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Minimum conservation size for Red Seabream (*Pagellus bogaraveo*) (STECF-16-09)

Edited by Clara Ulrich and Hendrik Doerner

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Institute for the Protection and Security of the Citizen (IPSC)

Contact information
STECF secretariat
Address: Maritime Affairs Unit, Via Enrico Fermi 2749, 21027 Ispra VA, Italy
E-mail: stecf-secretariat@jrc.ec.europa.eu
Tel.: 0039 0332 789343
Fax: 0039 0332 789658

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Abstract

The European Commission may consult the STECF on any matter relating to marine and fisheries biology, fishing gear technology, fisheries economics, fisheries governance, ecosystem effects of fisheries, aquaculture or similar disciplines. This report deals with the minimum conservation size for Red Seabream (*Pagellus bogaraveo*).The STECF issues its advice by written procedure in June 2016.

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MINIMUM CONSERVATION SIZE FOR RED SEABREAM (*PAGELLUS BOGARAVEO*) (STECF-16-09)

The STECF review was undertaken during May 2016.

Background

Red seabream is managed in European waters through TACs in the Atlantic.[1] A Minimum Conservation Reference Size (MCRS)[2] of 33cm exists in the Mediterranean. It is necessary for the protection of the species in the Atlantic to also set a MCRS in the Atlantic. In view of the existing scientific information from ICES (report of WKDEEP 2010) 33 cm seems to be an appropriate MCRS for red sea bream in the Atlantic.

Article 4 (17) of the Basic Regulation of the CFP[3] defines minimum conservation reference size as follows:

"minimum conservation reference size means the size of a living marine aquatic species taking into account maturity, as established by Union law, below which restrictions or incentives apply that aim to avoid capture through fishing activity; such size replaces, where relevant, the minimum landing size."

Request to the STECF

The STECF is requested to:

1. Compile the relevant biological information and scientific literature.

2. Advise, on the size, measured as total length, at which most (>50%) females mature for the Atlantic red seabream stock in the whole of its three different components: Areas VI, VII, and VIII; Area IX, and Area X (Azores region).

Confirm whether, in view of the existing scientific information, 33 cm is an appropriate MCRS for red seabream in the Atlantic.

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[1]Council Regulation (EU) No 1367/2014 of 15 December 2014 fixing for 2015 and 2016 the fishing opportunities for Union fishing vessels for certain deep-sea fish stocks.

[2] Regulation (EU) No 1380/2013 of the European Parliament and of the Council of 11 December 2013 on the Common Fisheries Policy.

[3]Council Regulation (EC) No 1967/2006 of 21 December 2006 concerning management measures for the sustainable exploitation of fishery resources in the Mediterranean Sea

3. Discuss possible added value of additional work (e.g. model the gender change and maturity sizes) for inclusion in the stock assessment.

STECF Response

The STECF acknowledges the contributions from Pascal Lorance, (EMH/RBE/Ifremer, Nantes, France; email: pascal.lorance@ifremer.fr) and Juan Gil (IEO, Cadiz, Spain (juan.gil@cd.ieo.es), which greatly helped the committee to address the request from the Commission.

Point 1 of the request. Compilation of the relevant biological information and scientific literature.

Distribution and stock identity

The blackspot seabream (*Pagellus bogaraveo*) is a male-first sex-changing sparid fish. It is distributed throughout the Mediterranean Sea and in the Atlantic from the Gulf of Cadiz to the West of the British Isles (Desbrosses, 1938). Adults inhabit depths ranging around 300-700 m. The depth distribution varies according to individual size, with larger fish occurring deeper (Desbrosses, 1938; Guégen, 1974; Silva *et al*., 1994 and Gil, 2006).

In the Atlantic, ICES recognises three stock units:

Subareas VI, VII, and VIII

Subarea IX (Atlantic Iberian Waters)

Subarea X (Azores Ground)

The blackspot seabream is found on the shelf and down to 700 m along the continental slope and on seamounts (Morato *et al*., 2001), but breeding occurs in shallower waters. Juveniles occur at the coast in various habitat types (Priol, 1932; Pinho *et al*., 2014). Although occasionally caught at the coast, large fish are distributed deeper than juveniles (Olivier, 1928; Desbrosses, 1938; Morato *et al*., 2001; Spedicato *et al*., 2002; Pinho *et al*., 2014). The species do seasonal spatial and depth migrations. This was observed for the Atlantic stock in ICES VI, VII, and VIII where tagging showed that individuals occurring to the North of the Bay of Biscay and Celtic Seas overwinter in the Cantabrian Sea, ICES VIII.c (Guéguen, 1974; Sánchez, 1983).

