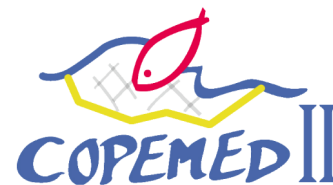




FOOD AND AGRICULTURE ORGANIZATION
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OCCASIONAL PAPER

15

PRELIMINARY JOINT ASSESSMENT OF *Pagellus bogaraveo* STOCK OF THE STRAIT OF GIBRALTAR AREA BETWEEN SPAIN AND MOROCCO (GSAs 01 AND 03)

A CopeMed II contribution to:

GFCM-SAC Sub-Committee on Stock Assessment (SCSA)

Working Group on Stock Assessment of Demersal Species

Split, Croatia, 5-9 November 2012

Málaga (Spain), October 2012

CopeMed II Occasional Paper N° 15 **(GCP/INT/028/SPA – GCP/INT/006/EC)**

CopeMed II (*Co-ordination to Support Fisheries Management in the Western and Central Mediterranean*) is a project under the responsibility of the Fisheries and Aquaculture Department of the Food and Agriculture Organization of the United Nations (FAO), executed by the Marine and Inland Fisheries Service and Coordinated from the Office of the Project in Málaga (Spain).

CopeMed II is financed by the DG Mare of the European Commission and the Government of Spain.

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For reference, this document should be cited as follows:

Belcaid S., Benchoucha S., Pérez Gil J.L., Gil Herrera J., González Costas F., García Prieto F., Talbaoui E.M., El Arraf S., Hamdi H., Abid N., Malouli Idrissi M., Lamtai A., Bernardon M., Camiñas J.A., Fernández I.L. Preliminary joint assessment of *Pagellus bogaraveo* stock of the Strait of Gibraltar area between Spain and Morocco (GSAs 01 and 03). Paper presented at the Working Group on Stock Assessment of Demersal Species (SCSA-SAC, GFCM), (Split, Croatia, 5-9 November 2012). GCP/INT/028/SPA-GCP/INT/006/EC. CopeMed II *Occasional Papers* n° 15: 18 pp.



**GENERAL FISHERIES COMMISSION
FOR THE MEDITERRANEAN
COMMISSION GÉNÉRALE DES PÊCHES
POUR LA MÉDITERRANÉE**



GFCM-SAC Sub-Committee on Stock Assessment (SCSA)

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Split, Croatia, 5-9 November 2012

PRELIMINARY JOINT ASSESSMENT OF *Pagellus bogaraveo* STOCK OF THE STRAIT OF GIBRALTAR AREA BETWEEN SPAIN AND MOROCCO (GSAs 01 AND 03)

(DOCUMENT AS COMPLEMENT OF THE GFCM STOCK ASSESSMENT FORM CARRIED OUT IN THE FRAMEWORK OF THE CopeMed II STUDY GROUP ON

Pagellus bogaraveo. Tangier, Morocco, 19-21 March 2012)

Preliminary joint assessment of *Pagellus bogaraveo* stock of the Strait of Gibraltar area between Spain and Morocco (GSAs 01 and 03)¹

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Abstract

The second meeting of the FAO CopeMed II Working Group between Spain and Morocco on blackspot seabream (*Pagellus bogaraveo*) stock of the Strait of Gibraltar area² was held in Tangier (Morocco) from 19 to 21 March 2012.

The main objective of this CopeMed II Working Group was to update the existing data and information on this stock shared by the two countries (GSAs 01 and 03) and to carry out a new joint assessment of the stock. The results of the stock assessment were prepared to its presentation to the GFCM, (General Fisheries Commission for the Mediterranean Working Group on Demersal Species, Subcommittee on Stocks Assessment, Scientific Advisory Committee) and to the ICES (International Council for the Exploration of the Sea, Working Group on the Biology and Assessment of Deep- Sea Fisheries Resources).

The WG conducted three different assessment models with the new available data. The first one was an update of the assessment carried out in 2010 with the VIT model. Second, the WG take the VIT model results to undertake a Yield per Recruit and Spawning Stock Biomass per Recruit analyses to determine the biological reference points. Third, the WG runed an assessment using the Depletion-Corrected Average Catch (DCAC) formula, a method to estimate sustainable yields for data-poor fisheries.

