common to all Mediterranean countries. There are various types of beach seine: with or without bag (similar to the trawl cod-end) and with different lengths, from 100 to 400 m. The smaller meshes can be up to 40 mm but also very small, to around 3 mm. Known in Italy as 'sciabica', in Spain as 'jabiga', in France as 'senne' they are generally used to catch schools of fish coming close to the coast in shallow waters (less than 20 m).
The seines in use in shallow waters are blamed to cause important damage to the coastal ecosystem for two main reasons: firstly, because of the amount of juveniles in the most of the catches and because of the friction on the sea-bed during the fishing operations. Regarding the juveniles within the catches, it is worth observing that some of the beach seines are designed specifically for targeting small fish such as small *Sardina pilchardus* fry ("bianchetto" in Italian or "poutine" in French), goby *Alphia minuta* ("rossetto" in Italian, "chanquete" in Spanish, "nauna" in French), or sandeel (*Gymnammodytes cicerellus*) ('cicerello' in Italian, "sanso" in Spanish,"lançon" in French). Small quantities of juveniles of triglidae young sparidae or young red mullets and, occasionally, rays may also occur in by-catch (Casavola *et al*., 1999b, Anonymous, 1985).
In Greece, through technological evolution of the traditional gear that used to be hauled by hands from the coasts, the beach seine, has been replaced by the boat seine (vintzotrata). The construction of the net, the fishing grounds and the fishing practice still remain the same,

except for the boat which has to be anchored at a distance less that 70 m from the coast. The catch composition in the 16mm bag varies significantly among the various areas (see part A). One of the most important species for the gear is *S. smaris*, a small sized but very popular and cheap fish, very abundant in Greek near shore waters. It can be caught only by the beach seine or illegally by the bottom trawl. Banning the gear would mean significant losses in the total Greek production.

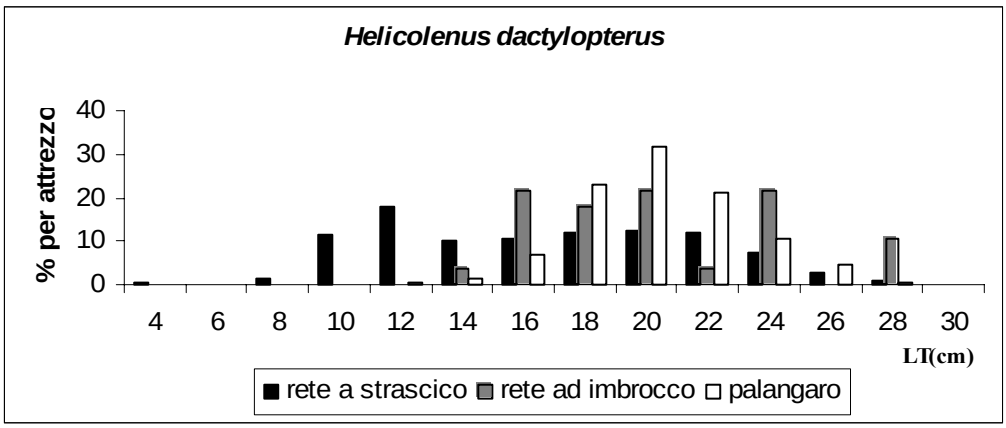
The **beach seine** is a fishing method under discussion. Several attempts were made to eliminate these practices but the difficulty is the social role that this fishing technique plays in some specific regions (such as Malaga, the French and Italian Liguria) with consumption of juveniles being part of regional tradition. Beach seining is not prohibited but its practice is often submitted to restrictive regulations, as for example limiting the fishing season to 2 months maximum or stop giving new licenses.
As a matter of fact, when rather large meshes (around 40 mm) are used in the bag of the larger seines and considering the slow motion of the seine over the bottom during the fishing operation, the majority of unwanted sizes have possibilities to escape. In the case of seine for small fishes (juvenile sardine, transparent goby, etc.) it is advisable that fishing activities are limited to a restricted period and in a restricted area.

- The Greek boat seine is not selective since the mesh size is very small. In addition, it operates in shallow waters, where the juveniles of many species are concentrated. A study that took place during 2000 in 3 areas in Greece showed that the problem of discards was quite severe in the Pagassitikos Gulf (because of the presence of many small *P. erythrinus*), where as in the other two areas the proportion of the discards was very low. Generally, with an exception of *P. erythrinus* no other significant by-catch or discard problems have been observed, at least in the areas of the study. More observations are needed in other areas or biotopes to estimate the effects of the gear in other species (e.g. *M. barbatus*). No selectivity experiments have been done related to beach seine in Greece and no attempt has been done to improve the selectivity. It is possible, at least for the juveniles of *P. erythrinus* to improve the selectivity using grids that would exploit the advantage of the flattened body shape of the juveniles.

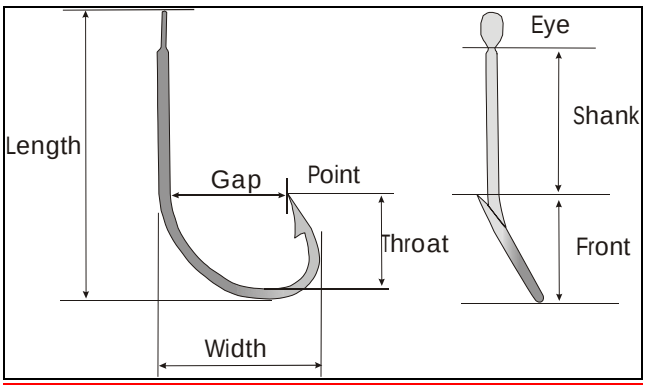
2.7 - Longlines

In general it can bet stated that small mesh trawling will catch more small fish compared to longlines. An example is given in the following figure (*Ungaro et al.,* 1999).

Catch comparison for Helicolenus dactylopterus caught with a bottom trawl, a gillnet and a bottom longline



Although there is no perfect evidence for fish size-selective effect of hook size, smaller hooks give, in general, higher catch rates than larger hooks. The reasons are the fact that a fish normally bites more easily on a small hook and that smaller hooks are thinner and therefore penetrate the flesh more easily.



description of different parts of a hook

In the hooking process, there are three most important dimensions of a hook is its overall width, which can be correlated with the mouth size of fish, its gap, the distance between point and shank, and the depth of the throat which ensure deeper penetration of the point and better holding power of the fish.
Unfortunately, there is no uniform system of hook measurements and dimensions can vary greatly from one pattern to the next.
With the shape and the size of the hook, several other factors may affect the catching efficiency of a longline hook, but the size and the type of the bait seem to be the most important (*Bjordal and Lokkeborg*, 1996). It is therefore possible to reduce the proportion of small fish in longline catches by increasing the width of the gap (the distance between the point and the shank of the hook) or the size of the bait. To increase artificially the size of this last one *Lokkeborg and Bjordal* (1995) suggest attaching a plastic body to the shank of the hooks above the point. This device molded in a circular form (4cm long, 2cm deep, 2 cm wide) and used in combination with a small bait may appear as a large item to the fish. The experiments carried out by the authors suggest however a better visual attractant effect for pelagic longlining than for bottom gear.
Publications on the effect of bait, branch lines size, number of hooks (effort/fish mortality) etc. is not available for the Mediterranean. Research in this field could support further development of the fishing method.
Bottom longlining is used for different carnivorous species (sparidae, groupers, seabass), for hake, scabbardfish *Pagellus bogaraveo* and sharks.
A 2-year study of the European hake (*Merluccius merluccius*) semi-pelagic (``pedra-bola") longline fishery was carried out in the Algarve (Erzini et al., 2001) using four hook sizes (SIAPAL brand numbers 10, 9, 7 and 5). At least 32 species of fish and invertebrates were caught, with hake dominating the catch (41 and 45% of the catch in numbers). Catch rates are extremely low, with less than 3.5 fish per 100 hooks for the most successful hook size (number 10). Catch rates (number of fish per 100 hooks) for hake and for all species combined decreased significantly with hook size. Hake catch size frequency distributions for the different hook sizes were highly overlapped, with the four different hooks catching a

wide range of sizes and little or no evidence of differences in size selectivity due to hook size even though the range of hook size used in this study was considerable. the majority of the individuals ranged in size from 30 to 65 cm, with mean TL of 47.4 cm (n à 580, S:D: à 5:89). Thus, all four hook sizes used in this study caught similar and wide size range, resulting in the observed highly overlapped catch size frequency distributions. This is not surprising since the hake is an ambush predator with a very large mouth and which can swallow fish more than half its size. For observing differences in size selectivity due to hook size it would probably be necessary to use much larger hook sizes. However the use of these sizes is not justified because they are not used in the fishery because the catch rates are much less than those of smaller hooks.

The overlapping catch size frequency distributions have important implications for the modelling of selectivity. The authors conclude that methodologies where it is assumed that parameters of selectivity curves are a function of gear size will not give reasonable results or may not even allow parameter estimation.

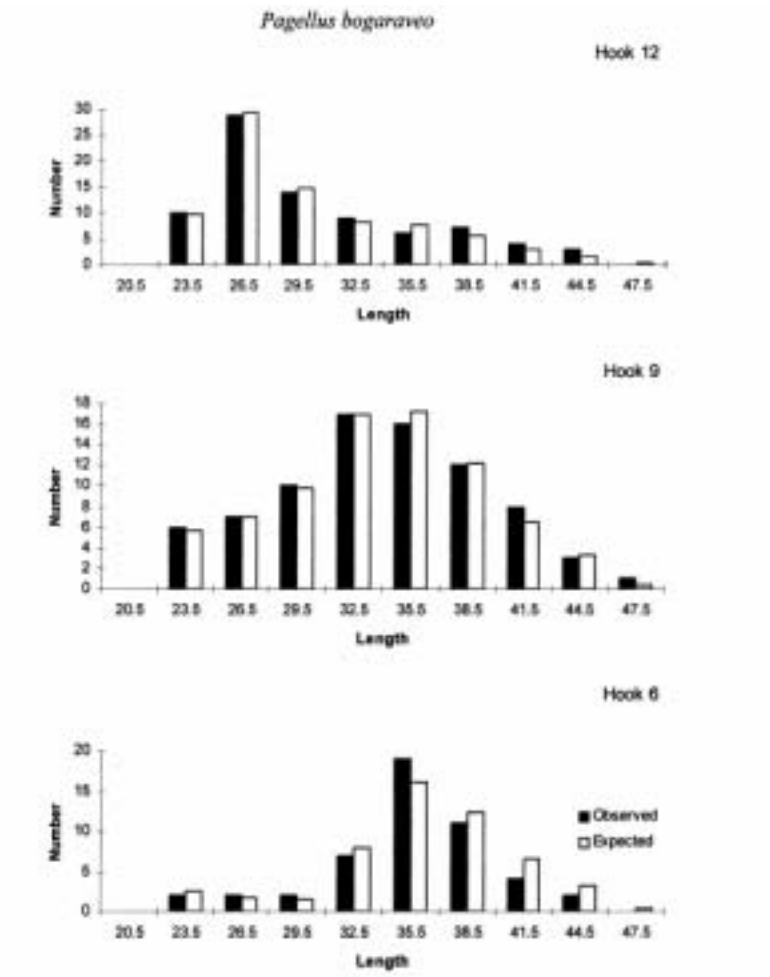
Black spot sea bream (*Pagellus bogoraveo*) is fished in several countries with bottom longline or handline (filiacioni, palangrotte) in North Atlantic waters and in Mediterranean sea. A selectivity study was carried out in the Azores on the deep water longline fishery in commercial fishing conditions between 90 to 315 fathoms (Souza et al., 1998). The fishing gear was a semi-pelagic longline usually employed by the fishermen and similar to other techniques used in other countries. 4 hook sizes referring to SIAPAL brand number were tested during 9 sets. The main dimensions of these hooks are :

N°	**12**	**9**	**6**	**4**
Gap (mm)	7.3	12.9	18.5	22.2
Width (mm)	13.04	15.2	19.62	22.79
Depth (mm)	8.18	15.55	22.91	27.82
Length (mm)	22.63	38.34	54.05	64.53

The methodology of Wulff (1986) and Kirkwook and Walker (1986) was used to fit to a hook selectivity model (Souza, 1996). Hook gap was used as measure of gear size and parameter of the selectivity.

The selectivity curves obtained for the 2 main species caught *Pagellus bogaraveo* and *Helicolenus dactylopterus* are generally logistic-type implying that above a certain size the fish are fully selected by the hook ; however small hook size appears to be less efficient for the biggest sizes of *Helicolenus dactylopterus* probably due to loss of bait or loss of fish.

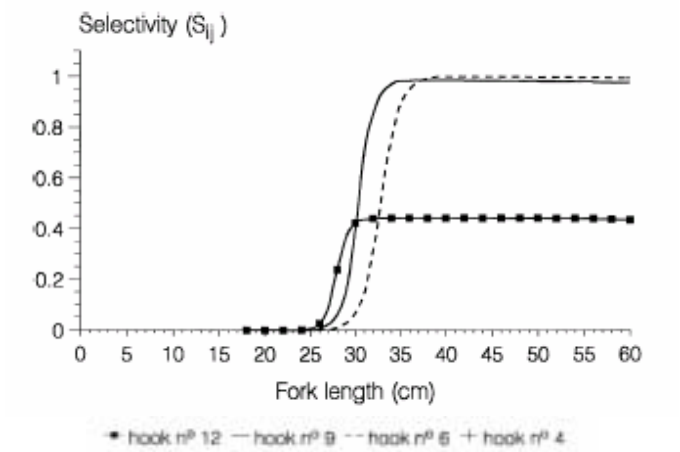
Although there was some overlapping between the different length distribution significant differences in size selectivity could be found for these 2 species and for length classes of 3cm.



Observed and expected catch size frequency distributions for three hook sizes for *Pagellus bogaraveo*.

For *Pagellus bogaraveo* the estimated sizes at 50 % selectivity were:

N°	12	9	6	4
Mean Length	30+/-5.71	33.6+/-5.65	35.5+/-4.82	
L50%	27.9	30.4	32.8	-



Estimated selectivity curves for three hook sizes for the black spot sea bream (P. bogaraveo)

Black spot sea bream is characterised by protandrous hermaphroditism. Depending on authors, this sexual change occurs at 2 or 3 years old (Campillo, 1992), between **200 to 320** mm(Petrakis et al., 2001), corresponding to 2 and 3 age class.
Micale and al., (2002) observe that functional males are more frequent in age 1+ and 2+, whereas functional female predominate in the 3+ class, above **25 cm**. The same authors determine a spawning size of **28 cm** at age **3** for males and at **29.5 cm** and age **4** for females, while Relini et al.(1999) a sexual maturity at **4-5 years** old and for a total length of **20 to 35** cm.. From studies on reproductive biology of red seabream from the Strait of Gibraltar (Gil et Sobrino, 2001) the maturity lengths were estimated to **30.14** cm for males and **35.72** cm for females.
These apparent contradiction between these different results are probably due to differences between ecological conditions and reproduction patterns for the different fishing areas and make difficult the choice of a same minimum legal size based on a common biological criterion.
However, if **30 cm** would be this minimum legal size for *Pagellus bogaraveo* the hook N° 9 with a $L_{50\%}$ at 30.4 cm appears to be the most suitable hook among the different size used in this study for this fishing area.
It is obvious that larger gap as for hook N°6 catch allow to catch less of undersized fishes, the choice of the corresponding gape size as legal size would not be conformed to the usual rule which choice the optimal size of a selectivity parameter according the value at $L_{50\%}$.
A more appropriate solution would to choice selective parameters (width and gap) close to the dimensions of one the most hook used by fishermen for hake and spot bream in Gulf of Biscay, Gulf of Lions and Ligurian sea ;the hook 3/0 (round hook - Mustad ref 533 D) which is certainly more selective than the N°9 thanks to larger gap and larger width.

N°	**9 (SIAPAL)**	**3/0 (Mustad)**	**6 (SIAPAL)**
Gap (mm)	12.9	14.15	18.5
Width (mm)	15.2	15.93	19.62
Length (mm)	38.34	35.62	54.05

Small fishing boats of small scale fisheries are commonly using bottom long-lines with small hooks to capture various species at depths ranged from 10 to more than 100 m.
The hook size selectivity of this type of gear was studied out in the south coast of Portugal (Erzini et al., 1996). 3 hook sizes were tested with a 600 hooks line was constructed with 200 hooks of each size set in traditional conditions of setting.

N°	**15**	**13**	**11**
Gape (mm)	7.63	8.75	10.53
Width (mm)°	8.23	9.93	11.89
Depth (mm)	8.74	10.30	13.00
Length (mm)	19.03	23.67	27.72

A total of 45 fishing trials were carried out providing 35 species with 58 % of sea breams. Catch rate were generally low, rarely exceeding 6 %.
The catch size frequency by hook size for six species was nevertheless fit to a skew-normal model (Helster et al.,1991), using simple linear functions in most of cases for describing the relationships between optimal length, standard deviation, good fits and the overall hook size (max length x max width).

Optimal length and standard deviation for different species caught by 3 sizes of hooks

N°	15	13	11
Serranus cabrilla	16.6+/-1.7	17.3+/-1.6	18.1+/-2.3
Diplodus sargus	29.2+/-5.7	28.7+/-4.3	31.3+/-4.3
Diplodus vulgaris	21.4+/-3.8	23.1+/-3.8	24.5+/-4.0
Boops boops	22.85+/-2.0	22.41+/-2.1	23.5+/-3.2
Spondyliosoma cantharus	20.2+/-2.6	20.83+/-2.7	20.4+/-2.1
Lithognathus mormyrus	26.9+/-3.7	27.95+/-3.5	20.5+/-3.5

The authors note a strong overlapping of the catch frequency distributions, with little evidence for an increase in mean size with hook size for most species.

Drift long lines are used in the Mediterranean Sea for swordfish (*Xiphias gladius*), albacore (*Thunnus alalunga*) and bluefin tuna (*Thunnus thynnus*) (*Camiñas et De la Serna*, 1995). Albacore longline fisheries in particular are blamed to catch small swordfish in large quantities, weighing less than 3 kg, especially in autumn when they are abundant (*Di Natale et al*. 1996; *De Metrio et al*. 1997).

It was observed in drifting longlining that large quantities of young fish are caught when small right hooks of 3 cm long are used while these are only marginal with larger right hooks of 9 to 10 cm long (*De Metrio et al*. 1998). The hooks employed for the albacore fishery are very small and certainly not sufficiently selective for swordfish whose young individuals are abundantly caught in autumn (*De Metrio*, 1988). According to Di Natale et al. (1992), hooks used in swordfish fishery range from 10 to 5.5 cm high and from 3.5 to 2.5 cm in wide. Below these ranges, smaller hooks are used in albacore fishery, while even larger hooks are used in bluefin tuna longlines. Although there is no perfect evidence for fish size-selective effect of hook size, smaller hooks give, in general, higher catch rates than larger hooks. The reasons are the fact that a fish normally bites more easily on a small hook and that smaller hooks are thinner and therefore penetrate the flesh more easily.
Some data, obtained from a scientific observers programme (*Pelusi & Di Natale, 2000*), could help to increse the understanding of the selectivity of the various types of surface drifting longlines used by the Italian fleet.

CATCH	LL SWO			LL ALB			LL BFT		
SPECIES	kg	CPUE-kg	CPU-kg	kg	CPUE-kg	CPU-kg	kg	CPUE-kg	CPU-kg
SWO	17302	120,02	142,99	113,1	3,45	16,16	0	0	0
ALB	160	1,11	1,33	9051,4	275,96	1293,06	0	0	0
BFT	1275	8,84	10,54	66,0	2,01	9,43	340,0	121,43	113,33
OTHERS	6853	47,54	56,64	1756,7	53,56	250,96	304,5	108,75	101,50

CATCH	LL SWO			LL ALB			LL BFT		
SPECIES	no.	CPUE-no.	CPU-no.	no.	CPUE-no.	CPU-no.	no.	CPUE-no.	CPU-no.
SWO	1096	7,60	9,06	51	1,56	7,29	0	0	0
ALB	17	0,19	0,14	2369	72,23	338,43	0	0	0
BFT	23	0,16	0,19	11	0,34	1,57	6	2,14	2,00
OTHERS	476	3,30	3,93	500	15,24	71,43	10	3,57	3,33

SPECIES	% kg	% no.	mean kg	% kg	% no.	mean kg	% kg	% no.	mean kg
SWO	67,61	67,99	15,79	1,03	1,74	2,22	0,00	0,00	0,00
ALB	0,63	1,05	9,41	82,38	80,83	3,82	0,00	0,00	0,00
BFT	4,98	1,43	55,43	0,60	0,38	6,00	52,75	37,50	56,67
OTHERS	26,78	29,53	14,40	15,99	17,06	3,51	47,25	62,50	30,45
TOTAL	100	100	15,87	100	100	3,75	100	100	40,28

According to the table, there is a clear species selectivity of the three types of longlines, and also a size selectivity, even if these data cannot be regarded as absolutes, because the objective of the study was not to define a comparative selectivity. To better define the selectivity, comparative studies should be conducted with differnt gears in the same area and at the same time. Selectivity in surface drifting longlines is heavily influenced also by season and the distance from the coast, due to the fact that high catches of juvenile swordfish and tuna can occur in autumn when fishing close to the coast, almost independently from the hook size.

A further problem is given by the high number of incidental catches of marine turtles occurring in the suface drifting longlines (De Metrio et al., 1984 and De Metrio & Megalofonou, 1988). In this case, the attraction induced by the bait might affect the species selectivity.

Many other factors than the shape and the size of the hook, may affect the catching efficiency of a longline hook, but the size and the type of the bait seem to be the most important (*Bjordal and Lokkeborg*, 1996). It is therefore possible to reduce the proportion of small fish in longline catches by increasing the width of the gap (the distance between the point and the shank of the hook) or the size of the bait. To increase artificially the size of this last one *Lokkeborg and Bjordal* (1995) suggest attaching a plastic body to the shank of the hooks above the point. This device moulded in a circular form (4cm long, 2cm deep, 2 cm wide) and used in combination with a small bait may appear as a large item to the fish. The experiments carried out by the authors suggest however a better visual attractant effect for pelagic longlining than for bottom gear.

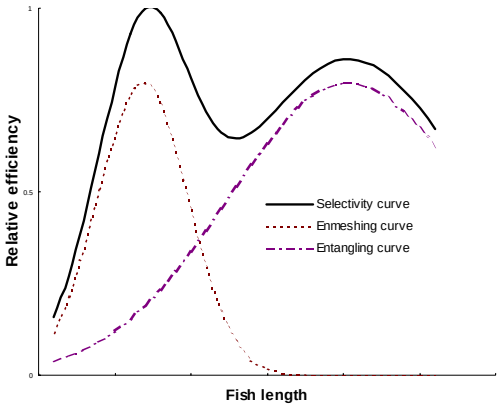
Publications on the effect of bait, branch lines size, number of hooks (effort/fish mortality) etc. is not available for the Mediterranean. Research in this field could support further development of the fishing method.

2.8 - Static nets

Static nets are the most common fishing gears used in the Mediterranean small-scale fisheries. Easier to set and less cumbersome than traps, safer than longlines and above all much more efficient, gillnets and trammel nets progressively replaced various other static gears for various target species. The investigations carried out on twelve fisheries using static nets (with different mesh sizes, dimensions and rigging) within the Greek, Italian, Spanish and

French small scale fisheries show a low level of undersized fish, in general (e.g. no more than 1 –3 % for hake gillnetting) (*Sacchi et al.,* 1998). Observations made on different commercial fisheries on the same area show that in most of fisheries using static nets, the proportion of undersized caught fishes is generally lower than when mobile/towed fishing gears are used (*Stergiou et al.,* 1996*; Ungaro et al.,* 1999).
The amounts of the discarding are variable and depending of market opportunities and soaking time. But except for crawfish trammel net which can stay at sea more than 5 days before being hauled, most of Mediterranean static nets are not left more ten hours at sea.

The catch process for gill nets is based on a combination of enmeshment of the fish in one of the meshes of the net webbing and entanglement of its body in the net panels. The first catch mode, enmeshment, plays the main role in the relation between the fish size and the mesh size, the second increasing the efficiency of the former on the larger and smaller fishes.



The two component curves of a bi-normal selectivity curve

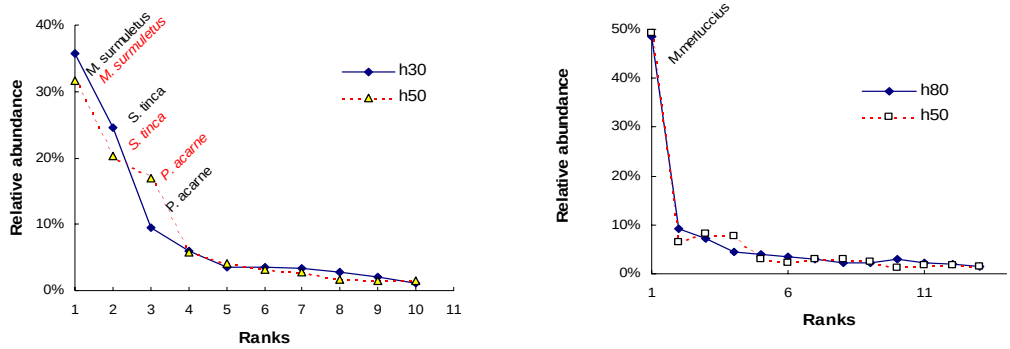
The two above mentioned components practically allow, according to their arrangement, to design fishing gear being highly selective for certain species and size of fish.
Several selectivity studies comparing different mesh sizes or types of static nets (trammel, gillnet) were carried out these last ten years in different Mediterranean countries (*Fabi et al*., 1998, *Sacchi et al.,*1998, *Sbrana et al*. 1999). All these studies observed that, for a given gear type, the number of species caught increases when the mesh size decreases; this number is also greater with trammel nets than with gillnets. The hanging of the net webbing (on the frame ropes, floatlines and leadlines) also affects the effectiveness of the static nets so that when the hanging staples are too tight, the space between the net panel and the bottom line is reduced and favour unwanted catch of benthic species (e.g. groundfishes, starfishes, sea urchins).