Recaptures from tagged juveniles show significant displacements from South Mediterranean breeding areas toward the Strait of Gibraltar (Area IX). However, recaptures from tagged adults in the Strait of Gibraltar area did not reflect large displacements, which are limited to local feeding that the fishing fleet follows. Adult fish seem to remain in the Strait of Gibraltar area as a resident population (Gil, 2006). In Azorean waters, large adults are caught on isolated seamounts where juveniles have never been observed, suggesting migrations from the coast of Islands where nurseries are distributed to seamounts located up to 100 km for Island coasts (Pinho *et al*., 2014).

The spawning season seems to take place during the first quarter of the year in the Strait of Gibraltar area (Gil and Sobrino, 2001). This coincides with those obtained by Krug (1994) for the Azores Islands and with previous studies from Cantabrian Sea (ICES VIII) by Sánchez (1983), Alcaraz *et al*. (1987) and Castro (1990).

Growth

The summary of literature available on growth is given Table 1.

The blackspot seabream is considered a slow growing species that can live up to 15-20

years and reach 50-60 cm.

In the Mediterranean Sea, ages were estimated using whole otoliths (Chilari *et al*., 2006). As otoliths become thick in fish older than a few years, all growth zones cannot be counted, leading to an underestimation of age. Age estimates derived from this method in this area are thus not presented here.

In the Atlantic growth studies have been made for all three stocks, fitting the von Bertalanffy Growth model. Most age and growth studies have been based on whole otoliths and are thus probably subject to the same problem of age under-estimation. There are strong differences in the estimated growth but it cannot be ascertained whether they are linked to the age estimation methods used (using scales or otoliths) rather than to actual differences in growth. Much younger ages have been estimated using whole otoliths and these are no longer considered realistic in the light of growth observed on tagged individual (ICES, 2013a).

Instead of otoliths, growth increments counted on scales can be used (Table 1). Such analyses are only available for the stock in areas VI, VII, and VIII. Growth estimates from Guéguen (1969) indicate that the species reaches a maximum size of about 60 cm. When the species was abundant, few individuals larger than 65 cm were reported. Age data from the 1960s in the Bay of Biscay indicate that at the end of the summer 0-group fish are about 10 cm long, group 1 is less than 20 cm and a total length of 30 cm is not reached before age 7 (Guéguen, 1969).

Maturity

The most extensive study of size at maturity and sex-change was done in the Azores, where growth, hermaphroditism and maturity parameters were estimated in the late 1980s and early 1990s (Krug, 1989, 1990, 1998). Maturity and proportion of sexes by size or age have not been estimated in detail for the two other stocks in the Atlantic. Maturity estimates are detailed further in the point 2 of the request.

Table 1.Life history traits (coefficients of the von Bertalanffy growth function, maximum observed size and size at 50% first maturity as females and males) of the blackspot seabream. Size are total length in cm, were applicable original estimates in fork length (FL) were converted to total length (TL) using the relationship TL=1.13*FL-0.04 (Krug, 1989).

	Coefficients of the Von Bertalanffy growth function				Maximum observed size	Maturity of females	Maturity of males	Source
Stock	Linf (TL, cm)	k	t_0	Age estimation method	Lmax (cm)	L50% Females (cm)	L50% males (cm)	
ICES VI, VII, and VIII	56.8	0.092	–2.92	Scales	70			Walford method from Guéguen (1969)
ICES VI, VII, and VIII	51.4	0.137	–0.97	Scales		40		Lorance (2011), new fit to mean length at ages from Guéguen (1969)
ICES VI, VII, and VIII	51.56	0.209	–0.53	Whole otolith for fish> 35 cm TL, sectioned otoliths for larger fish				Sánchez (1983)
ICES VI, VII, and VIII	53.86	0.127	–1.02	Scales				Ramos and Cendrero (1967)
ICES VI, VII, and VIII	48.66	0.196	–0.47	Whole otoliths		30-34	25-29	Alcaraz et *al*. (1987)

ICES VI, VII, and VIII	54.2	0.174	–0.66	Scales				Castro (1990)
ICES IX	58	0.169	-0.67	Whole otoliths	62	36	30	Sobrino and Gil (2001); Gil and Sobrino (2001)
ICES X	58.5	0.117	–1.55	Whole otoliths				Krug (1989)
ICES X	56.67	0.135	–1.08	Whole otoliths				Menezes *et al*. (2001)c
ICES X	62.24	0.102	-1.29	Whole otolithsotoliths				Pinho (2003)

Fishery

Information on fishery and length distribution is available from the ICES WGDEEP reports. Information from ICES WKDEEP 2015 is as follows:

Stock in areas VI, VII and VIII: The fishery strongly declined in the mid-1970s, and the stock is seriously depleted. Since the 1980s, it has been mainly a bycatch of otter trawl, longline and gillnet fleets and only a few small-scale handliners have been targeting the species. Data on these bycatch are limited because of the low occurrence in the species in the catches, and no length composition of the landings is available. But it is known that historical catch of blackspot seabream included landings of juvenile fish younger than 4 years old. At the time of the collapse of that stock, there was a commercial category for landings of fish <250g (Guichet *et al*., 1971).