The results of the assessments showed that the actual level of fishing mortality ($F_{bar} = 0.19$) is higher than the values calculated for the F_{msy} proxies ($F_{0.1}$ or $F_{40\%} = 0.12$). The WG recommended that the actual level of fishing effort should be reduced to set the fishing mortality level to a more sustainable value.

Key words: *Pagellus bogaraveo*, Strait of Gibraltar area, GSAs 01 and 03, stock assessment, VIT, YPR, DCAC models, Morocco, Spain, CopeMed.

¹ This paper should be cited as follows: Belcaid S., Benchoucha S., Pérez Gil J.L., Gil Herrera J., González Costas F., García Prieto F., Talbaoui E.M., El Arraf S., Hamdi H., Abid N., Malouli Idrissi M., Lamtai A., Bernardon M., Camiñas J.A., Fernández I.L. Preliminary joint assessment of *Pagellus bogaraveo* stock of the Strait of Gibraltar area between Spain and Morocco (GSAs 01 and 03). Paper presented at the Working Group on Stock Assessment of Demersal Species (SCSA-SAC, GFCM), (Split, Croatia, 5-9 November 2012). GCP/INT/028/SPA-GCP/INT/006/EC. CopeMed II *Occasional Papers* n° 15: 18 pp.

² CopeMed II. 2012. Report of the Second meeting of the CopeMed II Working Group between Spain and Morocco on blackspot seabream (*Pagellus bogaraveo*) of the Strait of Gibraltar area. CopeMed II Technical Documents N°26 (GCP/INT/028/SPA – GCP/INT/006/EC). Málaga, 2012. 37pp.

1. Background information

The CopeMed II Working Group between Morocco and Spain on *Pagellus bogaraveo* of the Strait of Gibraltar area was held to follow up the recommendations of the GFCM's Scientific Advisory Committee (Budva, Montenegro, 25-29 January 2010). The main objective of the WG was to carry out an update joint stock assessment of the blackspot seabream of the Strait of Gibraltar area in order to present the results to the General Fisheries Commission for the Mediterranean (GFCM) and to the International Council for the Exploration of the Sea (ICES), considering that the experts participating in the CopeMed II WG works in collaboration with the two regional fisheries organizations.

2. New available data and progress made on *P. bogaraveo* stock knowledge

Six Working Papers (WPs) prepared by the two countries and CopeMed II were provided to the WG presenting the new fishery and biological information available from Spain and Morocco (see <http://www.faocopemed.org/html/events.html>). The WG also prepared a revision of the available information summarized in Table 1.

Country	Metier/Fleet/ Gear	Period with Available Information				Biological Information
		Port	Landing	Effort	Length Distributions	
Spain	Voracera (Lines)	Tarifa	1983-2011	1983-2011(Sales) 2008-2011 (VMS)	1990-2011	1997-1999; 2003-2009
	Voracera (Lines)	Algeciras	1995-2011	1995-2011(Sales) 2008-2011 (VMS)	1995-2011	1997-1999
	Long-line	Conil	2002-2011	2002-2011(Sales) 2008-2011(VMS)	2002-2011	NA
Morocco	Long-line	Tangier	2001-2011	2001-2011 (Sales)	2005-2011	NA
	Artisanal	Tangier	2001-2011	2001-2011 (Sales)	2005-2011	NA
		Other Ports	2009-2011	Not available (NA)	NA	NA

Table 1. Landing, effort, length distributions and biological information available for the assessment by country, gear and port.

Spain.

The Spanish information was presented³. Data available from Tarifa port are catches (1984-2011), landings length distributions (1995-2011), fishery footprint and CPUE from observers (2005-2009) and from the Location and Track System for Andalusian Fishing Vessels (SLSEPA) of the Junta de Andalucía. The species is targeted by the “voracera” fleet in Algeciras (around 75% of the total longliners catches in GSA 01).