Investigation for selectivity studies of Red mullet and Hake gillnets was carried out in the Gulf of Lions (*J.Sacchi, 2001*) with different mesh sizes and different meshes number in height.

Characteristics of gillnet used for selectivity studies of red mullet and hake gillnet

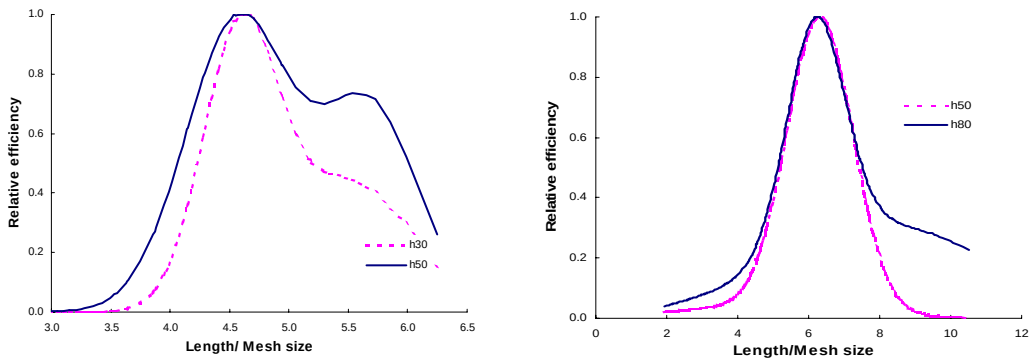
red mullet gillnet			**hake gillnet**		
mesh size (cm)	**no. height mesh**		**mesh size (cm)**	**no. height mesh**	
	30	***50***		***50***	***80***
3.8	1,14 m	1,90 m	**7**	3,50 m	5,60 m
4.2	1,26 m	2,10 m	**7.6**	3,80 m	6,08 m
4.6	1,38 m	2,30 m	**8**	4,00 m	6,40 m
5	1,50 m	2,50 m	**8.5**	4,25 m	6,80 m
			9	4,50 m	7,20 m

The analysis of species diversity (Shannon, Inverness index and rank abundance)) of the experimental catches demonstrated the high selectivity of these gears.



Comparison of the rank-abundance patterns of the catches of 2 meshes height (for Red mullet and for Hake

- Estimation of optimal ratio (fish length/stretched mesh length) were made by SELECT method and gave a value of 4.8 for Red mullet and 6.5 for Hake whatever is the net height.



Selectivity curves for Red mullet and Hake gillnet

A last observation showed that the increase of mesh size or the decrease of net height generally lead to a reduction of the catch per effort unit. One of main reasons would be the modification of the fishing efficiency of the gillnet due to the reduction of the number available meshes. The number of fish (e.g. target species individuals) per 10 000 meshes appear to be the CPUE index which takes indubitably more account of the fishing efficiency effect than the others.

Comparison of CPUE index of gillnet for the target species in relation with mesh size and net height (red mullet on left and hake on right).

CPUE		3.8 cm	4.2 cm	4.6 cm	5 cm
nbre/100 m	h_{30}	7.1	2.5	0.5	0.2
	h_{50}	10.0	4.4	4.6	1.1
nbre/100² meshes	h_{30}	0.9	0.3	0.1	0.0
	h_{50}	0.8	0.4	0.4	0.1
kg/100 m	h_{30}	0.6	0.6	0.1	0.0
	h_{50}	1.0	0.5	0.6	0.2

CPUE		7 cm	7.6 cm	8 cm	8.5 cm	9 cm
nbre/100 m	h_{50}	5.42	5.96	5.58	4.19	2.54
	h_{80}	7.96	6.65	6.12	5.27	4.38
nbre/100² meshes	h_{50}	0.76	0.91	0.89	0.71	0.46
	h_{80}	0.70	0.63	0.61	0.59	0.47
kg/100 m	h_{50}	2.35	3.13	3.26	3.01	1.85
	h_{80}	3.82	3.61	3.63	3.53	2.94

For example, for the red mullet gillnet an increase of mesh size from 3.8 cm to 4.2 cm corresponds to a decrease of 7.7 % in meshes number, of 62 % in fish number per100 m and of 42 % in kg per 100m . For hake gillnet, although the h_{50} nets catch generally more fish than the h_{30}, the CPUE index per mesh number reveal their less fishing efficiency; the highest values are given for 7.6 and 8 cm mesh length.

- For Greek waters, different studies were also carried out on different gillnet fisheries. Optimal length according mesh size are given here for species and different areas :

Pagassitikos Gulf *(Petrakis, 2000)*

Species/mesh	36	40	44	48	52	56	60	64
M. barbatus	133	147	162	177				
M.merluccius	193	214	236	257	279	300	322	343
P.erythrinus	113	125	138	150	163	175	188	200
C. linguatula	115	128	140	153	166	179	192	204

Ionian Sea *(Petrakis et al, 2001; Petrakis, 1998)*

Species/mesh	34	38	42	44	60	68	80	88	90	1000
M. barbatus	135	150	165	170						
M. surmuletus	125	140	155	160						
P.erythrinus	110	120	135	140						
B. boops	150	170	190	200						
D. annularis	85	95	105	110						
P. bogaraveo					207	235	276	304	311	345

S. Euboikos Gulf (*Petrakis and Stergiou, 1996****)***

Species/mesh	34	38	42	46
M. barbatus	132	148	164	179
P. acarne	110	123	136	149
P.erythrinus	107	119	132	144
S. flexuosa	130	145	161	176

Selectivity factors calculated from the preceding tables

	Pagassitikos Gulf	Ionian Sea	S. Euboikos Gulf
M. barbatus	3.7	3.9	3.9
M. surmuletus		3.7	
M. merluccius	5.4		
P. acarne			3.2
P. erythrinus	3.1	3.2	3.1
P;Bogaraveo		3.5	
B. boops		4.5	
S. flexuosa			3.8

A selectivity study on gillnet for hake has been carried out by a set of mesh sizes in Tuscany and in Algarve with 2 different set of mesh sizes, 53, 62.5, 70 and 82 mm mesh size in Tuscany and 70,80 ,90 and 100 mm in Algarve.
Among the different selectivity model tested, the bi-modal of the SELECT method provided the best fit particularly in Tuscany, taking account of entangling and enmeshing. Entangling of specimens determined a wide size range in hake catches as their is overlapping in catches distribution. In Algarve, the shape of the length frequency distributions is the same, independently of the mesh size used. There is also a discrepancy between catch distribution and selectivity curve probably due to the lack of larger specimen as it is suggested by the authors or perhaps also to a less efficiency of the largest mesh size.

Relation between mesh size and modal class

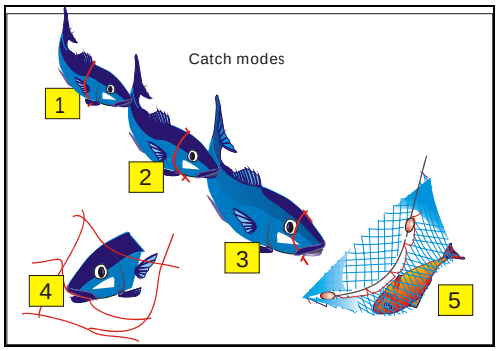
Tuscany					**Algarve**				
Mesh size (cm)	5,3	6,2	7	8,2	Mesh size (cm)	7	8	8,9	9,6
Modal class (cm)	34	40	44	52	Modal class (cm)	48	56	60	-

The results obtained in Algarve show also the effect of mesh size on catch sex ratio. Hake is a species with a sexual difference in growth, with females reaching larger sizes than males. The use of larger mesh sizes might result in a higher fishing pressure on the reproductive females.

Relation between mesh size and sex ratio for hake gillnet fishing (from Sbrana)

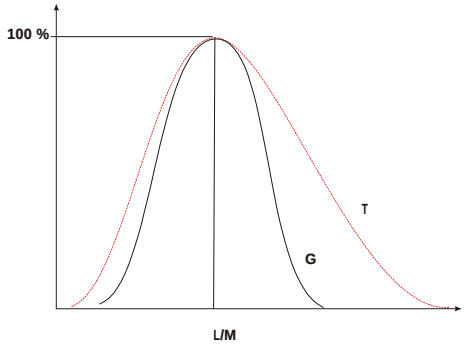
Mesh size	F	M	SR	χ^2
70	170	168	1.012	0.003
80	160	67	2.388	37.29
90	122	52	2.346	27.36
100	86	39	2.205	16.93

For trammel the main catch mod in trammel consists to purse fish into pockets which are formed by the passage of a part of inner panel through bigger meshes of outer panel. Consequently, selectivity in trammel net depends in first of the inner panel mesh size for the enmeshment process and of the combination of the hanging ratio and the height of the outer panel for the entanglement.



Different catch modes in static net fishing: 1 wedge, 2 gilled, 3 entangled by maxillaries, 4 entangled by teeth, 5 wrapped

Several experimentations comparing trammel with gill net show that selectivity curve of a trammel has approximately the same modal length that the gill net one of same mesh size that the one of its internal panel and its spread is more extended than the gillnet selectivity curve and in particular to the largest fish size.



Comparison between trammel net (dotted) and gillnet selectivity curves

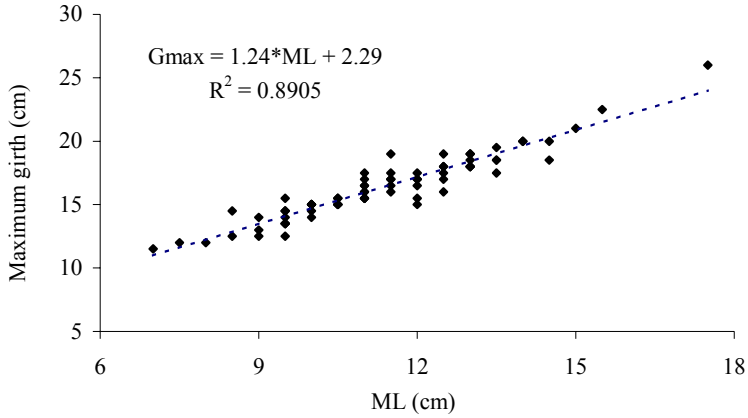
Furthermore the purse process gives a bigger efficiency to the trammel comparing to the gillnet.

This efficiency can be increased by the use of thinner or more soft twine. Multifilament is generally more soft and extensible than monofilament and provide consequently more tangling effect and therefore by-catch.

The selectivity of a traditional trammel net, a monofilament trammel net and a gillnet was investigated in central Adriatic sea and northern Tyrrhenian sea (Fabi et al., 1998) with 3 mesh sizes were tested : 45, 70 and 90 mm. The Sechin selectivity method evidenced that monofilament and multifilament trammel net had a similar selectivity as gill net for *S. flexuosa* that was caught by gilling and /or wedging. For the other species a percentage of tangled generally occured and increased from gillnet to monofilament trammel and multifilament trammel. Comparison between areas showed that the tangled effect on the great specimens was generally more evident in area where the great size classes were better represented.

A selectivity study for *Sepia officinalis* was carried out in a coastal zone of the eastern Ligurian Sea, for trammel, pots and fyke nets (Sbrana et al., 2003).Trammel net with monofilament inner panel was compared to traditional trammel net with multifilament panel.

For each trammel net type three inner pannel mesh sizes (45, 70 and 90 mm stretched) were tested.



Relation between mantle length and maximum mantle girth for Sepia officinalis

All collected specimens of cuttlefish were measured for mantle length (ML) to 0.5 cm. Additionally, maximum mantle girth (G_{max}) was taken on a representative sample of the catches. Selectivity was assessed by the indirect Sechin method, which was suitable for describing selectivity of these gears. Excepted a higher efficiency for the multifilament type there was no difference on selectivity curve between the 2 types and the size at first catch (ML_{50}) was estimated to 7.9 cm for the 2 types of nets.

Selectivity parameters for Sepia officinalis and different static gear (Sbrana, 2003)

	Nominal mesh size (mm)	Corrected mesh size (mm)	Length of catch (L50)	Selection range (cm) 25%<p<75%		SF	% individuals p<5% left
Monofilament trammel net	45	54	6,9	6,5	7,5	1,5	0,0
	70	86	11,7	11,3	12,1	1,7	0,9
	90	108	15,6	15,2	16,0	1,7	40,4
Standard trammel net	45	54	6,9	6,5	7,5	1,5	0,0
	70	86	11,7	11,3	12,1	1,7	4,7
	90	108	15,6	15,2	16,0	1,7	39,4
Trap	56	60	7,8	7,4	8,2	1,4	0,0
Fike net	52	62	8,2	7,8	8,6	1,6	1,8

2.9 – Surface gillnets

Surface gillnets are typical gear, used in the Mediterranean Sea to catch several pelagic species (*Xiphias gladius*, *Thunnus alalunga*, small *Thunnus thynnus, Auxis thazard, Sarda sarda, boops boops*, sharks and other species) since historical times (*Di Natale et al., 1992*). Some of these gears, particularly those having small mesh size, are particularly selective, because are used directly on schooling fishes in small coastal areas where these species are concentrated in some seasons.

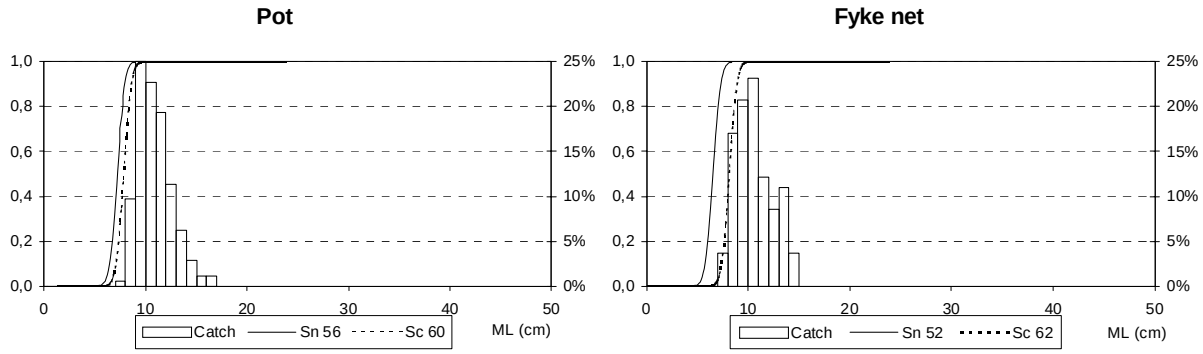
Some other gears, having larger mesh size, had several technological improvements after the '60s, reaching important length measures. This fact created the remarkable problem of the by-catch of protected species in driftnets, officially ended with the EC driftnet ban on 1st January 2002. A complete list of species included in the by catch is reported by *Di Natale et al.* (1992, 2001).
As a matter of fact, large mesh driftnets showed a particular selectivity, because the target species was usually the large majority of the catches but, at the same time, due to the remarkable environmental value of some by-catch components (particularly the cetaceans), it was decided to intervene to ban this activity. Besides of the high percentage of target specis in the catch, this large mesh driftnets are usually considered as non species/selective.
Large mesh driftnets and surface gillnets for swordfish are considered as quite size/selective for the target species and this has been confirmed by several studies (*Di Natale et al., 1992, 1996, 1998*). The size/selectivity in surface gillnes is induced not by the features of the gear but by the fishing pattern, because this fishery is carried out quite offshore and in spring-summer, when juvenile speciemens are less frequent. According to reliable data collected in the same Italian area in 1994-95, the undersize (<120 cm LJFL) swordfish fraction was respectively 39.4% and 38.8% of the total swordfish driftnets catches, while it was respectively 60.5% and 61.3% of the total swordfish longline catches (*Di Natale et al., 1998*).

2.10 – Tuna trap

Tuna traps have been largely diffused in the past in the Mediterranean, being the first industrial fishing in the area. Nowadays, only a few tuna traps still exists in the Mediterranean, based in Spain and Italy. The most typical gear has a high selectivity, induced by the possibility to directly intercept the migration course of the tuna. Other species can occasionally occur in the tuna trap (sunfish, swordfish, sharks). A smaller type of tuna trap, called "tonnarella" is still used in Liguria, target on small tunas and other pelagiuc species, but the selectivity, in this case, is different.

2.11 - Pot and trap fishing

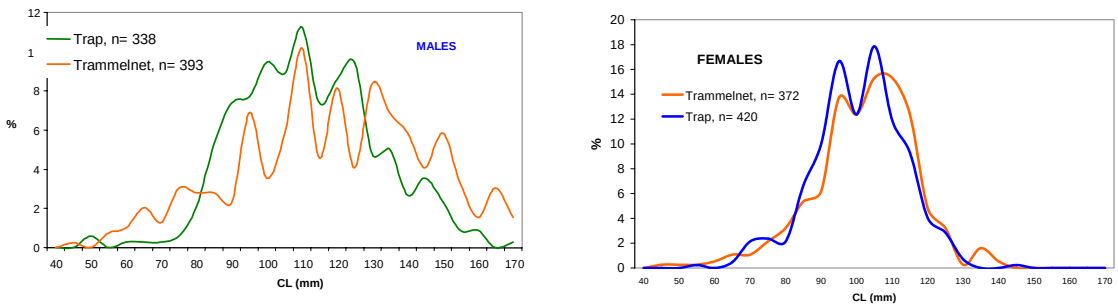
Pots are mainly used for octopus, lobsters, muray, crawfish, shrimps and occasionally in a few areas for seabream fishing. They are generally practised at small scale, excepted the Spanish pot fishery for deep red shrimp (*Plesionika edwarsii)* which is carried out by vessels of more 20 m long, working between Balearic islands and the South Western coast of Spain. They daily set more of 600 traps on bottom of 200-250 m depth. The ecosystem impact is as for bottom static net essentially regarding problem of loss and risk of ghost fishing.
The pot selectivity is poorly reported in the literature and concerns only few items.
In the study carried out waters on cuttlefish selectivity in Ligurian and previously described (Sbrana *et al*., 2003), the selectivities of rectangular pots covered by a net of 56 mm mesh size, and of fyke nets with external net of 52 mm mesh size were studied by the Sechin method.. the Selectivity Factor was estimated to 1.4 for the sepia pot and 1.6 for the fyke net.



Selectivity curves for pot and fyke net for sepia officinalis

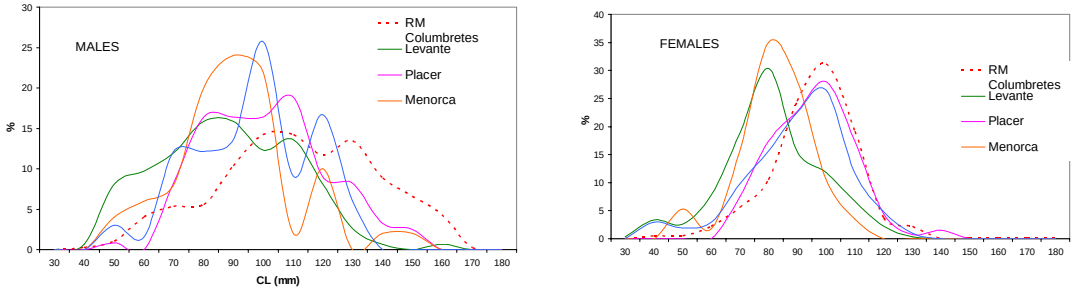
In recent studies carry out on spiny lobster (*Palinurus elephas*) in the western Mediterranean (*Raquel Goñi, Antoni Quetglas, Olga Reñones and Javier Mas, unpublished data*) observations onboard fishing vessels suggest that it is common practice to release undersized specimens when they are freed from the net in good condition (when soak times do not exceed 2-3 days). Undersized lobsters in trap fisheries are caught and released in very good condition.

The investigations on the catchability and selectivity of traps and trammel nets for *P. elephas* (*Goñi et al., in press*) indicated that, from the point of view of conservation, traps were preferable to trammel nets because they retained a smaller proportion of juveniles and because the largest lobsters (mostly males) were either too large to enter traps or were able to feed without entering. On the basis of the size structures of trap and trammel net catches of the protected population of the Columbretes Islands Marine Reserve, the study also concluded that the exploitation pattern of the females would be similar in trap and trammel net fisheries, while the exploitation pattern of the male component would differ and large males would be more abundant in populations fished with traps than in populations fished with trammel nets.



Size structure of males and females fished with traps and trammel nets from the protected population of P. elephas in the Columbretes Islands Marine Reserve

In the Spanish Mediterranean no *P. elephas* population exists that is solely fished by traps and thus it is not possible to verify these predictions. However, when we compared size distributions of trammel net catches from various fished populations with those from the protected population in the reserve, we observed that the no fished population contained a greater proportion of large males than exploited populations. As predicted, the size structure of females did not differ between the fished and no fished populations.



Size structure of trammel net catches in fished (various Western Mediterranean fisheries) and unfished (Columbretes Islands Marine Reserve) populations of P. elephas.

The implications of the pattern of exploitation of trammel nets for the sustainability of *P. elephas* exploited populations are difficult to assess in full. However, the decline in the availability of large males for mating in exploited populations of spiny lobsters may result in loss of reproductive potential of the population to an extent formerly attributed only to large females. Thus the change in exploitation pattern brought about by the substitution of traps by trammel nets in all *P. elephas* fisheries, may be one of the causes of their demise.

2.12 – Other gears

A huge variety of artisanal fishing gears are currently used in the Mediterranean sea and most of them has individual features, due to local tradition or fishermen's experiences.
One of this gear is quite rarely mentioned, besides of its very ancient tradition and it is the harpoon fishery for large pelagic species. This gear is used by a fleet based in thje Strait of Messina, now of about 16 vessels (in the past, this fleet was much more important). These vessels, having a very peculiar shape, are using maybe the most selective gear existing in the Mediterranean. As a matter of fact, the harpooner apply a strict voluntary selection of the fish prey: catches include swordfish, bluefin tuna, spearfish and sunfish.

DISCUSSION

Selectivity depends both on technical characteristics of the gear as on fishing practices. The attitude of fishermen, especially in an area where inspection is difficult, is very important for technical measures to have any effect. Consequently, the introduction of new technical measures should be accompanied with initiatives for improving the public awareness of the fishery problems.
It is recognised that in multispecies fisheries there is rarely a single minimum cod-end mesh size which is appropriate for all the species caught (P.A.M Stewart, 2001). Also according to (Petrakis and Stergiou, 1997), in general, it appears impossible to obtain satisfactory results in selectivity by using a single mesh for multi-species fisheries as Mediterranean bottom trawling. An approach by area and fishery may be necessary.
Social and political reasons may interfere with the introduction of selectivity improving measures for most of the Mediterranean fisheries and mainly for small and traditional vessels. Initially fishermen may be reluctant to embrace such devices, claiming that they result in the loss of commercial species and income. Often measures enforced in one fishery may benefit other fisheries. Although these selectivity devices are clearly of long term economic value to the fisheries, there is a lack of data to assess the economic and biological impacts of technical measures of selectivity. Predictions on longer term economic and biological consequences usually are quite speculative.

Problem of selectivity improvement in multi-gear fishery:

Most of Mediterranean fisheries exploit the same resources (like e.g. hake) with different gears and practices. The catch composition in age of each gear type may be different and can differently affect a same stock. The difficulty of this situation in terms of management has been often pointed out for hake shared stock fisheries (Aldebert et al., 1993), (Martin, 1989). A relatively numerically limited pool of mature fish which are normally not caught in trawls in shallow waters can constitute a significant spawning potential but are however vulnerable to bottom longline and gillnets which are working along the edge and on the slope of the continental shelf (Abella, Caddy and Serena, 1997).

Improvement of selectivity in this type of fisheries is difficult and generally needs the application of technical measures both on the fishing gear and fishing effort. On the Tuscany coasts hake fisheries, analysis of Y/R suggests that it possible to get significant result with a moderate increase of the cod-end mesh size for the trawlers with a significant general reduction of fishing pressure (Abella, Sartor and Sbrana, 2003).

The choice of technical measure for selectivity improvement imply to define in first an biological objective as the minimum catch size. Hermaphroditism, sexual dimorphism or reproduction pattern have to be taken more into account for the definition of the legal size which may be obviously bigger than the first age of sexual maturity which are commonly used. Nevertheless, the definition of an uniform legal size for the concerned species is uneasy because the reproduction pattern is strongly dependent of the ecological and social conditions of the populations and needs particular studies for each fishery.

It is also a common rule to fix the minimum legal dimension of the main selectivity parameter according a selection factor defined either from L50% or the modal size obtained by the selectivity curve. Because there is no or imprecise definition of tolerance limits, for undersized catches, this custom let in fact a part of tolerance for undersized catches and place often the fisherman in a wrong position face to the law and the fishery control. I would be therefore suitable that minimum legal sizes are fixed within limit intervals defined also from selectivity curve.