Stock in Area IX: Most of the landings come from longlines fisheries. Length frequencies of landings are available for the Spanish "voracera" handline in the strait of Gibraltar, showing an average length between 33 and 40 cm in the recent years (ICES, 2013). The proportion of landings below 30 cm is limited.

Stock in area X: There is a directed fishery with hooks and lines, and seabream is also a target in a multispecies multigear fishery. Fishery length compositions displays a mode around 25–28 cm, and most landings are between 24 and 36 cm. In the Azores, juveniles of age 0 have been fished to provide live-bait to the tuna fishery (Pinho *et al*., 2014). Although these catch have been regulated since 2009, they may still occur at a lower level.

Point 2 of the request. Size, measured as total length, at which most (>50%) females mature for the Atlantic stocks

For the stock in areas VI, VII, and VIII: Combining the proportions of individual by sex, maturity and size from previous studies, Lorance (2011) estimated L50% for the stock. Because of the hermaphroditism of the species, it is distinguished between the size of 50% maturity of females, estimated at 36 cm, and the size at which 50% of the total population are mature female, estimated at 40 cm. This is because at 36 cm some individuals are still males. 40 cm corresponds to an age of 8 years according to the growth curve also estimated in the Azores. An earlier analysis by Alcaraz (1987) estimated L50 at 30-34 cm.

For the stock in area IX, it has been estimated that males start maturing at a L50% around 30 cm. Around 33 cm an important percentage of individuals change sex and become females, maturing at L50 around 36 cm (Gil, 2006, ICES 2013)

For the stock in area X, ICES WGDEEP (2010, 2013) uses L50% values at 28 cm for males and 32 cm for females.

Point 2a of the request: confirm whether, in view of the existing scientific information, 33 cm is an appropriate MCRS for red seabream in the Atlantic.

A size of 33 cm corresponds to the L50% female mature in area X according to ICES (2013).

In the stocks in areas VI, VII, and VIII, a larger estimate of L50% females maturity is used by ICES (36 cm for the female component of the stock, 40 cm for the entire stock). Given the low level of the stock in areas VI, VII, and VIII and the peculiar hermaphrodite biology of the species, a recovery of the female mature biomass is needed to rebuild the stock.

STECF notes that the setting of a MCRS in the context of the EU landing obligation has

important ramifications. The CFP legislation (art. 4.17) specifies that "*'minimum conservation reference size' means the size of a living marine aquatic species taking into account maturity, as established by Union law, below which restrictions or incentives apply that aim to avoid capture through fishing activity*". The MCRS is intended to provide incentives to avoid the capture of non-mature specimen. A definitive indicator of maturity is though not defined in the regulation, and therefore the evaluation of the appropriateness of a certain value for MCRS requires an assessment of both the length at maturity of the species and the of the incentives and feasibility of changing fishing patterns to accommodate the MCRS. All fish caught under the MCRS will need to be landed and may not be used for direct human consumption.

STECF could not fully evaluate how the proposed MCRS may affect the exploitation of the various stocks, and the incentives to avoid the capture of juvenile fish, but on the basis of the available information on length composition it is likely that substantial catches of undersized seabream might occur, especially in the Azores fishery (area X).

Point 3 of the request. Discuss possible added value of additional work (e.g. model the gender change and maturity sizes) for inclusion in the stock assessment.

Data on gender change and maturity sizes from Krug (1989, 1990 and 1998) are from the 1980s. They were collected in a period where the exploitation in the Azorean areas was considered moderate. It is not known whether these biological parameters change with stock abundance as a result of density-dependent factors.

As a consequence, the primary additional work to be envisaged would be to improve the biological knowledge on species reproduction and maturity stages and update the estimates of size/age at maturity as male and female, the size-as sex-change and the proportion of gonochoric individuals (those which do not change sex). This would require dedicated sampling and accurate functional sex determination based on histological examination when macroscopic examinations is insufficient to evaluate which sex sis functional. Such data in combination with recent age-composition and growth estimation data would then be appropriate for population modelling and stock assessment taking full account of the sex-changing characteristic of the species.