Landings are distributed in commercial categories, owing to the wide range of sizes and for market reasons. Landings showed an increase from 1983 to a maximum in 1994. Since then landings have decreased, except in 1996 and 1997, reaching the lowest value of the recent years in 2002. From 2003 onwards it showed an increasing trend setting the highest value of the last years in 2009, when landings started to decrease again.

The effort unit chosen (number of sales) was not considered appropriate, as the missing effort (fishing boats with no sales) is not considered. This problem will be solved with new

³ http://www.faocopemed.org/pdf/occasional_papers/CopeMedII_ArtFiMed_OP10.pdf

information produced by a VMS (“green boxes”) installed by the Junta de Andalucía in the Spanish voracera fleet since 2008.

The former management plan for this fishery was based on the AAA/1589/2012 Order of July 17, establishing a plan for the blackspot seabream fishery in certain areas of the Strait of Gibraltar regulating the area, gear (voracera) and the fleet. The plan includes the minimum landing size and the annual Total Allowable Catch (TAC) to the EU Regulation and includes an authorized “voracera” fleet, fishing gear technical characteristics, a seasonal fishery closure between February 1st and March 31st and the regulation of the effort by week.

Morocco.

The most important Moroccan fleets targeting blackspot seabream are the longliners based at the port of Tangier and the artisanal fleet of the Strait of Gibraltar area. In the past years, the longliners fleet was more or less stable (98 to 102 vessels) while the artisanal fleet has increased in the 2009-2011 period (69 fishing boats).

The Moroccan information refers to a key port, Tangier and a fleet fishing in four main fishing grounds for the fleet: Bakhat, Imakhwen, Cabo and Ploné. The fishery is carried out at 200-700 m depth and the gear used is the longline known as “voracera”. The number of hooks by boat is between 200 and 2000 and the size of the hooks is between 8 and 11.

Since 2001, the effort (number of sales) and catches are available at the port of Tangier and both have increased until 2011 (catches represented 136 tons). CPUE increased until 2005 and in the period 2005-2009 was more or less stable. From 2010 onwards, a decrease of CPUE was observed.

Length catches range is 24-67 cm (total length) and the majority range is 29-38 cm. Length samples are recorded to the fork length and transformed to total length through using the relationship fork length-total length (Czerwinski et al. 2008: $FL = -0.731 + 0.910 * TL$).

The main regulations enforced by Morocco are: the gel of investment since 1992; the interdiction of fishing beyond 80 m depth in the area between Tangier and Al Hoceima and below 3 miles in the area between Al Hoceima and Saidia; the minimal landing size (25 cm fork length); trawls mesh size ≥ 50 mm; nets regulations (L = 1000 m, mesh size = 70 mm) and, the protection of areas (marine protected area) and anti-trawling artificial reefs.

Other national fishery targeting P. bogaraveo in Morocco and Spain: Catch and effort data. Biological data and information.

Catches per type of fleet in several ports of Morocco in the Mediterranean Sea and the Atlantic Ocean were reported showing that there are three different fleets targeting *P. bogaraveo*: longliners, artisanal boats and bottom trawlers, the two first units targeting this species while the trawlers catches of Blackspot representing part of the by-catch.

Longliners and artisanal fleets from Tangier constitute the most important fleet. Among the artisanal landing site (Figure 1) Ksar Sghir is the most important. There is information for catches and effort of these fleets from 2009.

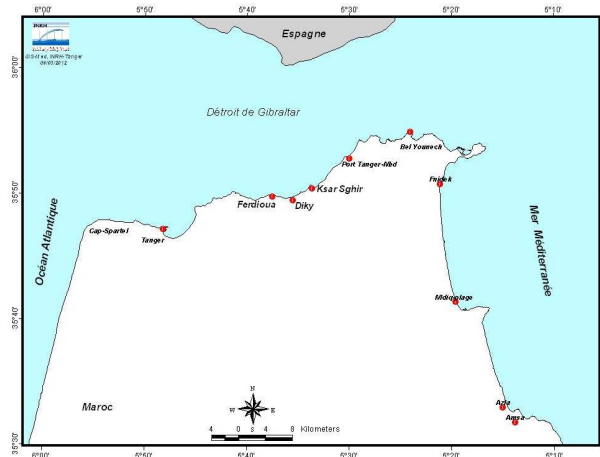


Figure 1. Localization of the main landing sites and ports of the Moroccan Strait of Gibraltar area.