CONCLUSIONS

The Mediterranean is a very complex area as to fisheries with a high variety of commercial fish species, fishing methods and fishing vessel types. General conclusions or recommendations applicable to the whole area are difficult to present.

For bottom trawling, it could be stated that discarding is quite high in the Mediterranean, caused by the rather small minimum mesh sizes used. Most authors cited agree that a mesh size below 40mm is too small for a sustainable fishery. Even the legal 40mm minimum mesh size is often questioned. The observation that the length at 50% maturity differs from one area to another, complicates the situation. The problem with determining a suitable minimum mesh size in a mixed fishery gets, however, magnified in the Mediterranean because of the large number of species and different fisheries. An increase in mesh size to 60mm would certainly improve the situation but will result in short time losses. It is, however, estimated that a long term gain can be expected for most commercial species. An extra problem exists with typical fisheries targeting species of a particular small size who will suffer from an increase in minimum mesh size.

Several options exist to improve trawl selectivity besides an increase in mesh size. Some experiments have been carried out in the Mediterranean, mainly with square mesh cod-ends but also with sorting grids and square mesh windows (separator panels have not been tried yet). Some of these devices showed promising results but due to specific local conditions that occur over the whole Mediterranean area these results cannot be extrapolated. Specific research projects in problem areas can improve the knowledge to support management in choosing the right management options for selectivity improvement.

Beam trawls are often blamed for their impact on the seafloor and life it contains. The French beam trawl fishery "gangui" has been banned since 2002. The by-catch observed in the Italian "rapido" trawl can be quite significant. An improvement of the selectivity of this type of trawl is desirable. An increase in mesh size can, however, be undone due to clogging of the meshes by sediment and epifauna. The concern has also been expressed on the technological development in this fishery.
The impact on the seafloor of dredges can be expected to be even higher than for beam trawls. The selectivity of the meshes is questionable due to frequent clogging of the meshes.
The purse seine has the potential to be quite selective but this depends mainly on the skills and the attitude of the skipper who has to select the target schools. Recent experiments have shown that methods can be developed to improve purse seine selectivity.
The beach seine is a fishing method under discussion. Local conditions seem to have a major impact on the sustainability of this fishery. If the target species is small in mature size and by-catches are low, a fishery with small meshes can be viable. If the target species is large, this fishing method has the characteristics that allow improvement of the size selectivity.
The selectivity of longlines can be questionable in general, but it depends upon the type of longline used, the type and size of the bait, the size of the hooks, the season and the area. As a matter of fact, the selectivity is not absolute but induced by a combination of factors. However clear and not ambiguous size selectivity can be got when it is possible to use series of hooks with large intervals of size. Nevertheless the catch distribution are often overlapping and small hooks are generally less efficient for the largest individuals, probably because of the catch loss or the fish avoidance (*Bjordal and Lokkeborg,1996*).
Static nets selectivity is a also a combination of factors where mesh size is the most important. Large progress has been made in the knowledge of relation between fish length and mesh size. There is obviously overlapping in catch distribution but mesh size control is easily to apply and has already provided fairly good results in static net fishery management. Gillnet as well trammels net are generally more selective than active gears and provide a minimum of unwanted capture. Nevertheless studies must be carried out for a better control of the entanglement which is the main cause of by-catch. Twine softness, slackness and hanging ratio are the main parameters pointed out and their effect must be estimated more precisely. As also for longline large mesh are less efficient for large fishes than small mesh for small fishes. Default of selectivity methods or avoidance behaviour this phenomena needs to be measured at least for its consequence in terms of the evaluation of static fishing efficiency. As matter of fact static nets as well other static gear need perhaps more technical measures for effort control than selectivity improvements. Excess of static nets effort can result in excess of by-catch and occasionally in discards and in increase risk of net loss and ghost fishing.
Traps and pots have the important advantages to be made with rigid material and to keep in life the catch. Selectivity are therefore easy to improve by the dimension of the mesh of the cover, the bar space or by the way of biodegradable panel. This type of gear has sorely a low efficiency which lead obviously to increase hugely the number of traps as it is the way to day for octopus pots. Consequences in terms of métier conflict and environmental effect must be evaluated for effort limitation.

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Appendix C-1: Summary of results in:

Fiorentino F., S. Ragonese, 2000. Trawl selectivity in main target species of Mediterranean on the basis of experiences reported in literature. Scientific Advisory Committee – GFCM meeting, Sub-Committee on Stock Assessment, Madrid, Spain, 26-28 April, 2000

Hake

The trend of L50 values in function of MS for Hake is shown in fig. 1a. In the same figure it is also shown the linear regression L50(cm) = 0.5147 MS(mm) – 8.5869 (r^2=0,7458; p<0,01), that represents the link between length at first capture and the mesh of the net.

The trend of selection range (SR) in function of mesh size (MS) does not show any clear relationship (fig. 1b).

The scattering of the selection factors (SF) in function of the mesh size (MS) is shown in fig. 1c. Although an high variability occurs, as it is indicated by the low determination coefficient (r^2), the linear relationship results highly significant, that is the selection factor increases with increasing of the mesh size (r^2=0,2728; p<0,01).

Red Mullet

The trend of L50 values in function of MS for Red Mullet is shown in fig. 2a. In the same figure it is also shown the linear regression L50(cm) = 0.3981 MS(mm) – 6.3495 (r^2=0,6639; p<0,01), that represents the link between length at first capture and the mesh of the net.

The trend of selection range (SR) in function of mesh size (MS) does not show any clear relationship (fig. 2b).

The scattering of the selection factors (SF) in function of the mesh size (MS) is shown in fig. 2c. Like for the Hake, even if an high variability occurs, as it is indicated by the low determination coefficient (r^2), the linear relationship results highly significant (r^2=0.2545; p<0,01).

Blue Whiting

No evident relationship were found, although it must be noted that analysis was based on too scanty data (figs. 3a-b-c).

Red and Violet Shrimps

Fig. 4a shows the relation between length at first capture and the mesh in Red and Violet shrimps.

The trend of selection range (SR) in function of mesh size (MS) is shown in fig. 4b. Although analysis is based on few experiments it seems that an increase of SR occurs when the MS raises

The selection factors (SF) seems to present a little variation while the MS increase, at least between 40 and 60 mm opening (fig. 4c).

Pink Shrimp

The relation of with L50, SR and SF are not significant, considering also that MS used in the experiments ranged between 30 and 40 mm opening.

Norway lobster

The trend of L50 values in function of MS is shown in fig. 6a. In the same figure it is also shown the linear regression L50(cm) = 0.6651 MS(mm) – 10.182 (r^2=0.7255; p<0,01), that represents the link between length at first capture and the mesh of the net.

The trend of selection range (SR) in function of mesh size (MS) and the two interpolating expressions are shown in fig. 6b. Although both the expressions have very high determination coefficients, the exponential relationship explains better the variation of SR in terms of variation of L50.

The scattering of the selection factors (SF) in function of the mesh size (MS) is shown in fig. 6c. No evident relationship were found and SF seems to fluctuate close to 0.4.

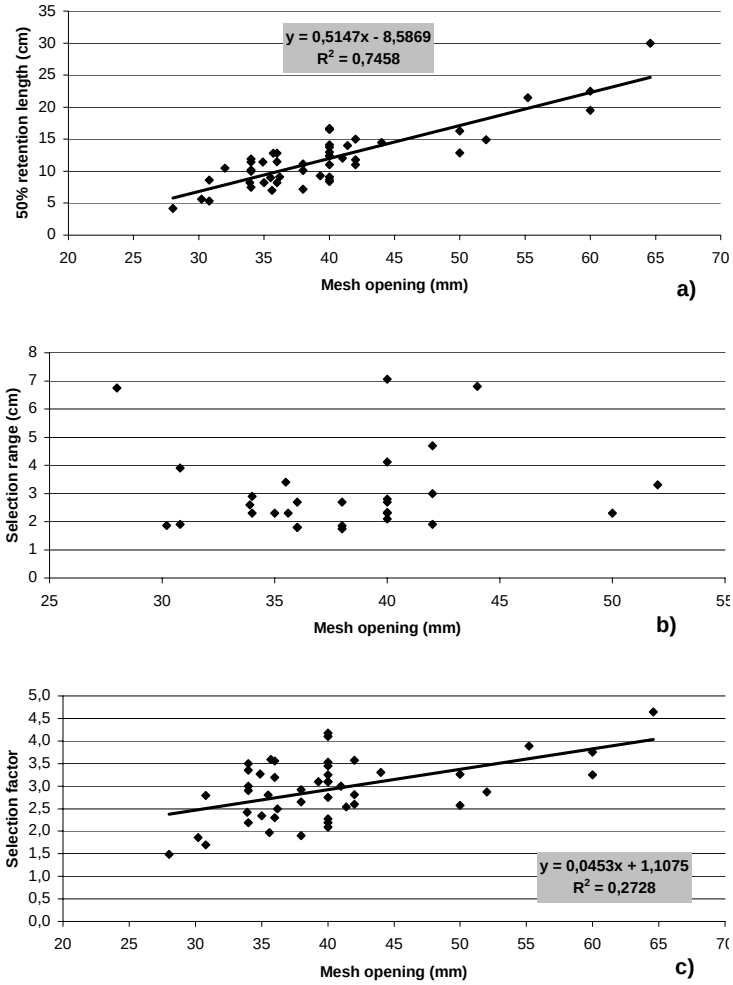


Fig.1 - Relationships between the mesh opening of the cod-end in mm and the 50% retention length in cm (a), the selection range (b) and the selection factor (c) in M. merluccius in the Mediterranean.

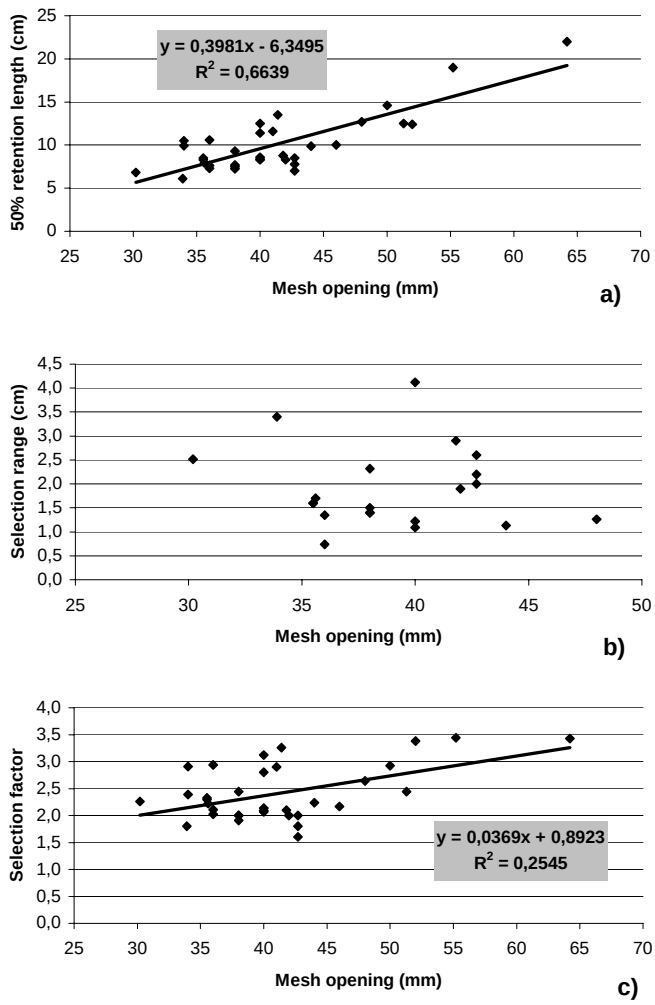
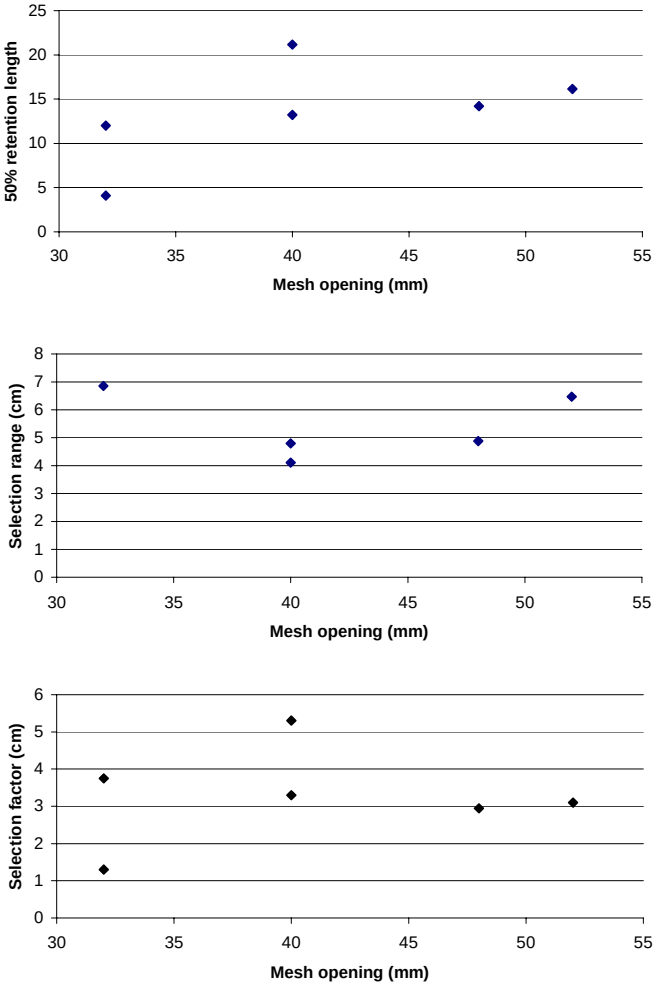


Fig.2 - Relationships between the mesh opening of the cod-end in mm and the 50% retention length in cm (a), the selection range (b) and the selection factor (c) in M. barbatus in the Mediterranean.



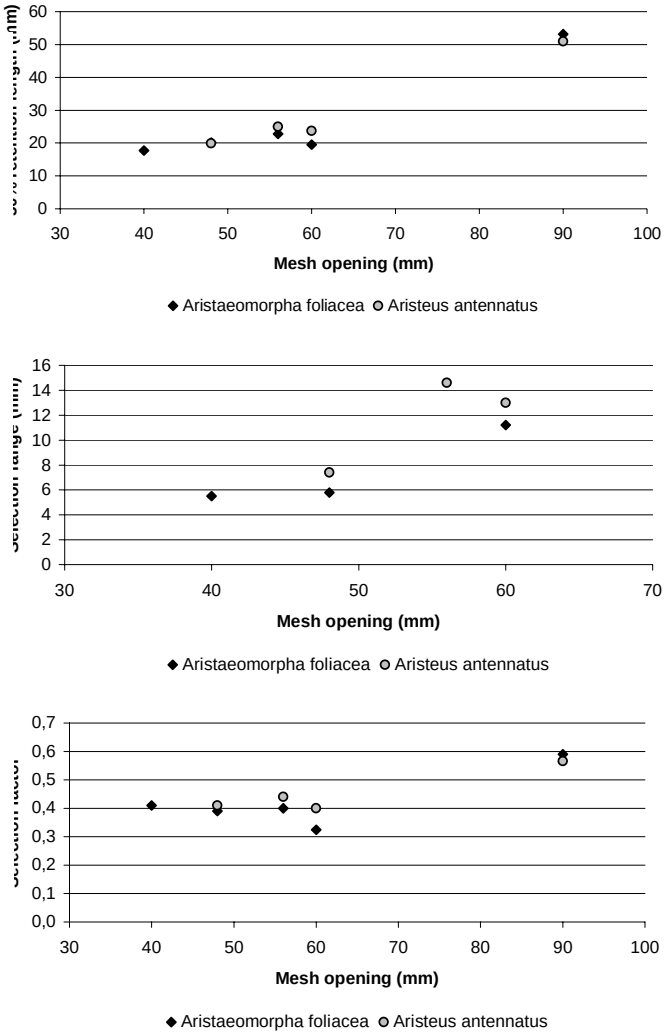


Fig.3 - Relationships between the mesh opening of the cod-end in mm and the 50% retention length in cm (a), the selection range (b) and the selection factor (c) in M. poutassou in the Mediterranean.

Fig.4 - Relationships between the mesh opening of the cod-end in mm and the 50% retention length in cm (a), the selection range (b) and the selection factor (c) in A.foliacea and A. antennatus in the Mediterranean.

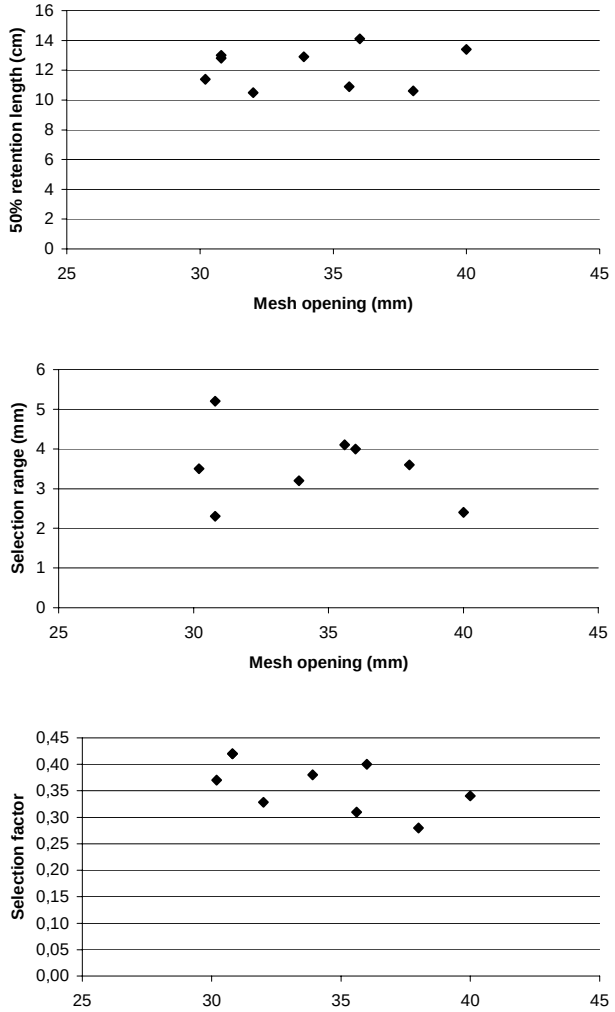


Fig.5 - Relationships between the mesh opening of the cod-end in mm and the 50% retention length in cm (a), the selection range (b) and the selection factor (c) in P. longirostris in the Mediterranean.

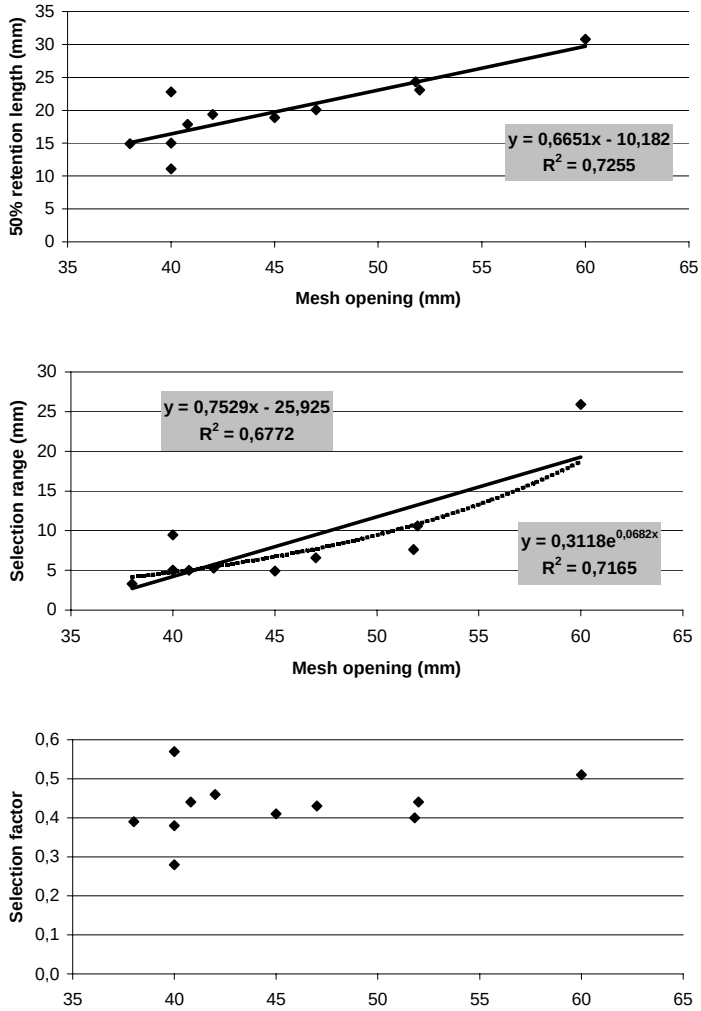


Fig.6 - Relationships between the mesh opening of the cod-end in mm and the 50% retention length in cm (a), the selection range (b) and the selection factor (c) in N.norvegicus in the Mediterranean.

SECTION D: SUMMARY OF NATIONAL AND REGIONAL LAWS CONCERNING BOTH TECHNICAL MEASURES AND SPECIAL FISHERIES

SPAIN

The Spanish law R.D. 1440/99 (B.O.E. 10/09/99) indicates the general regulation about the fisheries and his related activities. This law agrees with the European general rules (UE regulation 1626/94).

Other laws (Real Decreto Ley) assessing the minimum size (RD 560/1995), mesh sizes (RD 2108/1984) and penalties (RD 3/2001).

ITALY

The technical measures for the Italian fisheries are set up by both the law 963/1965 and the regulation n.1639/1968.

Such rules concern the allowed gears, their characteristics, the mesh size, the minimum size of the marine organisms allowed to be fished, the fishery seasons. After 1968, few ministerial regulations for many technical measures do exist.

The law n. 41/82 establishes the system of fishing licences delivering and considers the management of fisheries, the fishing effort control and the cooperation of fishing associations.

Both the above law 963/1965 and the regulation 1639/1968 establish the special fisheries and national derogations.

Ministerial Decree fixes the application of detailed rules, for special fisheries, in the framework of national laws. At present, UE regulation 1626/94 and following UE regulations establish a few derogations from the European rules.

At present does exist:

- trawl fishing in coastal area in winter months only in five maritime compartments for trawler with GT less than 10 and other obligations on meshes and areas.
- Fishery of *bianchetto*. In two winter months, authorization to catch juveniles of sardines and adults of *Aphia minuta* is possible to be kept. Detailed conditions and vessels allowed to fish, are fixed by ministerial decree.
- Few regional rules for lagune and coastal fisheries exist with limitations concerning gears and fisheries seasons.

FRANCE

French Mediterranean fishing fleets benefit from an array of national and regional legislation, which have for objective to regulate and control their fishing activity in terms of capacity, effort and selectivity. The Ministry of the Agriculture, Fisheries and Food governs this profession.

The French segmentation, as it is defined in the framework of MAGP for the allocation of the fishing capacity (power and tonnage), divides the Mediterranean fleet in 3 main groups of vessels according to their metier, and their target species: polyvalent small scale fishing vessels, polyvalent trawlers and pelagic purse seiners.

Their number and more precisely the annual exercise of their activity are limited by a national regime of licence which was established by national decree either for continental Mediterranean coasts (*Arrêté du 11/04/97 relatif à certaines mesures de gestion de la pêche côtière en Méditerranée continentale,)* or specifically for Corsica (***Arrêté du 14/06/91*** *portant création d'un régime de licences pour la pêche professionnelle dans les eaux autour de la Corse*). This one states in particular the conditions of licence allocation to the vessels and of transfer of decision to the Regional professional organisations. Other decree can complete and precise these conditions of allocation for a particular fleet, which targets species submitted to

a particular regime of conservation (e.g. for bluefin tuna *Arrêté du 11 avril 1997 portant fixation du nombre de licences pour la pêche professionnelle du thon rouge en Méditerranée continentale, etc.*).
Concurrently with that regulation which aims to control fishing effort, a national decree (*Arrêté du 19/12/94 portant réglementation technique pour la pêche professionnelle en Méditerranée continentale*) defines the conditions of fishery practice in French waters and consequently the characteristics of fishing techniques such as they must be in accordance with the UE regime of resource conservation. In this way, this regulation states the engine power limit for the trawler, the minimum allowed for cod-end mesh size for pelagic and bottom trawls, the dimension authorized for particular gears and minimum legal size for a selection of species. As for example, trawling licence are delivered only to vessels of more than 18m and of less 25 m long.
Moreover, the implementation of these technical measures is based on specific regulation, which defines the procedure control as the measurement of the mesh (EC n° 2550/97) or the net height.
Besides this conservative regulation, there are several official rules, which govern navigation and the work at sea in terms of security and social protection. These law may in some case increase indirectly the fishing capacity or, at the opposite, limit the application of the fishing effort.
With this national legislation, specific regulation may be institute for limiting fishing practices in specific area and particular conditions by regional administration (protected areas, sanitary measures) or fishermen organisation as prud'homie, fishermen regional council (e.g. seasonal closure time for crawfish or sea urchins, etc). They must be obviously in accordance with the National and UE legislation; fishing time, local hour of fishing departure, seasonal mesh size, prohibited gear are in a such way commonly regulated.