Secondly, specific stock assessment methods accounting for hermaphroditism and sex-separation would be needed, as the stock assessment is quite sensitive to even small changes in the age-specific probability of transition (sex change from one sex to the other), which influence significantly sex ratio, population size and population growth. Thus more complex assessment models such as Stock Synthesis, which provides a statistical framework for calibration of a population dynamics model, should be envisaged for the assessment of the red seabream stocks.

STECF conclusions

The blackspot seabream is a male-first sex-changing and slow growing species. Growth and maturity have been studied to various extents in the different stocks in the Atlantic and Mediterranean. Some differences have been observed across the various stocks, but it cannot be ascertained whether these reflect real biological differences across stocks or bias linked to the different methods used.

The size at which >50% of females are mature is estimated to be 36 cm total length in the Atlantic for the two stocks in areas VI, VII, and VIII and in area IX. This is slightly above the size of 33 cm suggested. 33 cm corresponds to the mean size at sex change

to female. Additionally, because of the hermaphroditism of the species, the size at which 50% of the total population are mature female is even larger (40 cm) than the size of 50% maturity of females. Therefore, 33cm cannot be considered an appropriate MCRS from a biological point of view in areas VI, VII, and VIII and in area IX.

Regarding the stated MCRS objective of avoiding capture of undersize fish, STECF cannot fully evaluate the effects of MCRS at 33cm or higher, but notes that substantial catches of individuals below 33cm have systematically occurred in area X. Discards quantity may thus increase as long as the stocks are not subject to the landing obligation

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Contact details of STECF members

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Name	**Address**[1]	**Tel.**	Email
STECF members			
Abella, J. Alvaro	Independent consultant	Tel. 0039-3384989821	aabellafisheries@gmail.com
Andersen, Jesper Levring	Department of Food and Resource Economics (IFRO) Section for Environment and Natural Resources University of Copenhagen Rolighedsvej 25 1958 Frederiksberg Denmark	Tel.dir.: +45 35 33 68 92	jla@ifro.ku.dk
Arrizabalaga, Haritz	AZTI / Unidad de Investigación Marina, Herrera kaia portualdea z/g 20110 Pasaia (Gipuzkoa), Spain	Tel.: +34667174477	harri@azti.es
Bailey, Nicholas	Marine Scotland Science, Marine Laboratory, P.O Box 101 375 Victoria Road, Torry Aberdeen AB11 9DB UK	Tel: +44 (0)1224 876544 Direct: +44 (0)1224 295398 Fax: +44 (0)1224 295511	baileyn@marlab.ac.uk n.bailey@marlab.ac.uk

Name	Address[1]	Tel.	Email
STECF members			
Bertignac, Michel	Laboratoire de Biologie Halieutique IFREMER Centre de Brest BP 70 - 29280 Plouzane, France	tel : +33 (0)2 98 22 45 25 - fax : +33 (0)2 98 22 46 53	michel.bertignac@ifremer.fr
Borges, Lisa	FishFix, Brussels, Belgium		lisa.fishfix@gmail.com
Cardinale, Massimiliano (vice-chair)	Föreningsgatan 45, 330 Lysekil, Sweden	Tel: +46 523 18750	massimiliano.cardinale@slu.se
Catchpole, Thomas	CEFAS Lowestoft Laboratory, Pakefield Road, Lowestoft Suffolk, UK NR33 0HT		thomas.catchpole@cefas.co.uk
Curtis, Hazel	Sea Fish Industry Authority 18 Logie Mill Logie Green Road Edinburgh EH7 4HS, U.K.	Tel: +44 (0)131 524 8664 Fax: +44 (0)131 558 1442	Hazel.curtis@seafish.co.uk
Daskalov, Georgi	Laboratory of Marine Ecology, Institute of Biodiversity and Ecosystem Research, Bulgarian Academy of Sciences	Tel.: +359 52 646892	Georgi.daskalov@gmail.com
Döring, Ralf (vice-chair)	Thünen Bundesforschungsinstitut, für Ländliche Räume, Wald und Fischerei, Institut für Seefischerei - AG Fischereiökonomie, Palmaille 9, D-22767 Hamburg, Germany	Tel.: 040 38905-185 Fax.: 040 38905-263	ralf.doering@thuenen.de
Gascuel, Didier	AGROCAMPUS OUEST 65 Route de Saint Brieuc, CS 84215, F-35042 RENNES Cedex France	Tel:+33(0)2.23.48.55.34 Fax: +33(0)2.23.48.55.35	Didier.Gascuel@agrocampus-ouest.fr
Knittweis, Leyla	Department of Biology University of Malta Msida, MSD 2080 Malta		Leyla.knittweis@um.edu.mt
Malvarosa, Loretta	NISEA S.c.a.r.l.		malvarosa@nisea.eu
Martin, Paloma	CSIC Instituto de Ciencias del Mar Passeig Marítim, 37-49 08003 Barcelona Spain	Tel: 4.93.2309500 Fax: 34.93.2309555	paloma@icm.csic.es