Table 2 presents the Moroccan landings by year, gear and landing points for the study area.

	CHALUTIERS			PALANGRIERS			BARQUES	
	2009	2010	2011	2009	2010	2011	2010	2011
AL HOCEIMA	0.888	0.278	0.373	2.958	3.112	6.678	0.163	0.292
NADOR	5.261	4.794	8.376	0.145	0.057	0.728	0.000	0.017
FNIDEQ	0.000	0.000	0.000	0.000	0.000	0.000	0.929	0.170
JEBHA	0.000	0.000	0.034	0.000	0.000	0.000	0.008	0.000
M'DIQ	0.240	0.232	0.082	1.498	0.897	2.129	0.000	0.000
KSSAR SGHIR	0.000	0.000	0.000	0.000	0.000	0.000	40.012	17.708
TANGER	0.046	0.103	0.095	90.272	93.826	102.075	7.885	17.165

Table 2. Moroccan landings (tons) for blackspot seabream by fleet and year.

The blackspot seabream is a by-catch for the Spanish mix trawl fishery targeting *Merluccius merluccius*, *Parapenaeus longirostris* and *Aristeus antennatus* in the GFCM GSA 01. Trawl fleet only caught 6% in weight of blackspot seabream in the period 2009-2011 in GSA 01.

Abundance indices for *P. bogaraveo* from the Spanish trawl survey MEDITS showed high variability and are depend on the certain substracts in the survey hauls.

FAO-ArtFiMed project monitoring system on artisanal fisheries in Diky (Strait of Gibraltar area, Morocco): main results on the P. bogaraveo fishery.

The document “Analyse de la base de données, du projet FAO-ArtFiMed, sur le suivi de l’activité de la pêche à Diky (Maroc). La pêche de la dorade rose *Pagellus bogaraveo*” was presented⁴. The artisanal fleet from Diky is composed by about 50 active boats built on wood, ranging 7 m average length and onboard engines from 20 to 40 HP. The fleet uses only hook gears all along the year and the average number of gears by boat is 5. Moreover, a similar fleet in others sites in the Strait of Gibraltar area (Oued Aliane, Ferdioua, Ksar Sghir, Oued Dalia, Oued Marsa and Benyounech) target the species. Data and results obtained by FAO-ArtFiMed during a year of sampling at Diky could be used to extrapolate to the rest of the mentioned Moroccan artisanal fleets.

⁴ http://www.faocopemed.org/pdf/occasional_papers/CopeMedII_ArtFiMed_OP09.pdf

Main results of the analysis of the Dikky SSF FAO-ArtFiMed database for the period March - December 2010 are:

- Total fishing effort targeting blackspot seabream was 404 effective days over 1187 fishing days, representing 34.04% of the total fishing effort for the period.
- Fishing effort has two maximum peaks in May and September.
- Total landing of Blackspot was 5 983 kg, representing around 16% of the total production in Dikky (37 800 kg).
- Landings are sold in commercial categories (same scheme that the fleet of Tangier).
- CPUE in kg presents two maximums: spring (May) and autumn (October).
- The average blackspot seabream value (Dhs/kg) increases from March to December with a maximum at the end of the year (November-December).
- Total value of blackspot seabream in Dikky reaches 433 990 Dhs (equivalent to 51 000 \$), representing 20.85 % of the total landings in Dikky (2.081.815 Dhs, ~247 000 \$).

Analysis of the commercialization of P. bogaraveo from Dikky (Morocco).

The document⁵ “Analysis of the chain value of the blackspot seabream (*Pagellus bogaraveo*) in Dikky (Morocco)” reported that the blackspot seabream fishery in Dikky employ up to 250 fishermen. In 2009, the production of blackspot seabream was approximately 20 tons (value of 1.8 million dirhams \approx 170 000 euros). That represented around 43% of the total production of the boats of Dikky and 57% of the total value of landings. The catch consists of approximately 42% of commercial categories 1 and 2 (\geq 800g), with 59% of the total value of blackspot seabream. Around 58% of the landings of this species are over 33 cm. Approximately, 98% of blackspot seabream production is exported to the Spanish market.