GREECE

The fisheries management and conservation policy is under the authority and responsibility of the Ministry of Agriculture. The legal framework for regulating all fisheries issues is provided by the Fishing Code (Law Decree 420/70). Since 1970, the Fishing Code has undergone only minor modifications and improvements (e.g. Law Decrees, 1740/87, 2040/92).

Surveillance and the prosecution policy is under the authority of the Ministry of Merchant Navy Marine. The responsibility for control and enforcement of discipline has been transferred to the patrol services (post authorities/coastguards), which are located in all important navigational and fisheries ports.

The management/conservation measures of the Greek legislation can be broadly separated in two major categories: those aiming to keep fishing effort under control and those aiming to rationalise the exploitation of the resources. The first set of measures contains restrictions on the number of vessels or fishing capacity of the vessels. The second set contains provisions on fishing gears, fishing practices and fishing areas or seasons. The Greek legislation does not contain provisions on catch limits (TACs), except for blue-fin tuna.

In 1979 restrictive measure for boat seines were introduced and in 1988 restrictions on the issue of licences. In 1991 a general ban on the issue of new licences was implemented. A complete prohibition of the issue of new licences in bottom trawl and purse seine fishery has been enforced in 1988. The Law Decree 666/1966 determines the minimum vessel

dimensions for bottom trawl and purse seines. The Presidential Decree 373/85 regulates the sport fisheries.

Greece has not defined an Exclusive Economic Zone and the technical measures related to fisheries are applied in the terrestrial waters (6 miles). For the coastal fisheries there are not important nation wide restriction except for the boat seines.

Bottom trawl

Bottom trawl fishery is closed from 1/6 until 30/9. In addition, in some closed gulfs or in ecosystems that have been characterised sensitive, bottom trawl is forbidden for 6-9 months (Patraikos, N. Euboikos Gulf, Gulf of Thessaloniki), all for all over the year (e.g Pagassitikos Gulf, Sea park of Sporades Island, Amvrakikos Gulf). Under the provision of the Council Regulation 1626/94 the prohibited fishing zone for trawlers has recently extended to 3 miles or to 50 m depth. According to the Greek Legislation, fishing is prohibited in the 1 mile zone from the coast, regardless the depth. The minimum mesh size of the cod end is 40 mm.

Purse seine

According to the legislation in force, the mesh size in the cod end must be at least 14 mm (full mesh) for the night purse seines and 40 mm (full mesh) for the day purse seines. The total length of the gear must be up to 800 m and the depth up to 120 m. Seining is forbidden inside 300 m from the coast and/or in depth less than 30 m. There is a closed season from 15th of December to the end of February of the following year for the night purse seines and from 1st of July to 31st of August for the day purse seines. Fishing with purse seine is forbidden within 500 m from the permanent fishing installations of stable fishing traps, in case they are in operation and within 1000 m from the entrance of aquaria when they are open. It is prohibited to purse seining to use the net as drift net. Purse seining is prohibited during full moon, 2 days before and 2 after, with the exception of Saronikos Gulf and the sea surrounding Crete for which this is only applied during Saturdays and the Sunday after the full moon. The intensity of the light must be up to 2000 candles per light boat when the number of lamp rafts is more than 5 and in case that the lights are not covered on top with reflector. In any case the total light intensity should not exceed 10000 candles per vessel. Apart from the above-mentioned restrictions there are many local time and place restrictions in closed gulfs and protected areas (e.g. Amvrakikos Gulf).

Boat seine

According to the Greek Legislation, fishing is closed from April to September included, in all Greek waters and there are more local restrictions (Maliakos Gulf, Kalloni’s Gulf). Fishing is allowed from one hour before sunrise until one hour after sunset. The mesh size in the codend is at least 16 mm (full mesh). The activity of the gear is restricted in a distance of about 1 nautical mile along the coast, only of smooth bottoms and during daylight. During hauling the vessel must remain stable and in a distance less then 70 m from the shoreline. According to the President's Decree 553/79 and 669/80, new licenses are not issued.

Nets

There are no general national provisions concerning net fishery. The only existed provisions valid for the whore Greek territory are those specified by the Council Regulation 1626/94, according to which the height of the bottom nets is restricted to 4 m and it is forbidden to carry on board and use more than 5.000 m of bottom nets. However, there are more local restrictions (Maliakos Gulf, Thermaikos Gulf, Mesologgi lagoon).

Longlines

There are no general national provisions concerning longline fishery. The only existed provisions valid for the whore Greek territory are those specified by the Council Regulation 1626/94, according to which is forbidden to carry on board and use more than 7.000 m of bottom longlines and more than 60 km of floating longlines. However, there are more local restrictions (Thermaikos Gulf, Mesologgi lagoon) and provisions concerning sport fisheries.

Dredges

The fishing period for dredging fishery in the entire Greek territory is from 1st of October to31st of May every year. According to the target species there are also some more prohibitions. Thus, for *Venus sp*. fishing is not allowed from 1st of August to 31st of October, for *Callista chione* from 1st of April to 30th of June, for *Modiolus barbatus. Donax trunculus Pecten sp., Venerupis sp.* from 1st of April to 31st of October.

Forbidden fishing methods and gears

There are some nation wide general prohibitions, e.g. midwater trawls, drift nets, nylon nets.

Minimum landing size restrictions

Minimum landing size regulations exists for some species according to 1626/94 Council Regulation.

Weight restrictions

Is forbidden to fish and sell:
Lobster, with weight less than 420 gr
Octopus, with weight less than 500 gr
Thunnus thynnus, with weight less than 6.4 kg.

Time restrictions

Swordfish fishery is closed from 1 of June to 30 of September.
For Octopus and Lobster there are as well closed seasons in specific areas for specific gears.

Species restrictions

The collection, transportation, processing, selling of red coral (*Corallium rubrum*) is forbidden, without special permission. Permissions are valid for one year but their validity duration cannot be more than 9 months. The collection starts on the 1st of April until the 31st of December.

SECTION E: SUMMARY, ADVICES AND FINAL CONSIDERATIONS

Both the characteristics of some fishing gears and of fishing fleets by fishery are summarised in the synoptic tables reported in the Appendix II and III respectively.

SPAIN

FISHERY SUMMARY

Bottom trawling

GSA 1 – NORTHERN ALBORAN SEA

Continental shelf

Fleet: 122 trawlers, mean length 11.5m, mean power 100 HP, GT from less than 20 to 80. This is the oldest segment of the fleet and most of the boats are wooden made.

Fishing time: from Monday to Friday for 12 hours/day during all the year except for a closed two-month season in the first half of the year. Target species: *Merluccius merluccius, Pagellus acarne, Octopus vulgaris, Parapenaeus longirostris*. Interactions with artisanal fisheries. By-catch species: *Loligo vulgaris, Mullus barbatus, Sepia officinalis, Sepia elegans, Ilex coinditei, Alloteuthis* spp. The biomass index shows a decreasing trend.

Slope

Fleet: 43 trawlers, mean length 17.5m, mean power 250 HP, GT>80. Catch: *Parapenaeus longirostris*. Fishing time: from Monday to Friday, for 12 hours/day.

Target species: *Nephrops norvegicus* and *Aristeus antennatus*

GSA 2 – ALBORAN ISLANDS

Slope

Fleet: 73 vessels, mean length 17.5m, targeting *Aristeus antennatus*.

Fishing time: all the year round except for a close two-month season in the first half of the year. The number of vessels is included in a restricted list subjected to specific regulations.

GSA 5 – BALEARIC ISLANDS

Continental and slope trawling

Fleet: 31 vessels; mean values: 18.5m (L_{OA}), 46.3 (GRT), 52.1 (GT) and 202 kW. Made of fibreglass (15.6%) and wood (79.7%). They operate all the year round. Age (mean): 27.8 years. Target species: *Merluccius merluccius, Mullus surmuletus, Spicara smaris, Octopus vulgaris, Aristeus antennatus*. The fleet is oversized.

GSA 6 – NORTHERN SPAIN

Continental shelf and slope

Fleet: 378 vessels, medium length 17m, GT from <20 to >150. Hull material: wood, fibreglass and steel. Fishing time: all the year round except for a close two-month season.

Target species: *Merluccius merluccius, Mullus barbatus, Octopus vulgaris, Eledone cirrhosa, Lophius* spp. *Micromesistius poutassou*. Discards: 33% of the total captured biomass. Low discard of commercial species. A total of 115 species were commercialised and 309 discarded.

GSA 1, 5, 6 - NORTHERN ALBORAN SEA, BALEARIC ISLANDS, CATALAN COAST

Deep-water fishery
Fleet: 180 trawlers. Management regulations applied in GSA 6 include a closure (one or two months) of trawl fishery. Monthly landings fluctuate between 6 and 20t.
Considering the three areas, catches arose up to 423t in 2000, decreasing to 388t in 2001.

Dredges

GSA 1 - NORTHERN ALBORAN SEA
The fishing area does not extend out of two nautical miles from the coast.
Fleet: 188 vessels, 6.2m mean length. The total power is 3,769 HP, the mean value is 31 HP. Total GRT is about 329, and the mean value is 2.8.
Dredges are used all the year round. Up to six species are regularly fished: *Donax* spp., *Chamelea Gallina, Venerupis rhomboides, Acanthocardia tuberculata, Callista Chione* and *Pecten maximus*.
Interaction with the trawl fishery operating in the shallower continental shelf targeting *Octopus vulgaris.* The Autonomous Government regulates the fishery. The fishing ground is divided in different areas alternatively exploited by the fleet.

GSA 5 - BALEARIC ISLANDS
Fleet: 12 vessels less than 7m length. Dredges are used all the year round. More than one dredge are used at the same time, being occasionally up to 6 dredges used simultaneusly. In *Pecten maximus* fishery, only one dredge is used in each haul since the dimensions of the dredge are bigger and the fishing operation is different than in other cases.
Catch: *Donax* spp., *Chamelea gallina, Venerupis rhomboides, Acanthocardia tuberculata, Callista chione* and *P. maximus.*
Interaction with the trawl fishery operating in the shallower continental shelf targeting *Octopus vulgaris*. The Autonomous Government regulates the fishery.

GSA 6 - CATALAN COAST
Fleet: 48 vessels having a mean length of 7m. Total power 2,178 HP; total GRT 181. Mean values: 45 HP and 31.8 GRT. Dredges are used all the year round. More than one dredge areused at the same time, being occasionally up to 6 dredges used simultaneusly. In *Pecten maximus* fishery, only one dredge is used in each haul since the dimensions of the dredge are bigger and the fishing operation is different than in other cases.
Catch: *Donax* spp., *Chamelea gallina, Venerupis rhomboides, Acanthocardia tuberculata, Callista chione* and *P. maximus*. Interaction with the trawl fishery operating in the shallower continental shelf targeting the *Octopus vulgaris*.

PURSE SEINE

The purse seine fleet of the South Mediterranean Region (SMR) continuously decreased in the last two decades, reaching a total of 321 vessels in 2003. The purse seine is not authorised in water shallower than 35m. The minimum distance between boats is 500m. Fishing activity: 5 days/week, for 23 hours/day. The fishery is forbidden from Saturday night to Sunday.

GSA 1 – NORTHERN ALBORAN SEA
Small pelagics
Target species: *Sardina pilchardus, Engraulis encrasicolus, Trachurus* spp., *Scomber* spp., *Auxis rochei, Scomberesox saurus, Sardinella aurita*.
Anchovy. Landings in the Northern area reached a minimum of 157t in 1993.
Fleet: continuously decreased in the last two decades, from more than 230 (1980) to 120

(2001). 93% of vessels <40 GRT, mean value: 17.2 GRT. A strong reduction of the largest vessels occurred from 1985 onwards, possibly linked to the decrease of anchovy catches. At present, only few vessels with a high GRT are working. Fishing time: summer-fall and fall, for sardine and anchovy respectively.
Sardine. Landings reached a peak in 1991-1992, but they decreased to a mean value of 1,000-2,000t in 1994-1998; then, landings recovered during the last four years. Moreover, CPUEs reached a peak in the last years, suggesting a possible increase of fishing effort.

GSA 5 - BALEARIC ISLANDS
Fleet: 12 boats, with a medium size of 11.2 m. Activity of each boat: 170 days/year.
Catches amount to 800t per year: *Sardina pilchardus, Trachurus* spp., *Sardinella aurita, Engraulis encrasicolus, Scomber* spp., *Seriola dumerilii, Boops boops* etc.
Blue fin tuna
Fishing time: from April to October. Fleet: 7 vessels. The catch increased from 1999 to 2002 with a mean of 1,580t.

GSA 6 - NORTHERN SPAIN
Small pelagics
Fleet: 179 vessels with an average length of 16m. The vessel number decreased by 20% from 1998 to 2001. Target species: anchovy, sardine, *Trachurus* spp. or *Scomber* spp.
From 1990 to 1994 the annual anchovy catch ranged between 17,000t and 24,000t, maximum annual catch for the period 1990-2000. From 1994, annual catches gradually decreased down to 7,350t.

FIXED AND DRIFTING GEAR FISHERIES

There are several artisanal fisheries using a lot of gears targeting many different species of fish, crustaceans and molluscs. These kinds of fisheries are well represented along the whole Spanish coast, usually spread in all ports. Additionally, some concentrations of vessels could be found in beaches.
The number of vessels involved in these fisheries is uncertain, since some boats have not any license to fish and others, officially active, only work a few days per year. The small-scale fishery in the Spanish Mediterranean has a limited importance if compared with bottom trawl and purse seine fisheries. Nevertheless, its social and economic importance is great. Artisanal fleet exceeds 3,000 small-sized (<10m) boats using more than 20 different gears, usually 2 or more by boat. The catches are characterised by a high species diversity and the landings are spread over a large geographic area so making data collection difficult. Approximate number of vessels: 3,139 vessels. All the boats are 6-9 m long, 3-4 GRT and 30-50 HP. Many boats use an outboard engine.
Moreover, an important drifting longline fishery targeting blue fin tuna and swordfish is carried out by a particular segment of the fleet.

GSA 1: 873 boats mostly using gillnets, trammel nets and bottom longlines. Other gears used are beach seines, combined gillnet-trammel nets, traps and hand-lines. Target species: *Pagellus* spp., *Mullus surmuletus, M. Barbatus, Octopus vulgaris* and *Sepia officinalis.*
GSA 5: 473 vessels, 7m of average length, fishing all the round year with trammel nets and bottom longlines. Target species: *S. officinalis, M. surmuletus, Pagrus pagrus, Dentex dentex,* and *Palinurus elephas*. *P. elephas* is fished from April to August. The other species may be caught all the year round.
GSA 6: 1,327 6m-long vessels using both gillnets and trammel nets; fishing activity is carried

out all the year round, targeting *Mullus surmuletus*, *M. barbatus* and *Pagellus acarne*.
Bottom longline: 230 9m-long boats targeting *Merluccius merluccius* all the year round. Artisanal polyvalent vessels: 196 7m-long boats, using different type of gears and targeting various species.
In the Alicante Gulf artisanal activity exists in 12 ports, with more than 150 boats daily landing. The port of Santa Pola concentrates more than half of the activity (57% of boats) landing more than 300/year.
In general, the fishery appears to be more or less stable; it reached a maximum CPUE in 1997 and then decreased slowly.
The species groups identified were: mullets (*Mullus* spp.), hake (*Merluccius merluccius*), octopus (*Octopus* sp.), sea breams (Sparidae), cuttlefish (*Sepia officinalis*), conger eel (*Conger conger*), shellfish (*Ruditapes* + *Donax* + *Chamelea*) and Mixed 1 *(*Sparidae + Scorpaenidae + Labridae).

Trammel nets

GSA1 – NORTHERN ALBORAN SEA
The trammel nets named "claros" are generally used on rocky areas from 5 to 10m depth, the "ciegos" in muddy and sandy grounds between 15 and 40m and the "langosta" trammel net up to 200m. The trammel net fishery is practiced by an uncertain number of boats.
Fishing time: "claro" is used from January to May, being replaced by "ciego" between June and September, coinciding with the *Mullus surmuletus* recruitment in the area. "Langosta" trammel net is also used in summer time.
Target species cuttlefish (*Sepia officinalis*) in "claros", red mullets (*Mullus* spp.) in "ciegos", and lobsters (*Palinurus mauritanicus*) in "langosta"; also other species are fished and sparids are the most important among them. Technical interactions with trawl fisheries.

GSA5 – BALEARIC ISLANDS
The trammel nets named "claros" are generally used on rocky areas from 5 to 10m depth, the "ciegos" in muddy and sandy grounds between 15 and 40m and the "langosta" trammel net up to 200m. The trammel net fishery is practiced by an unknown number of boats, probably greater than 400 boats. The "langosta" trammel net is used from March to August since there is a 6-month closure during the rest of the year.
GPS, radio, only a few vessels with echo-sounder. Target species: cuttlefish (*Sepia officinalis*) in "claros", red mullets (*Mullus* spp.) in "ciegos", and spiny lobster (*Palinurus elephas*) in "langosta"; also other species are fished, and sparids are the most important among them.
No quotas exist in *P. elephas* fisheries and reliable catch statistics are not available. In the Spanish Mediterranean effort controls and technical measures are used to manage fisheries. Fishing effort is regulated by an annual 6-month closure during the egg-bearing period (September to February) and there are caps on the amount of gears fished per boat (5,000m trammel nets) and on the soak time (<48 hours). The minimum mesh size of the trammel net outer and inner panels and the maximum size of the traps are also regulated. Finally, it is forbidden to land lobsters smaller than 80 mm CL (about 4 years) and berried females.

GSA 6– NORTHERN SPAIN
Most of vessels use more than one gear simultaneously or seasonally. The trammel nets named "sepiera" and "salmonetero" are the most frequent ones and caught more than 50% of the total artisanal catches. The trammel nets named "salmonetero" are generally used on *Posidonia* meadows from 15 to 30m depth, the "sepiera" in used on sandy grounds up to 20m, the "langostero" is used on rocky bottoms deeper than 50m, and the "lenguadera" on sandy

bottoms up to 30m. The trammel net fishery is practiced by an uncertain number of boats.
"Sepiera" is used from December to June, being replaced by "salmonetero" all the year round but especially between September and November, when a lot of juveniles occur in the area. The "langostera" trammel net is also used in summer time and the "lenguadera" from December to March. Target species are cuttlefish (*Sepia officinalis*) in the "sepiera", red mullets (*Mullus surmuletus*.) in "salmonetero", spiny lobster (*Palinurus elephas*) in "langostera", common sole (*Solea solea*) in "lenguadera". Other species are also fished and sparids and scorpenids are the most important.

Gillnet fisheries

GSA 1,5,6 – ALBORAN SEA, BALEARIC ISLANDS, CATALAN COAST

Gillnets ("solta" in Spanish) are used all the year around by the artisanal fleet, but the number of vessels using this kind of gears is uncertain. The "bonitolera" is used seasonally from August to November according with the migrations of the species. The basic gear is often modified according to the target species, which can be very different in either size or behaviour. Other two gillnets, quite spread along the coast, are that targeting hake and the "bonitolera" targeting small tuna fish. The mesh size ranges from 4 to 8cm. The most important species for traditional "soltas" are sparids and the two species of *Mullus*. Gillnets targeting hake are frequent in GSA6 and a great portion of the catch is hake. As an example, in the year 2000, in the Santa Pola port the "plastiquera" (local name for this type of gillnet) caught 109t, 47% of which corresponded to hake; while the "bonitoleras" caught 2.2t mainly consisting of *Sarda sarda*.
Technical interactions with trawl fisheries in some places and with other artisanal fisheries.

Longline and hand line

GSA 1,5,6 – NORTHERN ALBORAN SEA, BALEARIC ISLANDS, CATALAN COASTS

Large pelagics longline

Target species: *Thunnus thynnus* and *Xiphias gladius*. From1999 to 2002 blue fin tuna catches show a slight decrease with longline and a double increase with the hand line. Swordfish catch data doubled with the surface longline and decreased of 50% with the bottom longline.

Blue fin drifting longline

Fleet: total number of vessels was about 30-40. Fishing time: from May to July. Fishing equipment: the main line can reach a length of 40 nm with 1,800 hooks. Deck layout: 1-2 hydraulic haulers. 1-2 cranes to haul the catch. An electric winch to manage the fish on the deck. One small freezer to maintain the bait. The ice to maintain the catch is produced on board. Catch: mean annual catch for 1999- 2002 was 388t. Technical interactions with other large pelagic fisheries.

Bluefin hand longline

This fishery is practised by different types of vessels, from the artisanal ones to medium size boats with modern equipment. Fleet: variable, up to 200 small vessels and several medium size vessels. Fishing time: March-October. Mean catch for 1999-2002 was 58.5t. Technical interactions with other large pelagic fisheries.

Swordfish drifting longline

Fishing grounds: Spanish Levant coast, Ibiza Channel, Balearic Islands. Fleet: the total number of vessels practicing this fishery can be up to 120. Fishing time: the fleet fish all the year round, especially in summer and fall. Data on catch: mean yearly catch for 1999- 2002 was 1,203t. Recently some boats started using the American longline to fish on deeper waters

in respect to the traditional ones. The Spanish legislation allows only a longline having a total length up to 33nm and 2000 hooks. These dimensions are smaller than those normally used. Relationships between fishing effort, fishing mortality, catch. Standardized abundance index is decreasing.

Swordfish bottom longline

Seasonal activity: second half of the year. Mean catch for 1999-2002 was 133t. Technical interactions with other large pelagic fisheries. The present exploitation pattern seems to be sustainable on a short time.

Artisanal bottom longline

The fleet generally uses three different types of bottom longlines. Most of the vessels have a line hauler. Catch: sparids as *Pagellus acarne, P. bogaraveo, Dentex* spp., *Pagrus pagrus, Conger conger, Epinephelus marginatus, Polyprion americanus* and *Helicolenus dactylopterus*. Technical interactions with other artisanal fisheries and trawl fishery.

GSA 7 – GULF OF LIONS

Hake bottom longline

Fleet: 20 vessels, mean power of 128 HP, 6-19 GRT (mean value:13); length of 8-14.5m (mean value: 11.7m). Mean building year: 1991. Fishing time: all the year round. In the last years the catches showed a decreasing trend. A jointly assessing of this fleet and the trawl fleets (Spanish and French) targeting on hake was done in the last years. The main result shows that the resource is affected by an increasing overfishing and there may be a risk of recruitment overfishing as well.

Traps, pots

GSA 1, 5, 6 – NORTHERN ALBORAN SEA, BALERIC ISLANDS, CATALAN COAST

Traps for shrimps

Traps capture caridean shrimp *Plesionika edwardsi*. The fleet operates at 350-500 m. A ship that uses this gear has about 65 GRT and an average length of 19m. The number is unknown.

The trap shape is variable. They are lowered in lines of 350 traps and are collected every day. Annual landings vary between 60 and 100 t/year.

GSA 1 – NORTHERN ALBORAN SEA

Pots for octopus

This fishery is relatively recent and is practising by the same fleet fishing with dredges. Fishing time: all year, depending on the yields. The number of pots by ship deployed at the sea at the same time can reached 2,000 units.

SUMMARY OF SPECIAL FISHERIES

GSA 5 - BALEARIC ISLANDS

"Jonquillo" fishery

Fleet: 40 vessels having and an average length of 7m, using small boat seines. Fishing time: from December to April. Target species: *Aphia minuta* and *Pseudaphia ferreri*. This fishery is very selective.

Continental shelf

Fleet: 122 trawlers, mean length: 11.5m, GT: from <20 to 80, mean power: 100 HP but this value is underestimated since the official power recorded is lower than the real one. This segment of the trawl fleet is the oldest one and most of the boats are wooden made.

GSA 5 – BALEARIC ISLANDS

Continental and slope trawling

Fleet: 31 vessels; mean values: 18.5m (L_{OA}), 46.3 (GRT), 52.1 (GT) and 202 kW. Made of fibreglass (15.6%) and wood (79.7%). They operate all the year round. Vessel age (mean): 27.8 years. Target species: *Merluccius merluccius*, *Mullus surmuletus*, *Spicara smaris*, *Octopus vulgaris*, *Aristeus antennatus*. The fishery is overexploiting most of the resources because of the oversized fleet, the high fishing capacity and an inadequate exploitation pattern, based on the youngest age classes.

GENERAL CONCLUSIONS

Information come from Investigation Projects using different methodologies; as a consequence results are often not homogeneous and spatially and/or temporarily limited.

Demersal fisheries in the Spanish Mediterranean waters are highly complex because there are many different metiers and many target species. Trawl fisheries are multi-specific, so a management measure suitable for a single species might have an undesirable effect on another one.

Hake and octopus are the main species of trawl fishery. In both cases there are some interactions between trawl fishery and some artisanal fisheries. The nature and intensity of the interaction vary in the different areas. Moreover, a trawl fleet segment fishes in deep waters targeting *Aristeus antennatus.* Discard of marketable species is not frequent in both trawl fleet segments. Both historical series of abundance index obtained from trawl research cruises and landing data from the trawl fishing fleet show light decreasing trends in the recent years.

Main target species for purse seine fleet are anchovy and sardine. Landings data for both species show a decreasing trend in the last years. Results of research cruises using acoustic methods show a decreasing trend of the abundance index for sardine and anchovy and an increases in the abundance of other species of low market value.