Name	Address[1]	Tel.	Email
STECF members			
Motova, Arina	Sea Fish Industry Authority 18 Logie Mill Logie Green Road Edinburgh EH7 4HS, U.K	Tel.: +44 131 524 8662	arina.motova@seafish.co.uk
Murua, Hilario	AZTI / Unidad de Investigación Marina, Herrera kaia portualdea z/g 20110 Pasaia (Gipuzkoa), Spain	Tel: 0034 667174433 Fax: 94 6572555	hmurua@azti.es
Nord, Jenny	The Swedish Agency of Marine and Water Management (SwAM)	Tel. 0046 76 140 140 3	Jenny.nord@havochvatten.se
Pastoors, Martin	Pelagic Freezer-trawler Association, Louis Braillelaan 80, 2719 EK Zoetermeer, The Netherlands		mpastoors@pelagicfish.eu
Paulrud, Anton	Swedish Agency of Marine and Water Management	Tel.: +46 106986292	Anton.paulrud@hochvatten.se
Prellezo, Raúl	AZTI -Unidad de Investigación Marina Txatxarramendi Ugartea z/g 48395 Sukarrieta (Bizkaia), Spain	Tel: +34 667174368	rprellezo@azti.es
Raid, Tiit	Estonian Marine Institute, University of Tartu, Mäealuse 14, Tallin, EE-126, Estonia	Tel.: +372 58339340 Fax: +372 6718900	Tiit.raid@gmail.com
Sabatella, Evelina Carmen	NISEA, Via Irno, 11, 84135 Salerno, Italy	TEL.: +39 089795775	e.sabatella@nisea.eu
Sala, Antonello	Italian National Research Council (CNR) Institute of Marine Sciences (ISMAR), Largo Fiera della Pesca, 1 60125 Ancona - Italy	Tel: +39 071 2078841 Fax: +39 071 55313 Mob.: +39 3283070446	a.sala@ismar.cnr.it

Name	Address[1]	Tel.	Email
STECF members			
Scarcella, Giuseppe	1) Italian National Research Council (CNR), Institute of Marine Sciences (ISMAR) - Fisheries Section, Largo Fiera della Pesca, 1, 60125 Ancona – Italy 2) AP Marine Environmental Consultancy Ltd, 2, ACROPOLEOS ST. AGLANJIA, P.O.BOX 26728 1647 Nicosia, Cyprus	Tel: +39 071 2078846 Fax: +39 071 55313 Tel.: +357 99664694	g.scarcella@ismar.cnr.it gscarcella@apmarine.com.cy
Soldo, Alen	Department of Marine Studies, University of Split, Livanjska 5, 21000 Split, Croatia	Tel.: +385914433906	soldo@unist.hr
Somarakis, Stylianos	Institute of Marine Biological Resources and Inland Waters (IMBRIW), Hellenic Centre of Marine Research (HCMR), Thalassocosmos Gournes, P.O. Box 2214, Heraklion 71003, Crete, Greece	Tel.: +30 2810 337832 Fax +30 6936566764	somarak@hcmr. gr
Stransky, Christoph	Thünen Institute [TI-SF] Federal Research Institute for Rural Areas, Forestry and Fisheries, Institute of Sea Fisheries, Palmaille 9, D-22767 Hamburg, Germany	Tel. +49 40 38905-228 Fax: +49 40 38905-263	christoph.stransky@thuenen.de
Ulrich, Clara (chair)	Technical University of Denmark, National Institute of Aquatic Resources, (DTU Aqua), Charlottenlund Slot, JægersborgAllé 1, 2920 Charlottenlund, Denmark		clu@aqua.dtu.dk
van Hoof, Luc	IMARES, Haringkade 1, Ijmuiden, The Netherlands	Tel.: +31 61061991	Luc.vanhoof@wur.nl
Vanhee, Willy	Independent consultant		wvanhee@telenet.de
Vrgoc, Nedo	Institute of Oceanography and Fisheries, Split, Setaliste Ivana Mestrovica 63, 21000 Split, Croatia	Tel.: +385 21408002	vrgoc@izor.hr

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