Tuna fisheries targeting blue fin tuna are increasing their effort as a consequence of the development of “tuna farming”, although non reliable data are available from the beginning of this new practices.

The real fishing effort is difficult to estimate due to the modernization of the fishing fleet. Technological improvements have been introduced so increasing the vessel efficiency.

RECOMMENDATIONS

Most of the fisheries are artisanal and manpower dependent. Any management measure considered within the CFP should be based not only on the conservation of the resources, but on the socioeconomic consequences on the fishing sector as well. Moreover, the adequate management measures implementation, the instruments of surveillance and the appropriate penalties for the failures of those measures have to be created.

Permanent closed areas to reduce the impact on species or habitats protected by European Directives or International Conventions are strongly recommended. Seasonally closed areas should be implemented to protect spawning and/or recruitment of overexploited species.

Marine protected areas close to the coast or in specific environments have demonstrated to be useful management tools to reduce the artisanal fishery impact on target species and coastal ecosystems and to manage the fisheries. The implementation of marine protected areas in the continental shelf and off the economic zone is recommended.

General fishing effort should be reduced. Since some traditional measures aimed at limiting the fishing effort through the fishing capacity (HP or GT) have been unsuccessful, a more effective reduction of fishing effort could be got limiting the vessel number or the fishing

time. Anyway, an increase of fishing effort must not be accepted in the future.
Selectivity of the gears has to be improved. Since selectivity studies are not available for most of gears, the increase of mesh or hook sizes, or the introduction of new selectivity devices or gears modifications should not be decided until appropriate scientific information has been gained. The adopted selectivity of gears should agree with minimum landing sizes established on the basis of biological criteria.
When an interaction for a common resource exists between two different métiers, a management measure applied to one métier should be complemented with another measure of the same trend for the other one.
In order to achieve an effective common management of the resources, derogations of the general rules should not be contemplated.

FRANCE

GENERAL

The large diversity of French Mediterranean fishing activities is carried out in a narrow coastal strip from 3 or 10 miles wide except for the continental shelf of Gulf of Lions (14,000 km^2), which extends to 50 miles in its middle part.

The French Mediterranean fishing fleet consists of about 2,000 artisanal units which are divided in 3 groups of métiers: trawling, purse seining and small scale métiers. Except for pelagic purse seiners and pelagic trawlers, most of the fishing units are involved in several métiers working on different fisheries according to the season or market opportunities. Except for tuna purse seiners, all of them practise daily activities under constraints of national, regional and professional legislation.

Trawlers are allowed to practice only bottom trawling and pelagic trawling outside the 3 nm from the coast or e 50 m depth.

Pelagic purse seiners are allowed to practice only purse seine for pelagic fishes (sardine, anchovy, blue fin tuna),

Small-scale vessels practice different métiers from shore to slope, according to the season, type of coast, fishing ground and vessel capacity. They are generally small boats with 18m L_{OA} and 250 kW. The following fisheries can be identified:

a) coastal fisheries: they practise seasonally, and indifferently from shore to shelf, active and fixed techniques like trammel net, gillnet, combined nets, bottom longline.
b) Open sea fisheries: they include specialized metiers like gillnet for hake, trammel for sole, trammel for crawfish, longline for hake and drifting longline and gillnet for tuna ("thonaille").

FISHERIES SUMMARY

Bottom trawling

Two main groups of trawl metiers can be identified thanks to their landings: bottom trawling and pelagic trawling with a variable number of vessels in each group. The French Mediterranean otter trawl fleet includes 131 vessels working under trawling licence exclusively in the Gulf of Lions (GS7), 29 small fishing units ("ganguis à panneaux") included in the category of small scale métiers and working exclusively in the coastal waters of the Provence coast (GS7) and 10 bottom trawlers working in the coastal waters of Corsica (GS8). All the trawl fleet land about 27,000t per year. These landings are largely dominated by pelagic species.

The French legislation defines the characteristics of gear and trawler and the conditions of their use (*Arrêté du 19 décembre 1994 portant réglementation technique pour la pêche professionnelle en Méditerranée continentale; Art. 5*).

Bottom trawl is notably defined as a trawl with a weight and protected foot-rope. The gear is towed by only one boat. The nominal power of the engine is limited to 588 kW (ISO 3046/l) and the cod-end mesh size is fixed to 45mm. Furthermore, this regulation fixes up the accessory devices which are allowed for bottom trawl.

Trawling licence is only attributed to vessels ranging from 18 to 25m L_{OA}. In particular conditions (bad weather etc.), derogation for trawling can be allowed both to some vessels under 18m of length and within the 3 nm for a limited time by regional authority.

Specific regulation established by Fishermen organisations (Prudhomies) states both daily and weekly trawl fishery activity.

<u>Continental shelf bottom trawl fishery</u>

Bottom trawlers work about 200-220 days/year, mainly on continental shelf until 150m depth.

They land from 50 to 60t/year/boat of various demersal and/or bottom fish
This activity interacts with Spanish trawl and longline fleets and French trawl and gillnet for hake (*Merluccius merluccius*), and with gillnetting and laguna fishing activity for sea bream (*Sparus aurata*). The relationship between fishing effort and catch don't take account the increase of fishing efficiency due to technical evolution ((i.e. propulsion, bollard pull, trawl conception) occurred in the last 30 years. The fishermen legislation limits the fishing time but not the lasting and number of tows. In the last 40 years, the exploited surface is becoming 6 times higher. The nominal value of the engine power does not reflect consequently the real fishing power of the French trawlers.
Coastal bottom trawl "Gangui à panneaux"
About 29 vessels, older than 40 years, with a maximum L_{OA} of 12 m and 52 kW in average, use the "gangui à panneaux" in area of the Eastern Provençal coast, for 200 days/year either on *Posidonia* meadows or detritic bottom between 30 and 100m. This fleet benefits of national derogation for codend mesh size (20mm), but is allowed only to vessels less than 12 m length and 85 kW.

GSA 8 - CORSICA
Continental shelf (coastal)
The fleet consists of about 10 33-year old trawlers having 16.2m length and 187 kW in average. They work 200 fishing days/year at depth ranging from 50 to 650m along the Eastern coast of Corsica, in the Tyrrhenian Sea. They use mainly a LVO bottom trawl for mixed species, but target seasonally high valuable species (red mullet, bream, Norway lobster), demersal fish, small pelagic fish and shrimp (*Parapenaeus longirostris, Aristeomorpha foliacea, Aristeus antennatus*).

Pelagic Trawling

GSA 7- GULF OF LIONS
French trawlers involved in trawling for pelagic fish work about 200-220 days/year exclusively on the continental shelf of the Gulf of Lions. They use mainly a four doors pelagic trawl with a 20-mm codend mesh size. The annual landings are about 18,000t corresponding to about 65% of the total trawling capture. These catches include at least 70% of anchovy and sardine and no more than 10% of by-catch of other small pelagics such as mackerel, horse mackerel, bogs. This fishery is submitted to the same licence regime as the bottom trawling.

Dredges

Except for manual dredge for *Donax*, dredging is practised by fishing boats having a length from 5 to 12m and from 14 to 169 kW. Being in average 41 years old, they are the oldest boats of the French small scale fisheries. This fleet is polyvalent and can practice 1-4 techniques as gillnetting, longlining, coastal beam-trawling or shellfish culture.
Donax dredge fishery
Around 86 fishermen use this manual dredge for *Donax* clams (*Donax trunculus*) essentially in the shallow waters at lower depth than 2m in the Gulf of Lions.
Oysters dredge fishery
268 small scale vessels are currently involved in dredging oysters (*Ostrea edulis, Crassostrea gigas*) for 8 months/year/boat mainly in Gulf of Lions and in some bays of Provence coast.
Sea urchin dredge fishery
89 vessels are involved in dredging sea urchins (*Paracentrotus lividus)*, mainly on the Eastern part of Gulf of Lions and Provence coast of Gulf of Genova.

Murex dredge fishery
From 20 to 28 fishing boats are practising dredging murex (*Bolinus brandaris*) from April to September on muddy and sandy bottoms between 5 and 40m for a total of 85 months/year in the Gulf of Lions.

Fixed opening trawls

GSA 7: PROVENÇAL AND GULF OF LIONS COAST
Coastal beam trawl fishery
28 "gangui" beam trawlers, 44 years old in average, 8m long and with 51 kW, practise the "small gangui" in Provence, mainly from October to March. They target fish soup and shrimp. Their annual production is about 23t/year and the fishing activity ranges from less than 50 to 100 fishing days/year. This métier is questioned because it is carried out on Posidonia meadows.

PURSE SEINE

ALL MEDITERRANEAN SEA
Bluefin tuna fishery
The French bluefin fishery is exploited by a fleet consisting of about 33 purse seiners, 13 years old, 33m long and 689 kW in average. This activity is carried out for about 8 months, from the end of March to the end of November, for less than 150 fishing days/year from the Gulf of Lions and Balearic Islands to Libya. Catch ranges between 4,000 to 8,000t/year. This fishery is limited by annual quota, licence regime and closed period at the beginning of summer.

GS7 - GULF OF LIONS AND PROVENCE
Small pelagic fishery
Only 9 purse seiners for small pelagic fish remain in the Gulf of Lions. They are 17.81m long and have an engine power of 246 kW in average. They work mainly from spring to fall during for approximately 148 days/year. Their production unit may range between 150 and 200Mt/boat/year according to the weather conditions
White fish fishery
43 small purse seiners, 22 years old, 9,5m long and 120 kW in average, practise this activity from 10 to 30m in the Gulf of Lions and Provençal coasts, mainly from August to November. They target mainly Sparidae (*Sparus aurata, Lithognathus mormyrus*), *Scomber japonicus*, and Mugilidae.

Trammel nets

GSA 7 – GULF OF LIONS AND LIGURIAN COASTS
Sole trammel fishery
99 fishing vessels, older than 23 years, 9.6m long and with 113 kW in average, work from 60 and 100 m depth on the flat bottoms located at SE of Gulf of Lions for about 40 days/year from October to April, and between 10 and 35m depth, from July to September for about 60 days/year. They target (*Solea vulgaris*) and (*Solea lascaris*). The catches amount to about 20 kg/fishing trip.
Cuttlefish trammel fishery
28 boats, 24 year old, 7.6m long and with 84 kW in average, practise this technique in the

Gulf of Lions on sandy bottoms between 10 and 30m depth from February to April, during the spawning season. Catches are mainly composed of cuttlefish (*Sepia officinalis*) and various flatfishes as sole (*Solea vulgaris*, *Solea lascaris*).

Brill and turbot trammel fishery

Vessels having 8-10m length and 50-110 kW practise this technique on sandy grounds placed at lower depth than 6m for turbot and on flat bottoms from 16 to 25m depth for monkfish, rays and brill. Fishing season lasts from October to December and from March to June for about 60 fishing days/year/boat.

Murex trammel fishery

15 fishing boats, 27 years old, 8m length and with 88 kW in average, practise this activity in shallow waters and sandy bottoms of the Gulf of Lions coasts.

Scorpionfish trammel fishery

The fishing fleet are composed of 33-year old small vessels, 6-8 m long and 20-88 kW, working on coralligenous and seaweed bottoms, between 10 and 40m from May to July. This activity is focused on species for fish soup and "bouillabaisse", including scorpionfish (mainly *Scorpaena porcus* and *Scorpaena notata)*, breams *(Diplodus* spp.), "mostelles, and small-sized species such as red mullet (*Mullus surmuletus* and *M. barbatus*), labroids *(Symphodus* spp.*), Spicara moena* and *S. smaris*).

Crawfish trammel fishery

92 vessels, 32 years old, 7.6m long and with 57kW are involved in this fishery which is practised essentially on the hard bottoms of the slope of the Catalan and Liguro-Provençal coasts, between 50 and 200m. Fishing season lasts from March to October and the gears are generally set for 3-4 days, for approximately 150-300 days/year/boat. Target species: *Palinurus elephas, P. mauritanicus, Lophius piscatorius, Scorpaena scofra, Pagrus pagrus,* and *Zeus faber*.

Red mullet trammel fishery

18 boats, 29 years old, 8m long and with 56 kW in average, practise this technique mainly in the Eastern part of Provence and Western Gulf of Lions, in shallow waters (<10m), mainly from April to September for 150-250 days/year/boat.

GSA 8 – CORSICA WEST COAST

Coastal trammel net fishery for various fishes

About 200 boats having an average length of, 85 kW of power and 5 GRT, practise this technique on detritic grounds (rock, coral rock, sand and Posidonia meadoews) from 0 to 40m depth along the western coast of Corsica for 180 fishing days/year. This fishery targets mainly bottom coastal fish like red mullet, Sparidae, Scorpaenidae, Labridae, molluscs. The production of this activity would be estimate at about 500Mt (100Mt of *Mullus surmuletus*).

Deep trammel net for various fishes

Fishing areas are shared between 40 and 90m depth on detritic and coralligeneous bottoms. Both the fleet and the activity are the same as for the coastal trammel fishery. 300 Mt are assessed to be annually landed. The main species caught are *Scorpaena scrofa, Phycis phycis, Pagellus erythrinus* and *Sparus pagrus*. Some crawfish can be also caught.

Crawfish trammel net

The same fleet is concerned and fishing grounds are the same as for the other trammel nets. Fishing time: 120 days/year. Target species: *Palinurus elephas* and *Palinurus mauritanicus* (170 t/year with 50t of by-catch of lobster and spider crab). Other by-catch species: *Lophius* spp., *Scorpana scrofa* and *S. elongata)*, elasmobranches. Eight temporarily closure areas are set since 1979 to protect *P. elephas*.

Gillnet fisheries

Hake gillnet fishery

116 fishing vessels, 27 years old, 9m long and 97 kW in average, are working for hake, from the edge to the slope of the continental shelf, between 80 and 400m.

In winter they catch hake on bottoms placed at more than 100m depth, while in spring-summer the smallest boats catch sparids and the biggest ones use the "thonnaille". Annual catches are estimated at 300 Mt representing 15-16% of the French production. These catches are essentially composed of 30-45 cm long adults.

Red mullet gillnet fishery

191 fishing boats, 22 years old, 5-11m long and 75 kW in average, target *Mullus surmuletus* and/or *Mullus barbatus*. on bottoms located between rocks and seagrass meadows, between 8 and 25m depth, from April to the end of September. By-catch is mainly composed of Labridae (*Symphodus* spp.*)*, small scorpionfish (*Scorpoena notata*) and small Sparidae (*Diplodus* spp. and *Pagellus* spp.).

Sea bream and other Sparidae fishery

From 95 to 128 fishing boats, 25 years old, 7.5m long and 85 kW in average, practise seasonally this technique between 5 and 40m depth. Fishing season generally extends from March to June and from September to December for sea bream (*Sparus aurata*), May to June for porgies (*Pagellus* spp.*)* and June to September (*Lithognathus mormyrus*). By-catch: *Sarpa salpa, Oblada melanura Diplodus sargus*, and low valuable species such as *Alosa* sp., *Sardinella aurita* and/or *Trachurus* spp.

Seabass gillnet fishery

17 fishing boats, 23 years old, 7.5m long and 74 kW in average, practise this technique on bottoms between 5 and 30m depth from November to January at the rate of 20-80 days/year.

Mullet gillnet fishery

40 fishing boats, 27 years old, 6.6m long and 82 kW in average, are generally involved from June to July in this technique for 30-100 days/year/boat in coastal waters, from 5 to 15 m depth.

John Dory gillnet fishery

From 5 to 10 fishing boats, 6-10 m long and 20-80 kW, practise this technique from March to June and for 80 days/year/boat on coralligenous bottoms of the slope in the Eastern part of the French Ligurian coast, from 180 to 250m depth. By-catch includes: crawfish (*Palinurus* spp.), scorpionfish (*Scorpaena scofra*) and monkfish (*Lophius* spp.).

Longlining and handlining

GS7- GULF OF LIONS AND LIGURO-PROVENCAL COASTS

Large pelagics drifting longline

Less than ten, 27 years old vessels are regularly involved in this fishery in offshore waters affected by the liguro–provençal current. Their mean length is of 9m and the engine power 99 kW.

GS8 – CORSICA

About 20 vessels are involved in swordfish fishery around Corsica waters, practising alternatively static nets and trammel nets for crawfish.

Bottom longline for conger

34 bottom longliners, 29 years old, 8m long and 79 kW in average, practise this technique on hard bottoms from 10 to more than 100m depth, from October to January. Annual catch ranges between 130 to 150 t for the Gulf of Lions.

Various bottom longline fishery
Around 82 fishing boats, 32 years old, 7m long and with 72 kW in average, practise bottom longlining for different fishes living on hard bottoms between 10 and 50m depth.
Sea bass longline fishery
11 fishing boats, 31 years old, 6.5m and with 41 kW in average, are involved in sea bass fishery in shallow waters between 10 to 50m depth.
hake bottom longline fishery
17 fishing boats, 34 years old, 7.6m long and with 65 kW in average are involved in hake longlining on hard bottoms of the edge and slope of the continental shelf and in the canyons, from 50 to 200m depth.

Surface nets

GSA 7 – GULF OF LIONS, PROVENCE AND LIGURIAN COASTS
Surface net for bluefin tuna
Small vessels ranging from 7 to 15m length and with a lower engine power than 180 kW practise alternatively tuna, hake or sole gillnetting from April to May in the Gulf of Lions, from June to July in the Gulf of Genoa and from September to half November in the western Gulf of Lions. Catch is estimated to be about 300 t/year.
Combined nets
Fishing boats, 26 years old, 9.2 m long and with 74 kW in average, are involved in combined nets fisheries for 150-200 days/year/boat. Less than 1,500m of nets are generally set from the coast to deeper waters. Because the nets must extend along the entire water column, the stretched height (sum of gillnet and trammel heights) can reach 35m. Catches are mainly composed of transient species as *Scomber* spp., *Sparus aurata, Lichia ami, Seriola dumerili, Sarda sarda* and sometimes *Thunnus* spp.

Traps, Pots

GSA 7 – GULF OF LIONS
Octopus pot fishery
34 boats, 23 years old, 9m long with 121 kW in average. They mainly work on sandy and shell bottoms of the Gulf of Lions at depths between 3 and 30m. The best fishing period extends from September and December on 3-10m depth and from March to August on 14-25m depth. Catches are estimated at about 100t/year.
Conger trap fishery
Some small scale boats practise this technique on the same bottoms and depths as for conger longline fishery and approximately all the year round.

GSA 7 AND 8
Deep crustacean trap fishery
Fisheries using different kinds of traps targeting *Plesionika* spp., *Palinurus mauritanicus, Nephrops norvegicus.* Irregular and recent activity in GS7 and remaining activity in GS8 (Corsica) for crawfish. The same vessels devoted to the other small scale métiers practise this fishery on the muddy and sandy bottoms of the slope of the continental shelf and in the canyons, between 200 and 400m depth.

Beach seine

This gear is called Seine ou Senne de plage in France, *sciabica* in Italy, *jabega* in Spain, *vintzotrata* in Greece.

GSA 7 – PROVENCAL AND LIGURIAN COASTS
Around 27 vessels, from 4 to 14m long and from 7.5 to 178 kW practise "beach seining" along the French Ligurian coast targeting mainly juveniles of small clupeids ("poutine"). The total production reaches about 25t/year for about 60 days/year/boat. The fishing technique can be carried out from the beach or from a vessel according to the size of the seine. Specific regulations establish mesh size, dimension of the gear and fishing season for the different target species.

GSA 8 – CORSICA
Beach seine: 1.

Diver fisheries

GSA 7 AND GSA 8
Sea urchins fishery
27 fishing units, 8m long and with 107 kW in average, practise this fishery with 2 divers/unit on hard bottoms of the Provence and Roussillon coasts, from 0 to 30m depth.
This fishery is submitted to a licence regime establishing the number of fishermen to 36 and the fishing season according to the fishing harbour.
Red coral fishery
12 fishing licences are granted for this fishery in Corsica.

GSA 7 – GULF OF LIONS
14 fishing units, 8m long and with 103kW in average, practise this fishery on hard bottoms from 30 to 150m depth. Their activity is regulated by licence regime with a close number of divers.

GENERAL CONCLUSIONS
Seasonality of different fishing activities, polyvalence and lack of information prevent from giving an exhaustive description of all the French fisheries which can be sometimes mistaken with the metier concept. Presentation by metier is generally more convenient to give a comprehensible overview of the French fishing activities in the Mediterranean sea.
Some fisheries concern shared stocks as blue fin tuna, anchovy, hake but most of them are related to coastal resources which are exclusively exploited by French fishing fleet. Landing data come mainly from fish auction documents and voluntary fishermen' declarations collected during some surveys on the fishing activity. Log book system is just going to be applied and does not concern small vessels which make the majority of fleet and fishing auction data concern essentially trawler landings from the Gulf of Lions. Anyway, from these data sources it derives that most of catches is made of pelagic fish provided by the purse seine and trawl fleets. Also the accuracy of data on fleet technical characteristics is sometimes questionable and suffers of interactions of the different regulations on fishing, navigation and security.

RECOMMENDATIONS

Mediterranean fisheries suffer indubitably of a general non respect of the regulation in force. For a better observance, the management measures must take in account as far as possible the gear diversity and the regional conditions of their application, otherwise they are bound to fail or to be bypassed. It would suitable therefore to give some flexibility to a frame of general range regulation, so that the national administrations can adjust technical measures to the regional context involving fishermen' organisations in the making process of this regulation.

All towed gears are unevenly concerned by catches of undersized fishes and discards and need of selectivity improvement. Nevertheless, according to the versatility of the metiers and the multi-specificity of the catches, it is not easily acceptable to apply a same technical measure to all fisheries without risks for their profitability or discard increasing. Current mesh-size regulation should be really enforced rather than introduce more restrictive measures. At the opposite, different technical solutions based on behavioural differences like selectivity devices could be applied according to the different fisheries.

Selectivity studies must be generally implemented, especially for long-lining, but improvement in this field would be not sufficient without a fishing effort control policy.

Management of effort by fishing capacity (kW and GT) proved its limits. In fact, it did not take in account some effects of technological evolution of vessels, such as electronic positioning or safety improvement which have contributed to increase the efficiency of the fleet event though the number of fishing days and/or of active units did not increase.

Therefore, it should be appropriate to focus on a definition of "unit" based on the effective effort but also easy to control. For instance, bollard pull can perfectly define the maximal pull that a vessel using a towed gear can open out; for static gears, the maximum number of length of set nets, number of hooks or pots that can be put to water is a more exact measure of the fishing power than vessel tonnage or engine power.

Furthermore, fishing exploitation suffers also of a scarce knowledge on the seasonal distribution of juveniles and breeders of the main species. Specific studies must be carried out in this field with the aim of establishing efficient protected areas.

ITALY

Bottom trawling

GSA 9 - LIGURIAN AND NORTHERN AND CENTRAL TYRRHENIAN SEA

Continental shelf, traditional trawl

The total number of trawlers exerting the activity on the continental shelf is high especially in some ports. The fleet exerting this activity is represented by 180-200 vessels. Most of them are small-medium sized (<20m length) and low-medium powered (<260 HP). The main species caught are *Mullus barbatus*, *Sepia officinalis*, *Squilla mantis*, *Merluccius merluccius* on the coastal fishing grounds (depth<50m), and *Merluccius merluccius*, *Eledone cirrhosa*, *Raja* spp., *Scyliorhinus canicula*, *Trisopterus minutus* in deeper waters of the continental shelf. The fleet is active all year round, for 150-160 days/year in average.

Small hakes (<20 cm TL) represent majority of landings in many ports of GSA9. In addition, the illegal fishery in shallow waters inside the three miles (or 50m depth) from the coastline represents an evident problem, producing landings of under-sized specimens of other important species like *M. barbatus*, *Pagellus* spp. etc. In Summer some boats may utilise a superimposed cod-end in order to catch small specimens of *Eledone cirrhosa*.

Continental shelf, wide opening trawl

The number of trawlers exerting this activity is distributed in some ports of Tuscany (Livorno, Porto Santo Stefano) and especially in some ports of Latium. A total of 100-120 vessels exert this activity in GSA9. Most of vessels are medium-large sized (>20m length) and medium-large powered (>260 HP). The most important species are medium-sized specimens of *Merluccius merluccius*, *Mullus barbatus*, *Sepia officinalis*, *Squilla mantis* in the coastal fishing grounds (depth <50m), and *Merluccius merluccius*, *Eledone cirrhosa*, *Raja* spp., *Scyliorhinus canicula*, *Trisopterus minutus* in deeper waters of the continental shelf. Each vessel performs about 180 fishing days/year. The illegal fishery in shallow waters inside the three miles (or 50m depth) from the coastline represents an evident problem also in this fishery, producing landings of under-sized specimens of other important species like *M. barbatus*, *Pagellus* spp. etc.

Slope border

The total number of vessels involved in this activity greatly differs from port to port and represents about 15-20% (60-70 vessels) of the total trawl fleet of GSA9. The fishery target Norway lobster (*Nephrops Norvegicus)*, and deep-water rose shrimp (*Parapenaus longirostris*). The activity is carried out all over the year, but it is mostly concentrated from the spring to fall, due to more favourable weather conditions. Discard constitutes a considerable fraction of the total catch, ranging from about 15 to 30%. Discard of commercial species is mostly due to specimens of fishes smaller than the commercial size.

Deep water

The total number of vessels involved in this activity is quite low in respect to the total trawl fleet of GSA (about 50-60 vessels). The fleet carrying out this fishery is mainly localised in the ports of Liguria, Southern Tuscany and along the Latium coast. The vessels are characterised by a mean engine power of 300 kW and 50t GRT. The deep-water fishery targets red shrimps (*Aristaeomorpha foliacea* and *Aristeus antennatus*). The fishing activity is mostly carried out from spring to fall. Discard makes up a considerable fraction of the total catch, ranging from about 15 to 30%. Discard of commercial species is mostly due to specimens of fishes and cephalopods smaller than the commercial size. *Galeus melastomus* accounts for about 60% of discard of commercial species.

GSA 11 - SARDINIA

Fleet: the whole fishing fleet consists of 1,327 vessels (11,537 GRT). Trawlers are 191, mostly constituted of small-medium size vessels, with a mean engine power of 187 HP and 35.8 GRT. In the last ten years, an increasing of consistency of the large trawler fleet occurred which has been favoured by regional, national and from E.U subventions with the aim of reducing the fishing effort in shallower waters. Target species: *Mullus barbatus, M. surmuletus, Merluccius merluccius, Phycis blennoides, Parapenaeus longirostris, Aristeus antennatus, Aristaeomorpha foliacea, Plesionika* sp., *Palinurus elephas, P. mauritanicus, N. norvegicus, Octopus vulgaris, Eledone* spp.

Continental shelf

Fleet: average tonnage 12 GRT, mean engine power (110 HP). A decreasing trend in number of vessels was observed in the last years. Fishing time: 150-160 days/year. Daily trips. Technical interference with set nets and pots. It is likely that the electronic equipment may have increased the effective fishing time. Target species: common octopus, horned octopus, red mullet, cuttlefish, *Raja* spp., *Scyliorhinus canicula*, poor cod.

Slope-deep water

Fleet: 74 trawlers, mean GRT 73.3, mean engine power 303,6 HP. Target species: *Aristaeomorpha foliacea, Aristeus antennatus, Nephrops norvegicus, Parapenaeus longirostris* and *Merluccius merluccius.* An increasing trend in the number of vessels was observed. Trips: 1-3 days according to the distance of the fishing grounds.

Fishing days: 150-160 per year. Target species: *Aristeus antennatus, Aristaemorpha foliacea.*

GSA 16 - STRAIT OF SICILY

Fleet: about 355 monolicensed vessels trawlers, with an overall tonnage of 27,100 GRT and a total engine power of 94,496 kW. Excluding the fleet of Mazara del Vallo, trawlers usually perform daily trips, starting in early morning and coming back in the afternoon. Normally they carry out two 4-5 hour hauls per day.

Mazara del Vallo: 147 trawlers, 20,211 GRT, 59,970 kW. Fishing trips: (15 – 25 days)

Two main trawl fisheries can be identified:

- inshore trawling: target species: *Mullus* sp., *Merluccius merluccius, Pagellus* sp., *Uranoscopus scaber, Trachinus* sp., *Octopus vulgaris, Sepia officinalis, Eledone* sp., *Lophius* sp., *Parapenaeus longirostris, Nephrops norvegicus, Illex coindetii, Todaropsis eblanae, Zeus faber, Raja* sp.
- distant trawling: target species: *Parapenaeus longirostris, Aristaeomorpha foliacea.*

Continental shelf inshore fishery

Fleet: 240 boats, 7,850 GRT and 40,200 kW. Fishing time: 180 days/year**.**

Discards: 18% as yearly average.

Deep water distant fishery

Fleet: 115 trawlers, 140 GRT, mean power 410 kW.

Even though an overall reduction of fishing capacity of the Mazara del Vallo fleet in terms of number of trawlers occurred since late eighties-early nineties, a constant increase in the mean engine power and GRT is reported. The Mazara del Vallo fleet was developed towards large vessels, which can operate in the distant waters. Target species: *P. longirostris, A. foliacea, N. norvegicus, M. merluccius, M. surmuletus, P. erythrinus, P .blennoides, Galeus melastomus, Etmopterus spinax, A. antennatus, Todarodes sagittatus*

Although a reduction in fishing capacity of Sicilian trawl fleet is occurring since the eighties, the technological creep in nautical and fishing equipment is expected increasing the vessel efficiency. Discard: from 6% to a maximum of 72%.

GSA 17 - NORTHERN AND CENTRAL ADRIATIC

Continental shelf

The whole Northern and Central Adriatic can be considered as shelf areas. Fishing vessels do not generally make long fishing trips, the fish is stored in ice and not frozen, therefore each local fleet tends to exploits fishing ground close to its harbour. Fleet: 1,200, from less than 10 GRT to more than 100 GRT with an average engine power of 220 kW.

Fishing is carried out 5 days a week, all around the year. There is usually an interruption of about 45 days in summer due to a seasonal ban of trawling activities. The average number of fishing days per year is 158. The use of hydraulic net drums is spreading. The use of GPS has allowed a better localization of bottom obstacles to trawling and therefore slightly increased the available fishable area and probably the fishing mortality.

Catch landed in 1999: hake 2100t, red mullet 2900t, most cephalopods 5,000t; Norway lobster 1,000t and mantis shrimp 3,500t. Interaction with beam trawl fishery and coastal small-scale set net fisheries. Both effort and CPUE show a slightly decreasing trend over the last seven years but at present no clear conclusion can yet be drawn.

GSA 18 - SOUTHERN ADRIATIC

Bottom trawl mixed fishery (shelf-slope)

Fleet: 500-600 vessels. The number of trawlers remained quite stable in the last twenty years (or decreased slightly). Mean values: 20-25 GRT, 16-17m LOA and 160-170 kW. The fishery is operative for 190-200 days/year. Discard: 10-15% of the landed species. Technical interaction with bottom long-lines.

Pelagic trawling

GSA 17: NORTHERN AND MIDDLE ADRIATIC

120 vessels (60 pairs) in the Northern and Central Adriatic. Average values: engine power 400 HP and 50 GRT. Fishing time: five days a week, only by daylight, all year round, except for 45 days fishing stop in summer, ruled by Italian government. During the eight weeks following the fishing stop, the *volante* vessels are allowed to fish only four days a week. A fishing trip lasts 11-15 hours. Target species: *Engraulis encrasicolus*, and *Sardina pilchardus*. Anchovy catches in Italy reached a maximum value in 1980 (57,328t) followed by a quick decay in the following years until the crash in 1987 (3,375t). In the period 1988-1997 the modal length increased till to 13.5cm. Instead, in the period 1998-2002 the modal length of catch distributions seems rather variable. Catches of sardines amounted to 59,000t in 1981, decreasing in subsequent years; current catches are about 9,000t. A high percentage of sardine catches is directed to the fish processing industry. The modal length of sardine seems to show a cycle with a period of about ten years.

Fixed opening trawls

There are two types of fixed-opening trawls: rapido and ganghero. Their horizontal and vertical opening is ensured by a rigid, steel made framework. Rapido opening is provided in its lower portion with curved teeth which penetrate into the soft bottom and force soles to swim upwards, entering inside the trawl. The upper portion features an inclined wooden board acting as a depressor. The slides, placed at regular intervals, prevent the teeth from sinking deeper into the mud. Vertical opening is rather small (20 cm), while the horizontal one, which depends on the boat power, usually does not exceed 4m. Each boat may tow from two to five rapido at the same time.

Ganghero is very similar to the French “gangui”. Its opening is made of a steel pipe with bent

ends horizontally measuring 4-5m, the two ends measuring 1 metre approximately. Its opening is therefore a rectangle measuring 5x1 metres. The upper portion of the opening acts as a floating rope, while the lower one is made of a loaded cable attached to the bottom end of the side bends, on which two small slides are located. The side bends ensure the vertical opening of the gear. The net body is made of different netting of trapezoid shape, with mesh of various size. Overall body length from opening to cod-end is 20m.
Rapido is mainly employed to exploit soles (*Solea vulgaris*) and scallops (*Aequipecten opercularis*, *Chlamys glabra* and *Pecten jacobaeus*) on the soft, sandy and muddy bottoms of the Northern and Central Adriatic sea, whereas it is little used in the Tyrrhenian sea.. Ganghero is used in Sardinia, Apulia and Campania to catch shrimps, crabs and bottom species.
According to Presidential Decree 1639/68 and EU Regulation no. 1626/94, fixed-opening trawls must have a cod-end mesh size exceeding 40mm, and must be used outside the three miles from the coast, or on grounds deeper than 50m.

GSA 9 – LIGURIAN AND NORTHERN-CENTRAL TYRRHENIAN SEA

Rapido for soles

Only a few number of vessels use this gear because of the unsuitability of the seabeds generally characterised by a narrow continental shelf and rocky outcrops. In addition, according to the national fishing regulations, no new licences can be granted in this area for rapido trawl. Fleet: fishing vessels belonging to the fleet of Viareggio (2 vessels) and Fiumicino (1 vessel). Viareggio: 20.0m L_{OA}, 162-206 kW and 25 GRT. Fiumicino: 22.7m L_{OA}, 316 kW and GRT 38. Fishing time: 10-12 hours/day for 5 days a week. Fishing days range from 47 (fall) to 95 (winter). Caught species: *Raja asterias*, *Sepia officinalis*, *Solea vulgaris*, *Squilla mantis*, *Scophthalmus rhombus* and *Penaeus kerathurus*. Discard of commercial species 1-17% of the total catch. Interaction with bottom trawlers and set nets.

GSA 17 – NORTHEN AND CENTRAL ADRIATIC

A part of vessels of the northerner departments (Chioggia, Venezia, Monfalcone) may alternate rapido trawl for sole with the rapido trawl for scallops (*Pecten jacobaeus* and *Aequipecten opercularis*).

Rapido for common sole

Fleet: 146 vessels.11.5-23.9m L_{OA}, 15-61GRT, 68-303 kW. Capacity of fleets tended to increase both as number of vessels and engine power in the last years. Some technical changes have been made to the gear in order to increase its efficiency. The number of towed gears increased over the time as a consequence of the increment of the engine power. The electronic equipment was likely to increase the vessel fishing efficiency as they allowed to explore fishing grounds not exploited before. Total landings show a gradual increase, reaching in the 2000-2001 approximately 450t, corresponding to about twice the total amounts landed in 1996. Catch composition: *Squilla mantis*, *Sepia officinalis*, *Trigla lucerna*, *Penaeus kerathurus*, *Bolinus brandaris*. Discard represents up to 30% in weight and 40% in number of individuals**.** Technical interactions with set gears and bottom trawl net fishery. In 2001-02 the fishing effort showed an increase of about 11% on the average calculated on the period 1996-2002. At the same time, total LPUE remained practically constant, while the LPUE of sole gradually increased. In 2001-02 an increment of about 60% on the average of the period 1996-2002 was recorded. Although this would seem to indicate a good reaction of the stock, the prevalence of juveniles in the catches suggests caution in the exploitation of the resource by this fishery.

Dredges

Dredge fishery is well-developed throughout the western Adriatic Sea from Trieste to Bari, and to a lesser extent in the Tyrrhenian Sea.
Hydraulic dredging is the most widespread activity in the Adriatic Sea, although hand dredges are used as well, and mechanical boat dredges are preponderant in the Tyrrhenian Sea.
More than 700 fishing boats practise clam fishing using hydraulic dredges.
Dredges (hydraulic or mechanical) harvest *Ensis* spp., *Solen* spp., *Chamelea gallina*, *Donax trunculus* in the Tyrrhenian sea and *Callista chione*, *Ensis* spp., *Solen* spp., *Tapes philippinarum*, *C. gallina*, *Paphia aurea* in the Adriatic sea. ***T. philippinarum*** and ***C. gallina*** are by far the most important resources. In 2002 the total catch of molluscs reported for all dredges was 108t (86% of which made of *C. gallina*) in the Tyrrhenian sea and 13,296t (88% of which represented by *C. gallina*) in the Adriatic sea.
Fishing area varies according to the target species, but it is always included between 3m depth inshore and 3nm offshore, with the exception of hydraulic dredging targeting *C. chione* whose stocks are exploited further offshore (up to 10nm). For all species, with the exception of razor clams (*Ensis* spp and *Solen* spp.), hydraulic dredging is forbidden at lower depth than 3m. Fishing grounds are prevalently sand-silty, although in the northernmost portion of the Adriatic Sea *C. chione* is exploited on coarser grounds.
The national regulation in force envisages a fixed number of licenses for each port of registry.
In addition, this fishery is locally managed by management consortia within each Maritime District, which operate within the limits set by national and EU laws. Consortia are responsible for setting catch quotas, and temporal/spatial fishing closures according to the different target species.
In this context, it appears unnecessary to collect data on fishing effort, since annual samplings carried out by public scientific Institutes in conjunction with management consortia could be enough to evaluate the situation in the different ports of registry.

PURSE SEINE

GSA 17 - NORTHERN AND CENTRAL ADRIATIC

Purse seine for small pelagic

Fleet: about 63 vessels; average tonnage 85 GRT; average engine power 300 HP.
Fishing time: from April to November. improvement of fishing efficiency by electronic equipments over the last 10 years lead to an increased fishing mortality.

Purse-seine for tuna

Net length: 1,200-2,100m; net height: 200-350m; mesh size: more than 120mm stretched.
Interactions with tuna long lines.

FIXED AND DRIFTING GEAR FISHERIES

The main set gears are: set nets, long lines, movable trap nets. An increasing number of fishing boats using static gears, whose size ranges from 4 to 10 GRT. Data collected on some small-scale fleets of the Adriatic sea showed that the best capacity parameter related to fishing effort is the length of nets. This factor, which could be considered as a measure of actual capacity, is more strictly related to the overall length of the boat than to engine power or tonnage. Therefore, the installation of powerful engines onboard of small boats does not directly contribute to an increase in fishing effort, but it is only a way to reduce the transfer time from the port to the fishing grounds and should be duly taken into account in terms of safety.

Set nets may differ in the method used for lowering or fitting out. As far as net hauling is concerned, a distinction has to be made between fixed nets (anchored to the bottom), driftnets and *'ferrettare'* (left at the mercy of sea currents).
(a) In driftnets, mesh size exceeds 180mm in length, whilst in *'ferrettare'* is smaller. Hanging ratio ranges between 0.25 and 0.70, even though some set nets have values out of this interval. Several types of fish traps exist; for example, traps for cuttlefish, basket changeable nassa (*Nassarius mutabilis*), traps for depth shrimps, traps for lobsters, and other types of traps to catch several species at one blow.

Trammel nets

GSA 9 – LIGURIAN AND TUSCANIAN SEA

Trammel net for *Sepia officinalis* and "pesce bianco"

Target species: *Sepia officinalis, Lithognathus mormyrus, Sparus aurata, Solea vulgaris, Octopus vulgaris* etc. Although the majority of vessels may change type of gear over the year according to the abundance of the target species, nearly all the boats of the small-scale fishery use this gear during the year. In Livorno, where about 60 artisanal boats exist, the percentage of the fleet using this type of trammel net ranges between 60% and 80% according to the season. Fishing time over the year: 36 days/boat in spring and 25 days/boat in summer. Some boats may use GPS to localize more distant fishing grounds. Discard of target species is generally negligible. Interaction with other small-scale gears and with illegal trawl fishery.

Trammel net for red mullets

Target species: *Mullus barbatus* and *Mullus surmuletus.* The highest catches of the two species are obtained in summer, just after reproduction. Low percentage of discard. Fleet: the number is quite variable from year to year according to the abundance of the resources. For example, in Livorno a high number of small-scale vessels used this type of trammel net in 1999: 14 in spring (30% of the active fleet) and 19 in summer (50%). On the last year a lower number of vessels employed this gear: 5 in spring (13% of the active fleet) and 6 in summer (15%). The maximum of activity was observed in summer 1999 (36.7 fishing days/boat) and in spring 2000 (31.8 fishing days/boat). Interaction with other small-scale gears and with illegal trawl fishery

GSA 11 - SARDINIA

Trammel net targeting *Palinurus elephas*

Target species: *Palinurus elephas*. May and June are the most productive months. Fleet: 254 vessels, 1,631 GRT, 22,627 kW. Fishermen involved: 587. Fishing time: from the 1st of September to February, for about 180 days/year. A powerful net hauler makes easier the hauling of net from deep bottoms. Significant decreasing of boats, catches and mean size of catches through the years. A slight increase of catches occurred after the institution (1991) of a regional regulation establishing a closing season (45 days) for this fishery.
Management measures should take into account fishing capacity and fishing effort regulation, checking the dimension of the fleet and the length of the net used per boat/day. In addition, regulations concerning spatio-temporal closures are useful to protect grounds where important restocking aggregation occurs in some periods of the year.

Gillnet fisheries

GSA 9 – LIGURIAN AND TUSCANIAN COAST

Gillnet targeting hake

The fleet targeting hake, *Merluccius merluccius*, consists of about small-medium sized 80

vessels, with a mean engine power of 120 kW and mean GRT of 12t.
The hake fishing season by gillnets starts usually in October-November and ends in May-June. Few species dominate the total catch: hake, horse mackerel (*Trachurus trachurus*), tub gurnard (*Trigla lucerna*) and chub-mackerel (*Scomber japonicus*). Sometimes discard can affect some species of low commercial value like horse mackerel.
Gillnet targeting common sole
Fleet: 9 vessels (mean gross tonnage of 4.1t, mean L_{OA} of 7.7m, mean engine power of 54.4 HP). In the last few years four boats employed this gillnet regularly, while the other ones utilised it only occasionally and jointly with trammel nets. Fishing time over a year: 13 days in winter, 80 days in fall. Catch composition: *S. vulgaris, Raja asterias, Squilla mantis, Trigla lucerna.* Discard *of* S. *vulgaris* ranged from 0.3% of the total catch in spring to 5.2% in fall. Interaction with illegal trawl fishery in the coastal area and with other small-scale gears.
Gillnet targeting white fish
Fleet: 4 vessels. The catches per unit of effort show a high variability with an increasing trend from winter to fall. Target species: Sparidae, *Squilla mantis, Dicentrarchus labrax, Solea vulgaris* and Mugilidae. Interaction with the illegal trawling in the coastal area and with other small-scale gears. A high correlation was observed between total landings and total length of nets used by the fleet. A lower correlation was found between total catch and total number of fishing days.

GSA 17 – NORTHERN AND CENTRAL ADRIATIC
Gillnet for common sole
Fleet: 2,370 (without multi-purpose vessels). Total GRT: 4,760; mean GRT: 2; total kW: 65,139; mean kW: 27.5; mean L_{OA}: 6.4m; crew: 1-2 people. Length of nets ranges from 1,000 to 5,000 m per boat.
A study carried out on the fleets of three ports of the Northern Central Adriatic Sea made of 77 artisanal vessels (average GRT 2.7; average engine power 37.3 kW) showed that the number of vessels devoted to this fishery gradually increased from 1999 to 2002. Fishing time: all the year round with a minimum in winter. Thinner and thinner filaments are going to be used to increase the gear efficiency. Electronic equipment and net hauler likely increased the vessel fishing efficiency.
Target species: *S. vulgaris, Squilla mantis* and *Trigla lucerna.* Discard of commercial species*:* 6-8% in weight of the total catch. Interaction with rapido trawl fishery and bottom otter trawling exploiting common sole. Conflicts with all illegal trawl activities inside three miles offshore and clam fisheries with dredges. No significant decrease of LPUE of the common sole was detected in 1999-2002, in spite of the increase of fishing effort. Catches of common sole are mainly made of juveniles, therefore caution would be suggested in the eventual increase of the fishing effort in terms of both fishing capacity and fishing activity.

Longline and handline

GSA 18 - SOUTHERN ADRIATIC
Fishery 1 - drifting longline (large pelagics)
Drifting longline fishery is carried out mostly in offshore waters. Fleet: 15-20 boats, 10÷15 GRT, 75÷150 kW. A decreasing trend is reported in the last years. A much higher number of vessels have a multi-purpose licence and do not appear in the official statistics for this gear. Fishing time: July-December for swordfish and September-November for albacore. An increasing use of line hauler has been detected. Drifting longline appears to be selective with respect to the target species (swordfish and albacore). Swordfish catches: decreased in the last five years. Albacore catches did not show a well-defined trend. Albacore fishery was totally

banned in 1998. Technical interaction with trawling activities. The swordfish fishery has to be carefully monitored due to the large number of immature specimens collected by the gear.
Fishery 2 - offshore bottom longline (demersal fishes)
Fleet: 20-30 vessels, 10-15GRT and 75-150 kW. Fishing time: 20-30 days/year.
An increasing use of line hauler has been detected. Target species: hake. The quantity of landed catches could be estimated at 300-500 kg/vessel/fishing trip. The sizes of the hakes are larger than 25-30cm as a rule. Technical interaction with trawling activities.

SICILY
Drifting longline
Target species: swordfish, albacore and blue fin tuna. This fleet is not defined because some vessels have a specific licence for drifting longlines whilst most vessels have a multi-gear licence, without a clear distinction of the main gear. It is believed to reach about 1200 vessels of various sizes, from 5 to over 30 m. An increasing use of line hauler has been detected. Albacore and blue fin tuna longline CPUE data are not collected on a regular base, with serious gaps. Abundance is consequently difficult to be correlated. Interference: tuna purse seine, bottom trawling, large ships able to cut the main line into several pieces, creating troubles to recover gear and catches. The current length limit established by EC Reg. 1626 appears far from the reality of offshore fishery, especially in the case of swordfish and blue fin tuna. Therefore, the recent modification of the gear, increasing the distance between the branch lines up to 150m, together with the behaviour of these species suggest a revision of the regulations. For a possible reduction of juvenile swordfish catches, a close season approach might be useful. Lack of standardisation of most of the data collected in different areas and the consequent difficulty in making proper comparisons. Mortality: almost stable for albacore and swordfish. The number of juveniles in catches continues to be quite relevant and its reduction is necessary.

SUMMARY OF SPECIAL FISHERIES

GSA 9 – LIGURIAN AND NORTHERN-CENTRAL TYRRHENIAN SEA
Fishery 1 - Danish seine and surrounding net without purse line for transparent goby (*Aphia minuta)*
The catch composition is almost always monospecific. Fleet: 50 boats with mean 6.5 TSL and 93 HP (68 kW). Fishing time: between November and March. No negative impact either on the resource (a relatively light level of exploitation of the species has been estimated) or on the accompanying species and environment is produced by this fishery. A policy of fixed number of licenses seems to be enough to ensure the stock maintenance.
Fishery 2 - inshore bottom trawl for transparent goby
Ten bottom trawlers exploited transparent goby in Tuscany between January and March in the last ten years. The bottom trawl net is mainly utilized in the Viareggio Maritime Division. Only a very low number of vessels fished *A. minuta* in the last years (around 15 vessels were operative in the fishing season 1994-1995 while only 4 in the season 2002-2003). Trawlers have a mean TSL of 7.5t and engine power of 70 kW. The catches with this gear are multi-specific, and *A. minuta* always represent a very low portion of the catch in weight.
Fishery 3 - Danish seine and surrounding net without purse line for sardine fish fry (bianchetto) and transparent goby (rossetto)
Fleet: about 80 boats in 1997, smaller than 10 GRT and 150 HP in engine power. 60 days per year between January and April. Annual tax for the licence. Catch: 95% sardine and transparent goby.

GSA 17- NORTHERN AND CENTRAL ADRIATIC

Inshore bottom trawl for transparent goby

Fleet: 20 boats in 1997, smaller than 10 GRT and 150 HP in engine power. Fishing time over the year: 60 days/year between January and April. Annual tax for the licence. Data on catch: 95% sardine and transparent goby.

Bottom trawling in western Adriatic inside the 3 miles zone

Fleet: 528 small trawlers; engine power <150 HP, tonnage <10 GRT. They are allowed to operate from November to March, in coastal waters, with a mesh size >12mm because of the presence, in wintertime, of adults of some small-sized species such as *Atherina boyeri*, *Arnoglossus laterna*, gobids,, *Sepiola* spp, *Alloteuthis media* etc. The absence or very low captures of juveniles of other commercial species is the biological support for allowing this fishery. Annual tax for the licence and compulsory catch declaration.

Bottom trawling for cuttlefish in western Adriatic inside the 3 miles zone

Fleet: 528 boats, smaller than 10 GRT and 150 HP in engine power; registered in 5 maritime compartments. Fishing time over the year: from April to mid June. Annual tax for the licence and compulsory catch declaration. Catch: cuttlefish, scaldfish, little squid, small gobies.

GSA 18 – SOUTHERN ADRIATIC

Inshore bottom trawl for transparent goby and sardine fry

Commercial catches mainly consist of *A. minuta* and sardine fry specimens (> than 90%). At present the authorised vessels are 150, but a future decrease is planned. The vessels are <10 GRT and their engine power is <110 kW. They are authorised to fish in wintertime for 60 days between January and April. Annual tax for the licence and compulsory record of catches. The fishery is currently operating under the derogation allowed by the Italian Presidential Decree 1639/68.

GSA 19 –WESTERN IONIAN SEA

Danish seine and surrounding net without purse line for sardine fish fry (bianchetto) and beach seine for sardine fish fry (bianchetto)

Fleet: About 130 boats in 1997: about 70 using beach seine, smaller than 10t GRT and 150HP in engine power. Annual tax for the licence. Fishing time over the year: 60 days/year between January and April. Data on catch: 95% sardine and transparent goby.

SOUTHERN ITALIAN SEAS

Surface gillnet for swordfish and albacore

Fishing season: from late April (or the beginning of May) to August. Fishing trips: from 1 to 5 days; more often daily trips. Fleet: about 500 vessels from about 7 to over 30m L_{OA} (1992) but, after the adoption of the Italian plan for the reconversion of the driftnet fleet, the total number gradually decreased to about 100 until the enforcement of the EC driftnet ban on 1st of January 2002. In the last 10 years several vessels were made in fibreglass or in steel, often replacing older dismissed vessels. All the vessels have a multi-purpose licence. Catches reached peaks of over 12,000t of swordfish and 6,000t of albacore in the ‘90s. The trend was more or less flat, with yearly variations, till 1999, then showed a relevant increase in mean length and weight. The Mediterranean swordfish population appears almost stable in the last 20 years. The same situation exists for albacore (*Thunnus alalunga*), because the population appears almost stable on the long period, with a few variations from year to year and without any particular trend.

GENERAL CONCLUSIONS

The analysis of the various fisheries, carried out around all the Italian coasts, leads to the following technical and biological considerations:

a) the data referred in this report give a complete and sometimes detailed picture on several fisheries, whereas there is a lack of information for some others. Moreover, many aspects, mainly concerning fishing activities, gears selectivity, rigging devices and vessels have not yet been investigated enough.
b) There is evidence of a lack of common collection methodologies and a consequent difficulty in making proper comparisons between fisheries of different areas/countries, which negatively affect a proper management of fisheries and resources.
c) In the last ten years some fishing fleets were concerned by a reduction of the number of vessels favoured by regional, national and E.U subsidies aimed to reduce the fishing effort in shallow waters. Consequently, this measure lead to a partial renewal of the fleet addressed towards bigger vessels.
d) Studies on small-scale fisheries using set gears put in evidence that the length of the boat or the dimensions of the gears (i.e. length of net, the number of hook etc.) rather than the engine power are better related to the fishing mortality.
e) In some cases, it is referred that the cod-end mesh size is lesser than the allowed one. The application of both national or EU rules appears very often lacking.
f) For some trawling fisheries, data concerning the vessel engine power are felt to be underestimated. As a matter of fact, most engines for trawlers are supercharged and intercooled, delivering an almost double power in respect to the corresponding not supercharged engines having the same geometrical characteristics.
g) Many trawlers are equipped with ducted propellers which are able to develop a 27% more pull than a conventional one.
h) The fleet appears to be older than 25 years on average.
i) Many vessels are equipped with electronic and/or mechanical devices.
j) Data of the Italian fleet appear to be quite good, but unfortunately most of the fishing vessels have multiple licenses and then it is difficult or almost impossible to correlate the fishing capacity to the catches. This situation strongly unable any statistical analysis.
k) Important amounts of juveniles of target species occur in the catches of some fisheries. Discard of undersized fishes results to be relevant in many cases.
l) The number of vessels involved in gillnet fishery is very low in respect to the total small-scale fisheries. Nevertheless, in the Northern and Central Adriatic Sea, the vessel number and activity of gillnet fishery for soles as well as of rapido trawlers gradually increased in the last years.

RECOMMENDATIONS

1. Lack of information for some fishery aspects could be covered in the context of the national data collection programme. To this end, an approach based on fleet segments, gears and species should be envisaged.
2. A standard methodology for data collection on the different aspects of the fishery components, (i.e. resources, gears and vessels) should be adopted on a regional basis. That means a stronger coordination among national data collection programs of the Mediterranean EU countries.
3. An increase of selectivity is envisaged for several Italian fisheries. To this end, it is strongly recommended that an improvement of control on legal mesh sizes actually in force be effectively applied. As concerns trawling, the adoption of squared mesh

panels could increase selectivity just enough to overcome the need of imposing 60mm-codend minimum mesh size. Specific studies on selectivity should be encouraged for some set gears used by small-scale fisheries, with particular concern for those showing an increase in the last years (i.e. gillnets).

4. Nurseries of the most important species are well known both over time and space. It is recommended temporary fishing stops to safeguard the juveniles. In this context a strict enforcement of the ban in the coastal area is also recommended to protect juveniles of many species and to reduce conflicts between trawling and other fisheries.
5. Concerning gillnets, management measures for hake should take into account the fishing capacity and fishing effort regulation, controlling the fleet dimension and the net length per boat/day (frequently longer than 5,000 m). Although the number of boats is not so high, they exert an important fishing mortality on the adults of hake population. Spatio-temporal closures might be envisaged for the spawning areas.
6. To prevent catch of juvenile swordfishes, temporal fishing closures should be adopted taking into account the seasonal occurrence of these specimens in the different Mediterranean areas.
7. Trawling in GSA9 targeting *A. minuta* may produce a negative impact on several species, on the *Posidonia* beds, and may create some conflicts with small-scale fishers. It is recommended to convert this activity into purse seine fishery that does not produce any negative impact either on the resource, on the accompanying species and on the environment.
8. The old age of the fleet needs to be taken into account especially under a safety point of view. The fleet renewal should be carried out looking at the new findings in terms of building materials, hydrodynamic performances of the hull and deck machinery without increasing the fishing capacity.
9. A more effective control of fishing effort is recommended. Willing to check the effective power on board, it should be necessary to prescribe to trawlers an official document where the propeller characteristics (diameter, pitch and the revolutions number) besides the shafting diameter are declared. Anyhow, some technical means, as the bollard pull or the fuel consumption, could be used to check the engine power. For static gears, the greatest length of net and number of hooks or pots that could be put to sea would be a more suitable parameter to evaluate the fishing capacity, than tonnage or engine power.
10. As the engine power of the small fishing boats using set gears (trammel nets, gillnets, longlines etc.) does not directly contribute to an increase in fishing effort, powerful engines on board of such vessels should be looked as a means to reduce the transfer time in rough sea conditions, then increasing the safety level of the crew; moreover, a shorter time spent cruising means more free time for other social needs.
11. The introduction of blue box could be a powerful tool to check and manage fishing effort.
12. “Special fisheries” should be accurately and continuously monitored in order to evaluate their consistency with the resource management.
13. The minimum landing sizes of the different species should be established taking into account the selectivity of the gears, using the current legal mesh size. This will prevent from discarding at sea species of high commercial value or from the sale of undersized fish illegally.
14. Specific studies should be encouraged to increase actual knowledge on some increasing fisheries (i.e. gillnet for sole and rapido trawling) and their impact on the resources in order to evaluate the need of appropriate regulations.
15. Fishing area where dredging for clams is carried out varies according to the target

species, but in most of cases is included between 3m depth and generally inshore of 3 nm where the target species live. As a consequence, banning of this fishery in such area might lead to the disappearance of this activity with strong socio-economic consequences.

GREECE

GENERAL

The quality of scientific data and of assessment of the resources is far from being considered as satisfying. Many aspects, like biology, population dynamic, selectivity of fishing gears have not been studied with a constant sampling procedure and a data analysis protocol over a long time period. The lack of basic knowledge does not allow the scientific community to express documented opinion about the management of the resources and very often the given advices are based on either speculations or low quality data. The scientific information for many species is absolutely absent although some of them are very important in terms of catch and value (lobster, caramote prawn, *Dentex* etc). The same is true for many métiers and selectivity of several fishing gears.

The data related to the fishing fleet of the Ministry of Agriculture are of good quality but there are still some problems, which are not related with the procedure followed for the data collection and classification, but with the existing license scheme in Greece. For example, there are vessels that are allowed to fish with bottom trawl and purse seine. Since it is not recorded the gear they are using or if they change métier during the year, these vessels are classified in only one category and the estimation of the fishing effort of each gear is always biased. In addition, the purse seiners can choose to operate either during the day or at night. The number of the purse seiners that work during the day or at night is unknown. All the estimations of the fishing effort in Greece refer to the night purse seines. Since some vessels work during the day (targeting to different species), the fishing effort of the night ones is always overestimated.

The general feeling is that there are serious problems concerning the fishery resources and there is urgent need of adopting measures to protect the stocks and to avoid future deterioration. But when we get into specific points then the picture is not clear. Which stocks are suffering and which are the responsible fishing gears? There are stocks, like hake and Norway lobster, that showed a declining trend over the last years, as it appears from the official and the scientific data. In addition, this is a common opinion between majority of fishermen. Large specimens of *Epinephelus* spp. species are getting more and more rare. The stock of *Pagellus bogaraveo* is fished intensively.

On the other hand, there are stocks that are not affected in such extend. Red mullet is one of the most important species for Greece targeted by bottom trawls and nets. Maybe the fishing effort targeting red mullet is higher than that targeting hake, but the stock seems to be in good state. Horse mackerel is another example. It is not target species of any gear, but it appears as by-catch in almost all the gears, in significant quantities. An important proportion is discarded (depending on the season, the area and the production of other species). So far there are no indications that this stock is under pressure. Similar conclusions can be drawn for pickerel and probably for many cephalopods.

Natural fluctuations in the abundance of the stocks, especially for the small pelagics, are very important and should be taken into account. Until 2002, the catch of anchovy in Greece was declining, the size of the individuals was getting smaller and the conclusion was that the stock was seriously endangered. During 2003, without any specific management action, the stock recovered, the catch increased out of any prediction, the prices in the market in some cases became lower than the price of sardine, the catch consisted of large-sized specimens and generally all the predictions were proved wrong.

In general, the species that reproduce during the first year of life and at a small size respond better to the pressure of the fishing activity. These stocks suffer much less, they adapt to the fishing pressure easier and generally are in a better situation. The robustness of these stocks depends on the success of the incoming year class more than in the case of the long-lived

species that reproduce at large size in the second year of life or later.
It should be pointed out that the catches in Greece include more than 80 species. Two of them (sardine and anchovy) contribute for about 15% each one. All the others contribute for less than 5%. Managing one specific species, e.g. hake (introducing measures targeting to improve the situation of the hake stock), in fact, concerns only a very small proportion of the Greek production.
The national data collection project launched on the last year is expected to solve many of the problems related to the quality of the data and to fill significant gaps of information. As a result, the quality of the scientific advice is expected to be improved.

Bottom trawling

GSA 20 – IONIAN SEA
The fleet consists of 36 vessels with an average length of 22.19m, mean capacity of 69.7 GT and mean engine power of 262.6 kW. The main target species are: *Merluccius merluccius, Loligo vulgaris, Mullus* spp, *Parapenaeus longirostris, Boops boops, Spicara smaris, Trisopterus minuts capelanus.*

GSA 22 - AEGEAN SEA
The fleet consists of 282 vessels with a mean length of 24.28m, mean capacity of 88.5 GT and mean engine power of 308.5 kW. The main target species are: *Parapenaeus longirostris, Merluccius merluccius, Mullus* spp, *Lophius* spp., *Octopus* sp., *Nephrops norvegicus.*

GSA 23 - CRETAN SEA
The fleet consists of only 6 vessels with a mean length of 27.96m, mean capacity of 51.3 GT and mean engine power of 310.5 kW. The main target species are: *Merluccius merluccius, Mullus* spp., *Aristaeomorpha foliacea* and *Aristeus antennatus*

Purse seine

The purse seine fleet in Greece is distinguished into two major types:
- those operating during the day;
- those operating at night using light, which is the most common activity.

The most important difference between them is related to the mesh size of the net (14 mm for the night and 40 mm for the day, both full mesh).
The fishing period for the night purse seines starts on the 1st of March and stops on the 15th of December of each year, while for the daily purse seines starts on the 1st of September and stops at the end of June. In addition, purse seining is prohibited during full moon, 2 days before and 2 after, with the exception of Saronikos Gulf and the sea surrounding Crete where this ban is only applied on the Saturday and Sunday after the full moon.
The main catch of night purse seines consists of *Sardina pilchardus, Engraulis encrasicholus, Scomber* spp. and *Trachurus* spp. The main target species of the purse seines operating during the day are migratory pelagic species, like *Sarda sarda, Caranx* spp, *Seriola dumerili, Argyrosomus regius*.

GSA 20 - IONIAN SEA
The fleet consists of 41 vessels with a mean length of 17.45m, mean tonnage of 34.1 GT and mean engine power of 171 kW.
According to the National Statistically Service of Greece the catch of sardine in the Ionian sea

in 2000 was almost at the same level as in 1990 (1,200t). During this period the catch was high and the maximum value was observed in 1995 (2,471t). The catch of anchovy in 1990 was 1,390t, reduced to 653t in 1991. In the following years it increased constantly until 1998 (2,264 t). In 1999-2000 the catch was lower than in 1990 (871t).

GSA 22 - AEGEAN SEA

The fleet consists of 264 vessels with a mean length of 18.74m, mean tonnage of 38.5 GT and mean engine power of 179 kW.

According to the National Statistically Service of Greece the catch of sardine in 1990 was 9,634t and from 1992 to 2000 it increased approximately up to 16,500t. The catch of anchovy was quite constant from 1990 to 1999 (about 13,500t). A decline was observed in 2000 (8,980t).

GSA 23 - CRETAN SEA

The fleet consists of 11 vessels, with mean length of 16.67 m, mean tonnage of 30.2 GT and mean engine power of 129 kW.

According to the National Statistically Service of Greece the catch of sardine in 2000 was at the same level of that recorded in 1990 (140t). In 1992-1998 the catch was higher (320-660t). The catch of anchovy in GSA 23 is very low.

CONCLUSIONS

The species that is mainly supporting the income of night purse seiners is anchovy. There are indications (scientific and catch data) that the stock biomass of anchovy and sardine during the last years (after 1998) has been declining and the mean landing size decreasing. However, it maybe that the anchovy stock is recovering, since in 2003 the catches of this species increased. Official data are not yet available.

There are many complains of the small-scale fishermen for the day purse seining. They consider the use of this gear harmful because it is employed in shallow waters targeting demersal species. There are no yet available data related to the operation of the gear, catch composition, CPUE, impact on the substrate, etc.

Generally there are no conflicts between night purse seine and other fishing gears. Locally, there is competition mainly with bottom trawling, because during the closed season for purse seines the trawlers catch sardine and anchovy.

There is no TAC management in Greece and the management of purse seine fishery is based on effort control (license system, closed seasons).

Boat seine

In Greece, the cod-end mesh size for boat seining is at least 16mm (full mesh). No doors are used in the use of the gear and this activity is carried out inside a distance of about 1nm from the coast, only on flat bottoms and during daylight. According to the President's Decree 553/79 and 669/80, new licenses for boat seining are not issued. The fishing period extends from the 1st October to the 31st March (April-September is closed season) although more local restrictions exist.

The main target species are: *Boops boops, Spicara smaris, Loligo vulgaris, Spicara flexuosa, Sardina pilchardus, Trachurus* spp.

GSA 20 - IONIAN SEA

The fleet consists of 108 vessels with a mean length of 9.5m, mean tonnage of 5.1 GT and mean engine power of 54.1 kW. According to the National Statistically Service of Greece, the

catch of pickerel in 1990 was 545t and it decreased in the following years (until 1999) until 2,116t. In 2000 it was 1,055t.

GSA 22 - AEGEAN SEA

The fleet consists of 316 vessels with a mean length of 10.2m, mean tonnage of 7.6 GT and mean engine power of 62.8 kW. Majority of vessels (90%) operate in the Central and Southern part of the Aegean Sea. The catch of pickerel in this area showed a decreasing trend from 4,770t in 1990 to 1,497t in 2000 with the exception of the extremely large catches in 1994 (10,700t).

GSA 23 - CRETAN SEA

The fleet consists of 6 vessels, with a mean length of 9.7m, mean tonnage of 5.4 GT and mean engine power of 71.3 kW. The average production of pickerel was 529t in 1990-2000.

CONCLUSIONS

Instead of the complete banning of the gear, a policy of 'selective use', aimed to reduce the negative impact on the environment and on the juveniles, should be approached.

Set gears

GSA 20, 22, 23

The fleet of the small-scale fishery consists of 18,142 vessels. The characteristics of the fleet in each GSA area given in the table bellow.

Area	**No of vessels**	**Length (m)**	Mean GT	**Mean kW**
GSA 20	3,916	6.6	1.83	17.37
GSA 22	13,421	6.8	2.56	22.92
GSA 23	805	7.0	2.97	20.63

In Greek small-scale fishery target a great variety of species and therefore many different fishing gears are used. Almost all the vessels change métier during the year. The allocation of the effort per fishing gear used is extremely difficult. Available data on catch composition, size composition, discards etc. are very limited. The information provided in this report concern the main categories of small-scale gears: trammel nets, gill nets and longlines.

Trammel nets

Trammel nets are the most important gear of the inshore fishery, used all over the year in nearly all the ports. There are several kinds of trammel net differing for thetechnical characteristics, according to target species. Target species: *Merluccius merluccius, Penaeus kerathurus, Solea vulgaris, Diplodus sargus, Mullus surmuletus, Mullus barbatus, Pagellus erythrinus, Dentex dentex, Sepia officinalis* and other Sparidae species.

Gill nets

Gillnets are also used all over the year in the whole country with different intensity from port to port. The main target species are: *Mullus barbatus, Mullus surmuletus, Boops boops, Caranx sp, Pagellus erythrinus, Sarda sarda, Sparidae, Scomber scombrus, Scomber j. colias, Sphyraena sphyraena, Merluccius merluccius* and *Atherina hepsetus.*

Longlines

This gear is mainly used on rocky bottoms. The depth varies according to the target species. In shallow waters down to 90m the target species are: Sparidae, *Epinephelus* spp. In deeper waters (150–500m) the target species are *Mercluccius merluccius, Pagellus bogaraveo,* and Sparidae (big specimens). The most common target species of longlines in Greece are:

Pagellus erythrinus, Sparus aurata, Pagrus pagrus, Diplodus sargus, Merluccius merluccius, Epinephelus spp, *Mustelus* spp. Longlines are also used for the catch of large pelagic species which is a special type of fishery.

Dredges

GSA 20, 22, 23

572 coastal vessels held official permit to use dredges among other coastal gears, but only 25 of them use dredge as main gear. The active number of vessels using dredges is not known and the fishing effort has not been assessed. The characteristics of the fleet in each GSA area are given in the table bellow.

Area	No. of vessels	Mean GT	Mean kW
GSA 20	36	3.0	24.1
GSA 22	534	2.9	37.6
GSA 23	2	1.9	39.5

The species that are usually fished are: *Venus* sp., *Pecten* sp., *Arca noe, Callista chione, Cerastoderma glaucum, Donax trunculus, Spisula subtruncata, Modiolus barbatus.*

RECOMMENDATIONS

1. Closed seasons/areas. In the National legislation and in the framework of the Common Fishery Policy for the Mediterranean, the measure of closed seasons and areas for one or more fishing gears is used extensively. However, the enforcement of these measures should be strict and illegal fishing should be reduced drastically by increasing surveillance and by informing the fishermen. New closed areas for specific time periods should be established in collaboration with the fishermen' organizations. In some particular cases the situation is mature and the fishermen' organizations already suggested such measures. In the Northern Aegean Sea, the bottom trawl skippers suggested to close a specific area for a certain period, in order to protect the juvenile hakes and in the West-Central Aegean the purse seine skippers had a similar idea to protect juvenile anchovies.
2. Fishing effort reduction. During the last years in the framework of the MAGPs an attempt has been made in order to reduce the fishing effort by reducing the fishing capacity. But still the problem remains. In Greece, almost all the fishermen agree that the fishing effort should be reduced. Disagreements start when specific measures have to be decided. The coastal fishermen support the opinion that their gears are selective, so there is no need to restrict their fishing effort, whereas the remaining fishermen argue that there are already effort limitations and they cannot afford further restrictions. New effort restrictions should involve all or majority of fishing gears. In a few specific métiers, restrictions could be introduced for specific gears (e.g. gill net *P. bogaraveo* métier).
3. Minimum mesh size of bottom trawl. According to 1626/94 Regulation, the cod-end mesh size of bottom trawl is 40 mm. Any future increase of the mesh size should be based on a well-documented knowledge on the selectivity of the proposed mesh sizes, on the biological impact on the stocks and on the socio-economic consequences for the bottom trawl fishery sector. The possibility of having different meshes in different depth zones should be also examined. The introduction of a bigger mesh in the depth zone 50-150m will result in a lot of reactions, but it will be more easily accepted in the

depth zone deeper than 150m, at least in Greece.

4. Minimum mesh size for set nets. In the Greek and E.U. legislation for the Mediterranean there are no restrictions for the mesh size of gillnets and trammel nets. In fact, it is quite difficult to introduce such a measure because there are specific localised metiers targeting to small-sized species (e.g. *Atherina*). A minimum mesh size for gillnets and trammel nets could be introduced taking into account these peculiarities. Anyway, a minimum mesh size should be introduced for specific metiers (e.g. *P. bogaraveo* fishery).
5. Special fisheries. As it appears, in all the Mediterranean member states, there are specific fishing metiers, operating in a very specific way and targeting particular species. These fisheries are usually accused for having significant negative impact on the substrate or on the juveniles of many species. On the other hand, they are related with the local tradition, they supply the market with fish products (in some cases these products will disappear because no other gear is catching them) and there are people working in these metiers. Instead of talking about complete banning of these gears, it should be better to examine the possibility of a 'selective use'. The negative impact could be reduced by either limiting the effort or modifying the gear.
6. Sensitive habitats. The Posidonia meadows are expanded in the entire Mediterranean basin. The National and E.U. legislation is protecting this ecosystem. However, the complete banning of towed gears on the Posidonia meadows, prohibits the use of the gear. In Greece, boat seines operate in this ecosystem targeting pickerel, which is the species supporting the fishermen' income. The direct effect of the use of this gear on the Posidonia plants has not been studied. From on board observations, the amount of green leaves in the cod-end was very small, but there is the possibility that the ropes destroy the plants without leading them in the cod-end. In Greece, there is quite strong legislation in order to protect lagoons and estuaries from fishing activities.
7. Minimum landing size. The selectivity of the fishing gears and the consumers' habits should be taken into account when establishing a minimum landing size for a particular species. Otherwise, if the minimum landing size is based only on the length at first maturity, it will result in increase of discards, illegal marketing and inactive legislation. The enforcement of this measure so far in Mediterranean was not strict. In some cases, like red mullet, illegal bottom trawl fishing in shallow waters and close to the coast could be reduced if there was no market to sell the undersized specimens.
8. Discards. All the fishing gears are producing discards but in different quantities, in different species and in different sizes. Discarding practises are related with the selectivity of the fishing gear, but also with the market demand or local peculiarities. By improving gear selectivity, the amount of discards will be reduced but the losses in catch will be increased as well.
9. Effort restriction for offshore fisheries. In each country there are different regulations aimed to restrict the fishing effort of some fisheries (bottom trawling and purse seining). The experience gained in each country, by applying specific management plans, should be compared with the others and the possibility of establishing a common management scheme should be examined in order to improve the exploitation of resources, to reduce discards, to increase income and to improve the social life of fishermen.

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APPENDIX II: SYNOPTIC TABLES OF FISHING GEARS CHARACTERISTICS BY GEOGRAPHIC SUBAREA AND FISHERY

CHARACTERISTICS OF FISHING GEAR

Fishing metier: 1.1 - ***Bottom trawling***

GSA	Bridles			Warp		Otter boards			Piece of netting before the codend		Codend				Type of Net[2]
	L (m)	d (mm)	Mat.	L (m)	d (mm)	S (m^2)	P (kg)	Shape (*)	Length (m)	1.1.1 D_1 (m)	L (m)	Type of closure	1.1.2 D_2 (m)	Ratio D_1/D_2	
1	150/400	25-44	PP	1000/2000	>14	2-4	250/650	R,O			6-13	B	12-14.40 = (300-360)x40		LO-HO
2	300/400	40-44	PP		>14	4	500/650	R,O			11-13	B	12-14.40 = (300-360)x40		HO
5	150/400	25-44	PP	1000/2000	>14	2-4	250/650	R,O			6-13	B	12-14.40 = (300-360)x40		LO-HO
6	150/400	25-44	PP	1000/2000	>14	2-4	250/650	R,O			6-13	B	12-14.40 = (300-360)x40		LO-HO
7	80/100	14	Mix	300/500	18	1.5/2.8	500/1000	R,O	12	12 = (300x40)	5	A	12 = (300x40)	≤ 1	HO-LO
	15/50	16-20	Mix		6 -10	0.84	60/100	O		10,7		B	9,6	0,9	LO
8				150/1300	14-18		15/600					A			LO-HO
9	260	28-32	Mix		13	1.5-2.5	200-400	R,O	15-16	11-15 = (300-400) x38	5	B	11-15 = (300-400)x38	1	LO
	120	28-30	Mix		13	2.0-2.5	300-500	R,O	20-22	24 = (600x40)	10	B	24 = (600x40)	1	HO
	260	28-32	Mix		13	1.5-2.5	200-400	R,O	15-16	11-15 = (300-400) x38	5	B	11-15 = (300-400)x38	1	LO
	260	28-32	Mix		13	1.5-2.5	200-400	R,O	15-16	11-15 =(300-400) x38	5	B	11-15 = (300-400x38	1	LO
11	120/210	22-26	Mix	1000	8-11	1.1-1.3	130/150	R	7-8	12	6-8	B	12	1	LO
	180/300	30-32	Mix	2000	14-15	2.5-3.0	350/500	R	25-30	12-14	6-8	B	12-14	1	LO
16	200/230	28-30	-	1300/1500	12-14	1.8/2.0	250/300	R,O	20-23	11-13=(300-450)x(38-28)	6-7	B	11-13=(300-450)x(38-28)	1	LO
17	250	22-24	Mix	150/900	12-13	1.9/2.4	260/280	R,O	5	10.4 = 260x40	6	B	11.20 =280x40	0.9	LO
18	150/250	25-55	Mix	500/2500	12-15	1.5/1.7	70/200	R ,O	16-20	8-12 =(200-300)x 40	6.4-8	B	8-12 =(200-300)x40	1	LO
20	-	-	-	180/280	24-50	1.5/2.2	200/400	R,O	11-23	18-24 =(450-600)x40	5.4-11	B	12-16 =(300-400)x40	1.5- 2	LO
22	-	-	-	180/280	24-50	1.5/2.2	200/400	R,O	11-23	18-24 =(450-600)x40	5.4-11	B	12-16 =(300-400)x40	1.5- 2	LO
23	-	-	-	180/280	24-50	1.5/2.2	200/400	R,O	11-23	18-24 =(450-600)x40	5.4-11	B	12-16 =(300-400)x40	1.5- 2	LO

[1] **A**. The closure of the codend is made by 2 steel cables which are passed through the last range of meshes of the codend.
B. The closure of the codend is made by a single rope of PA is tied around the codend. **C**. The closure of the codend is made by the Atlantic way.
[2] **LO**: low opening, **HO**: high opening **VHO**: very high opening; (*) rectangular or oval: **D: circumference (N° of meshes * stretched mesh size)**

Fishing metier: 1.2 - *Pelagic trawling*

GSA	Warp		Piece of netting before the codend		Codend				Type of Net[1]
	L (m)	d (mm)	Length Of the piece	Circumference (m) (N° of meshes * str mesh size A	Length (m)	Type of closure	Circumference (m) (N° of meshes * str mesh size B	Ratio A/B	
1									
2									
5									
6									
7	300/500	18	24	12 = (300x40)	7	A	12 = (600*20)	<1	B
8									
9									
11									
16									
17	400/700	14	15	14.4 = (400x36)	25-30	B	14.4 = (800x18)	1	B
18									
20									
22									
23									

[1] **A**: pair trawling **B**: four panel trawlnet

Fishing metier: 1.3 - *Dredges*

GSA	1.1.3 Dredges				
	Length of raking bar	**Weight (kg)**	**Mesh size (mm)**	**Towed by hand (h) or by vessel (v)**	**Target species**
1	0.5-3		25-50	V	*Donax spp, C. chione, C. gallina, V. Rhomboides, Pecten maximus*
2					
5	0.5-3		25-50	V	*Donax spp, C. chione, C. gallina, V. Rhomboides, Pecten maximus*
6	0.5-3		25-50	V	*Donax spp, C. chione, C. gallina, V. Rhomboides, Pecten maximus*
7	1.2	10	15	H	*Donax trunculus*
	2.5	<50	80	V	*Crassostrea gigas, Paracentrotus lividus, Micromismus sulcatus*
	2-4	50-200	80	V	*Bolinus brandaris*
8					
9	3	600		V	*Ensis spp., Solen spp., Chamelea gallina, Donax trunculus*
11					
16					
17	3	600		V	*Callista chione, Ensis spp., Solen spp., Tapes philippinarum, Chamelea gallina, Paphia aurea*
18*[a]	2.5-3	600-800	120	V	*C. gallina, A. tuberculata*
18*[b]	2.5-3	300-350	80	V	*E. siliqua, S. marginatus*
20	1.2	10-12	70-80	H & V	*Venus sp., Pecten spp, A. noe, C.chione, C. glaucum, D. trunculus*
22	1.2	10-12	70-80	H & V	*Venus sp., Pecten spp, A. noe, C.chione, C. glaucum, D. trunculus*
23	1.2	10-12	70-80	H & V	*Venus sp., Pecten spp, A. noe, C.chione, C. glaucum, D. trunculus*

Fishing metier: 1.4 – ***Fixed opening trawl***

GSA	Length of raking bar (m)	Weight (kg)	Mesh size (mm)	Towed by hands (h) or by vessel (v)	Target species
1					
2					
3					
4					
5					
6					
7					
8					
9	3.0	180	50	v	*Solea vulgaris, Sepia officinalis, Raja asterias*
11					
16					
17	1.2 – 4.0	50 - 250	44 – 56	v	*Solea solea*, Pectinidae, *Sepia officinalis*
18					
19					
20					
21					
22					
23					

2

Fishing metier: 2 - ***Purse seine***

GSA	2.1.1 Purse seine					
	Total length(m)	**Stretched height (m)**	**Mesh size (mm)**	**Day / Night**	**Lights (Y/N)**	**Target species**
1	300-400	80-90	14-18	N	Y	*S.pilchardus, E.encrasicolus, Trachurus spp*
2						
5	300	80-90	14-18	N	Y	*S.pilchardus, E.encrasicolus, Trachurus spp*
6	300	80-90	14-18	N	Y	*S.pilchardus, E.encrasicolus, Trachurus spp*
7	2000	230	140	D	N	*Thunnus thynnus*
	300-600	70-150	24	both	Y	*Sardina pilchardus; Engraulis encrasicolus*
	180-600	30-80	70	D	N	*Sparus aurata, Lithognathus mormyrus*, Mugilidae.,
8						
9						
11						
16						
17						*S.pilchardus, E.encrasicolus, Trachurus spp, Scomber spp, B.boops*
18						
20	450-750	50-200	16-28	N	Y	*S.pilchardus, E.encrasicolus, Trachurus spp, Scomber spp, B.boops*
	500-800	50-150	40-56	D	N	*S.salpa,A.thazard, S.sarda, Trachurus spp, Scomber spp,*
22	450-750	50-200	16-28	N	Y	*S.pilchardus, E.encrasicolus, Trachurus spp, Scomber spp, B.boops*
	500-800	50-150	40-56	D	N	*S.salpa,A.thazard, S.sarda, Trachurus spp, Scomber spp,*
23	450-750	50-200	16-28	N	Y	*S.pilchardus, E.encrasicolus, Trachurus spp, Scomber spp, B.boops*
	500-800	50-150	40-56	D	N	*S.salpa,A.thazard, S.sarda, Trachurus spp, Scomber spp,*

3

Fishing metier: 3.1 - ***Trammel nets***

GSA	Trammel nets				
	Mesh size (stretched) [mm]	**Total length per day (m)**	**Stretched height of outer panels (m)**	**Soaktime (h)**	**3.1.1 Target species**
1	I:40-100 O: 250-600	1500-5000	065-5	2-24	*Solea spp, Mullus spp., M. kerathurus, S. officinalis, P. elephas, Sparidae*
2					
5	I: 40-100 O: 250-600	1500-5000	065-5	2-24	*Solea spp, Mullus spp., M. kerathurus, S. officinalis, P. elephas, Sparidae*
6	I: 40-100 O: 250-600	1500-5000	065-5	2-24	*Solea spp, Mullus spp., M. kerathurus, S. officinalis, P. elephas, Sparidae*
7	70-110	5000m	1.5-1.8	15	*Solea vulgaris , Solea lascaris, Sepia officinalis*
	120-200	3000-6000	1.8	30	*Scophthalmus rhombus; Psetta maxima*
	80-120	300-1000	1.5	24-32	*Murex brandaris*
	30-82	≤ 1500m	1.5-1.8	12	*Scorpaena spp,*
	80-120	500-5200	2max	72-170	*Palinurus spp, Lophius piscatorius, Scorpaena scofra,*
	45-55	1000-2000	1.5-1.8	10-12	*Mullus spp*
8	65	2500 ma	2m	8	*Mullus surmuletus, sparidae, scorpaenidae, labridae*
	100-120	2500	1.2m	10-12	*Scorpaena scrofa, Phycis phycis, Pagellus erythrinus and Sparus pagrus*
	166	4000	1m	48-72	*Palinurus spp, Homarus spp*
9	I: 60-70 O:320-360	4000-5000	1.80	12	*Sepia officinalis, Lithognathus mormyrus, Solea vulgaris*
	I: 40-45 O:260-300	2000-4000	1.40	3-5	*Mullus barbatus, Mullus surmuletus*
11	52-78	1000-1500	2.0-2.5	48-72	*Palinurus elephas*
16					
17	I: 70 O:340	500 - 1500	1.2 – 2.0	12 - 24	*Solea solea, Sparidae, Dicentrarchus labrax, Sepia officinalis*
18					*Mullus spp., S. officinalis, O. vulgaris, Sparidae, Mugilidae, Scorpaenidae*
20	36-92	1000-5000	1.1-6	3-24	*Solea spp, Mullus spp., P. kerathurus, S. officinalis, H. gammarus, Sparidae*
22	36-92	1000-5000	1.1-6	3-24	*Solea spp, Mullus spp., P. kerathurus, S. officinalis, H. gammarus, Sparidae*
23	36-92	1000-5000	1.1-6	3-24	*Solea spp, Mullus spp., P. kerathurus, S. officinalis, H. gammarus, Sparidae*

4 I = Inner O = outer

Fishing metier: 3.2 - ***Gill nets***

GSA	Mesh size (mm)	Total length per day (m)	Stretched height (m)	Soaktime (h)	Target species
1	22-100	1200-8000	2-25	2-12	*Sparidae, Moronidae, Mullus spp., Atherina spp., M. merluccius,S. Sarda,Auxis rochei, Belone belone, Exocoetidae.*
2					
5	40-100	1200-8000	2-25	2-12	*Sparidae, Moronidae, Mullus spp., M. merluccius,S. Sarda,Auxis rochei.*
6	40-100	1200-8000	2-25	2-12	*Sparidae, Moronidae, Mullus spp., M. merluccius,S. Sarda,Auxis rochei*
7	80	3000-5000	4 - 7	12	*Merluccius merluccius*
	34 - 56	200-2000	?	2 or 3	*Mullus surmuletus, Mullus barbatus,*
	62 - 125	2000	4 – 25	10	*Sparidae,*
	80 – 100	500	4	15	*Dicentrachus labrax*
	80-100	300 - 2000		10	*Mugilidae*
	100 – 140	1000	8 – 12	10-48	*Zeus faber*
8					*"thonaille"*
9	50-55	3500-7000	3 - 4.70	6-8	*Merluccius merluccius, Trigla lucerna*
	80-85	2000-4000	4.10	12	*Solea vulgaris, Scophthalmus rhombus*
11					
16					
17	64 – 100	1000 - 5000	1.6 – 6.0	12	*Solea solea, Sparidae, Sciaenidae, Dicentrarchus labrax*
18					
20	18-220	1000-5000	1.5-70	3-24	*Atherina spp, Mullus spp.,B. boops, M. merluccius,S. sarda, Scyliorynchu spp, Sparidae*
22	18-220	1000-5000	1.5-70	3-24	*Atherina spp, Mullus spp.,B. boops, M. merluccius,S. sarda, Scyliorynchu spp, Sparidae*
23	18-220	1000-5000	1.5-70	3-24	*Atherina spp, Mullus spp.,B. boops, M. merluccius,S. sarda, Scyliorynchu spp, Sparidae*

Fishing metier: 3.3 - *Longlines and handlines*

GSA	Type (bottom, floating, drifting)	Hook size (h-w)	No of hooks per boat per day	Soak time (h)	Target species
1	B	24/42.5-10/21	25-650	2-12	*Sparidae, Lepidopus caudatus, C. conger, Epinephelus spp*
2					
5	B	24/42.5-10/21	25-650	2-12	*Sparidae, C. conger, Epinephelus spp*
6	B	24/42.5 -10/21	25-650	2-12	*M.merluccius, Sparidae, C. conger, Epinephelus spp*
7	D	5/0	400-1800	10	*Xiphias gladius*
	B	2/0-5/0	200-1000	10	*Conger conger*
	B	2/0-3/0	120-2500	10	*Sparidae*
	B or F	2/0-3/0	60-500	10	*Dicentrachus labrax*
	F-B	3/0	300-1200	10	*Merluccius merluccius, P.bogaraveo*
	Handline	3/0	60	1/4h	*Pagellus bogaraveo*
8	D	5/0	400-1800	10	*Xiphias gladius*
9					
11					
16					
17					
18	B -offshore	5-7	500-1500	6-12	*M. merluccius, T. lucerna, Scorpena spp., P. bogaraveo, P. americanus, Raja spp.*
	B - inshore	5-10	?	6-12	*Sparidae, C. conger*
	D - albacore	4-6	3500-5000	12-18	*T. alalunga*
	D - swordfish	2-4	2000-3500	12-18	*X. gladius*
20	B	5-14	250-600	12	*M.merluccius, Epinephelus spp, Sparidae (large specimens)*
22	B	5-14	250-600	12	*M.merluccius, Epinephelus spp, Sparidae (large specimens)*
23	B	5-14	250-600	12	*M.merluccius, Epinephelus spp, Sparidae (large specimens)*
LP-FR					
LP-GR	F	1-4	400-1000	12	*Thunnus spp, X.gladius*
LP-I					
LP-SP					

Fishing metier: ***Combined nets***

GSA	Mesh size		Total length per day	Stretched height [1]	Soak time	4.1.1 Target species
	Upper panel	Lower panel				
1						
2						
5						
6						
7	42-50	50	500-1000	5-6	15	*Scorpaena spp., Mullus spp.*
	56	83	500-1000	5-6	15	*Scomber spp*;
	56-100	83-100	500-2000	10-20	15	Sparidae
	62-83	62-83	300-800	25-30	15	*Sarda sarda, Lichia amii*
	125	160	300-800	21	15	*Thunnus spp. Seriola dumerilii*
8						
9						
11						
16						
17						
18						
20						
22						
23						

[1] Stretched height of external piece of trammel net and stretched height of gillnet part.

5

Fishing metier: ***Boat seine***

GSA	Total length (m)	Length of wings	Max length of ropes	Codend or smallest mesh size	Towed by hand (h) or by vessel (v)	Target species
1						
2						
5						
6						
7	200	80		6 -18	H or V	Juvenils of clupeoids of small fish
8						
9						
11						
16						
17						
18						
20	200-440	144-400	200-900	16	V	*B. boops, S. smaris, L. vulgaris, S. flexuosa, S.pilchardus, Trachurus spp*
22	200-440	144-400	200-900	16	V	*B. boops, S. smaris, L. vulgaris, S. flexuosa, S.pilchardus, Trachurus spp*
23	200-440	144-400	200-900	16	V	*B. boops, S. smaris, L. vulgaris, S. flexuosa, S.pilchardus, Trachurus spp*

Fishing metier: *Fyke nets*

GSA	Fyke nets					
	No of bags	**Height of leader net (m)**	**Smallest mesh size**	**No of pairs per day**	**Soaktime (h)**	**Target species**
1						
2						
5						
6						
7						
8						
9						
11						
16						
17						
18						
20	2 - 5	1.5 – 2.4	20	100 - 1000	12 - 72	*Octopus spp., Mugil spp., A. anquilla, D. labrax, S. aurata*
22	2 - 5	1.5 – 2.4	20	100 - 1000	12 - 72	*Octopus spp., Mugil spp., A. anquilla, D. labrax, S. aurata*
23	2 - 5	1.5 – 2.4	20	100 - 1000	12 - 72	*Octopus spp., Mugil spp., A. anquilla, D. labrax, S. aurata*

APPENDIX III: SYNOPTIC TABLES OF FISHING FLEETS AND ROUGH FISHING EFFORT BY GEOGRAPHIC SUBAREA AND FISHERY

Fishing metier: 1.1 - ***Bottom trawling***

GSA	Depth (m)	Vessel N	Total GT	Total kW nomimal	GT/N	kW/N	Fishing days/year	Target species
1	50-700	165	9477	23760	57.4	144	180	Demersal species
2	400-700						90	Demersal species
5	50-700	944	53283		56.4		180	Demersal species
6	50-700	31	1560	4460	52.1	149	180	Demersal species
7	20-600	131	10,870	40,100	83	306	210	Demersal species
	12-30	29	116	1,510	4	52	80-210	Demersal species
8	50-650	10 -12	350	2,440	30	187	200	Demersal species,deep crustaceans
9	50-200	200	6,200	32,000	31.0	160.0	150-160	Demersal species
	50-200	110	4,620	27,720	42.0	252	180	Demersal species
	200-500	72	3,024	17,280	42.0	400.0	170	Demersal species
	500-700	58	1,798	10,788	31.0	186.0	170	Demersal species
11	50-700	191	6,831	35,636	35.76	186.57	190	Demersal species
16	50-500	240	7,850	40,200	32.7	167.5	200	Demersal species
17	70-260	820	28462	177120	34.71	216	170	Demersal species
18	50-500	500-600	10,000-15000	80,000-102,000	20-25	160-170	190-200	Demersal species
20	50-500	36	2,446	9,454	67.9	262.6	200	Demersal species
22	50-500	282	24,954	87,004	88.5	308.5	200	Demersal species
23	50-500	6	803	1,863	51.3	310.5	200	Demersal species

Fishing metier: 1.2 - ***Pelagic trawling***

5.1.1 GSA	Vessel N	Total GT	Total kW nomimal	GT/N	kW/N	Fishing days/year	Target species
1							
2							
5							
6							
7	131	10870	40100	83	306		*Engraulis encrasicholus, Sardina pilchardus*
	29	116	1510	4	52		
8							
9							
11							
16							
17	127	5919	51615	46.61	406.42	81	*Engraulis encrasicholus, Sardina pilchardus*
18							
20							
22							
23							

Fishing metier: 1.3 - *Dredging*

GSA	Vessel N	Total GT	Total kW nomimal	GT/N	kW/N	Fishing days/year	Target species
1	118	329	2774	2.8	23.5		Bivalves
2							
5	12						Bivalves
6	48	181	1603	3.8	33.4		Bivalves
7	68-89			2	58	40-100	*Ostrea edulis, Crassostrea gigas, Microcosmus sulcatus, Paracentrotus lividus*
	20-28			2	58	40-100	*Bolinus brandaris*, flatfishes and bivalves
8							
9	27	229	2713	8.5	101	58	*Ensis* spp., *Solen* spp., *Chamelea gallina*, *Donax trunculus*.
11							
16							
17	599	6367	64789	10.5	110	107	*Callista chione*, *Ensis* spp., *Solen* spp., *Tapes philippinarum*, *Chamelea gallina*, *Paphia aurea*.
18	74	678	7355	9.2	99.4	150	*Callista chione*, *Ensis* spp., *Solen* spp., and *Chamelea gallina*. *Venus verrucosa*
20	36	108.9	869	3	24.1	*	*Callista chione*, *Modiolus barbatus*. *Donax trunculus Pecten sp.*, *Venerupis sp.*
22	534	1,557	20,089	2.9	37.6	*	*Callista chione*,*Modiolus barbatus*. *Donax trunculus Pecten sp.*, *Venerupis sp.*
23	2	3.8	79	1.9	39.5	*	*Callista chione*, *Modiolus barbatus*. *Donax trunculus Pecten sp.*, *Venerupis sp.*

* Dredging is a temporal type of fishery in Greece so it is not easy to estimate the fishing days per year.

Fishing metier: 1.4 - ***Fixed opening trawl***

GSA	Vessel N	Total GT	Total kW nomimal	GT/N	kW/N	Fishing days/year	Target species
1							
2							
5							
6							
7	28	84	1428	3	51	80-150	*Fish soup, various bottom fish*
8							
9	3	88	684	30	228	47-95	*Raja asterias, Sepia officinalis, Solea vulgaris*
11							
16							
17	146	5,707	37,885	39.36	259	100-180	*Sole, scallops*
18							
20						*	
22						*	
23						*	

7

Fishing metier: 2 – ***Purse seine***

GSA	Vessel N	Total GT	Total kW nomimal	GT/N	kW/N	Fishing days/year	Target species
1	130	3502	17620	27	135.5	180	*Engraulis encrasicholus, Sardina pilchardus*
2							
5	12	137	982	11.4	81.9	170	*Engraulis encrasicholus, Sardina pilchardus*
6	3	675		225			Blue fin tuna
	179	7856		43.9		170	*Engraulis encrasicholus, Sardina pilchardus*
7	33	6270	22737	190	689		
	9	345	2214	38.33	246		
	43	311	5160	7.23	120		
8							
9							
11							
16							
17	127	5355	39,579	42.17	311.65	186	
18							
20	41	1,399	7,009	34.1	171	207	
22	264	10,178	47,228	38.5	179	207	
23	11	332	1,422	30.2	129	207	

Fishing metier: 3.1 - ***Trammel netting***

GSA	Depth (m)	Vessel N	Total GT	Total kW nomimal	GT/N	kW/N	Fishing days/year	Length/vessel	Target species
1									
2									
5									
6									
7	10-100	99	693	11187	7	113	60-100	2000 - 8000	*Solea spp*
	10-30	28	84	2352	3	84	40	2500-2800	*Sepia officinalis*
	16-25	99	693	11187	7	113	60	3000 -6000	*Psetta maxima,*
	10-30	15	60	1320	4	88	50	300-1000	*Murex brandaris*
	3-35				2	47	40-50	100-1500	*Scorpaena spp.*
	50-200	92	276	5244	3	57	150-200	500-5200	*Palinurus spp.*
	<10	18	56	1008	3	56	150-250	100-2000	*Mullus spp.*
8	0-40	200	1000	17000	5	85	180	2500	*Various bottom fishes*
	40-90	200	1000	17000	5	85	180	2500	*Various bottom fishes*
	40-90	200	1000	17000	5	85	120	4000	*Palinurus spp.*
11	50-200	254	1631	22627	6.4	89.1	180		*Palinurus elephas*
16									
17									
18									
20									
22									
23									

Fishing metier: 3.2 - ***Gill nets***

GSA	Depth (m)	Vessel N	Total GT	Total kW nomimal	GT/N	kW/N	Fishing days/year	Length/ vessel	Net length (m) per day/100	Target species
1										
2										
5										
6										
7	150-250	5	15	300	2-3	20-80	<80		10-15	*Zeus faber, Palinurus spp;*
	80-400	116	686	11252	6	97	60-180		300-100	*Merluccius merluccius*
	8-25	191	523	14325	3	75	20-80		2-20	*Mullus spp.*
	5-40	95-128	330	9350	3	85	60-100		5-20	*Sparus aurata*
	5-30	17	34	1275	2	75	20-80		5-10	*Dicentrachus labrax*
	5-15	40	80	6560	2	82	30-100		3-20	*Mugilidae*
8										
9	80-500	78	936	9360	12	120	60	6000		*Merluccius merluccius*
11										
16										
17										
18										
20										
22										
23										

8

Fishing metier: 3.3 – ***Longlines and handlines***

GSA	Depth (m)	Vessel N	Total GT	Total kW nomimal	GT/N	kW/N	Fishing days/year	Length /vessel	No hooks per day/100	Target species
1										
2										
5										
6										
7	offshore	10	60	990	6	99	80 to 100		400-1800	*Xiphias gladus*
	10 -100	34	102	2686	3	79	80 to 100		200-1000	*Conger conger*
	10-50	82	246	5604	3	72	80 to 100		120-2500	*Sparidae*
	10-50	11	22	451	2	41	80 to 100		60-500	*Dicentrachus labrax*
	50-200	17	51	1105	3	65			300-1200	*Merluccius merluccius, Pagellus bogaraveo*
8										
9										
11										
16										
17										
18 *	150-400	30					30		5-15	*M. merluccius, T. lucerna, Scorpena spp., P. bogaraveo, P. americanus, Raja spp.*
18**	10-50	?								*Sparidae, C. conger*
18***	surface	20					30		20-35	*X. gladius*
18****	surface	20					20		35-50	*T. alalunga*
20										
22										
23										

9 ***Bottom –offshore; ** Bottom – inshore; *** Drifting – swordfish; **** Drifting - albacore**

Fishing metier: ***Combined netting***

GSA	Depth (m)	Vessel N	Total GT	Total kW nomimal	GT/N	kW/N	Fishing days/year	Length/vessel	Target species
1									
2									
5									
6									
7	5-6				5,5	74	150		*Scorpaena spp., Mullus surmuletus*
	5-6				5,5	74	150		*Scomber spp.*
	10-35				5,5	74	150		*Sparus aurata*
	10-35				5,5	74	200		*Lichia amii, Sarda sarda*
	15-35				5,5	74	200		*Thunnus spp., Seriola dumerili*
8									
9									
11									
16									
17									
18									
20									
22									
23									

Fishing metier: ***Boat seine***

GSA	Depth (m)	Vessel N	Total GT	Total kW nomimal	GT/N	kW/N	Fishing days/year	Target species
1								
2								
5								
6								
7	<10	27	135	1296	5	48	60	Juvenils of clupeoids and Small Fish
8								
9								
11								
16								
17								
18								
20	0 - 70	108	555	5,841	5.1	54.1	100	
22	0 - 70	316	2,232	19,855	7.1	62.8	100	
23	0 - 70	6	33	428	5.5	71.3	100	

10

Fishing metier: ***Fyke netting***

GSA	Depth (m)	Vessel N	Total GT	Total kW nomimal	GT/N	kW/N	Fishing days/year	Target species
1								
2								
5								
6								
7								
8								
9								
11								
16								
17								
18								
20	0 - 60	108	202	1,739	1.9	17	120	
22	0 - 60	1334	3,916	38,732	2.9	29	120	
23	0 - 60	5	14	105	2.8	21	120	