Fishermen reported that 100% of the vessels’ owners had a delivery commitment with traders (4 traders in Dikky). This commitment is based on the fact that fishermen go into debt to merchants to cover the removal costs and the purchase of fishing equipment. In exchange, fishermen offer their catch in priority to this trader, therefore becoming in their creditor. Reimbursement is mainly offered in kind (90% of situations in fish), without interest.

Information on stock identification, migration and interactions with other stocks in the Strait of Gibraltar and surrounding areas. Geographic representation (Maps) of survey and catch data.

There is not much information available on the stock structure of *P. bogaraveo* in the area. Migration patterns have been studied using tagging surveys in the GSA 01 Spanish Southern Mediterranean region and the Strait of Gibraltar area (Gil et al., 2001; Sobrino and Gil, 2001). Since 1997, 7066 individuals were tagged (juveniles + adults) and, at the moment, 396 recaptures were notified. Recaptures from juveniles showed significant displacements from GSA 01 breeding areas towards the Strait of Gibraltar area. However, recaptures from tagged adults did not reflect big displacements, which are limited to feeding movements among the different fishing grounds where the “voracera” fleet works (Gil, 2006).

The longline fishery in the Moroccan coast is the major activity in the Strait of Gibraltar area and this fleet is mainly based in the port of Tangier. The number of longliners targeting blackspot seabream in the Strait of Gibraltar area is approximately 102. There are nearly 435 artisanal boats targeting *Pagellus bogaraveo* in the strait of Gibraltar. The

⁵ <http://www.faocopemed.org/html/events.html>

following two main fishing areas (Figure 2) were identified in the Strait of Gibraltar area from the investigations with fishermen: West of Cap Spartel to the East of Benyounech and Fnideq to Martil.

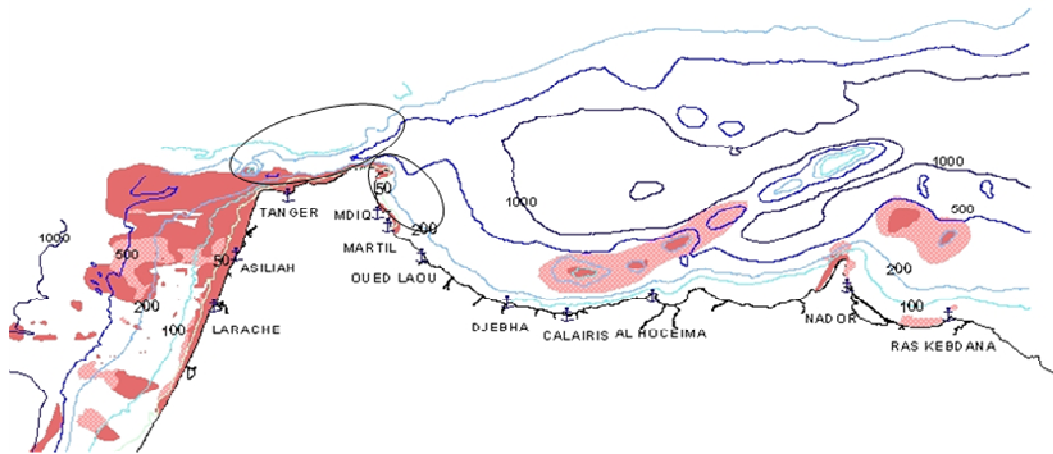


Figure 2. Map of the main Moroccan fleet fishing grounds. The circles present the most important fishing grounds of the Moroccan longliners and artisanal fleet in the Strait of Gibraltar area.

Six main fishing areas (Figure 3) were identified for the Spanish fleet based on the information provided by the Location and Track System for Andalusian Fishing Vessels (SLSEPA) of the Junta de Andalucía in the period August 2007-December 2009.

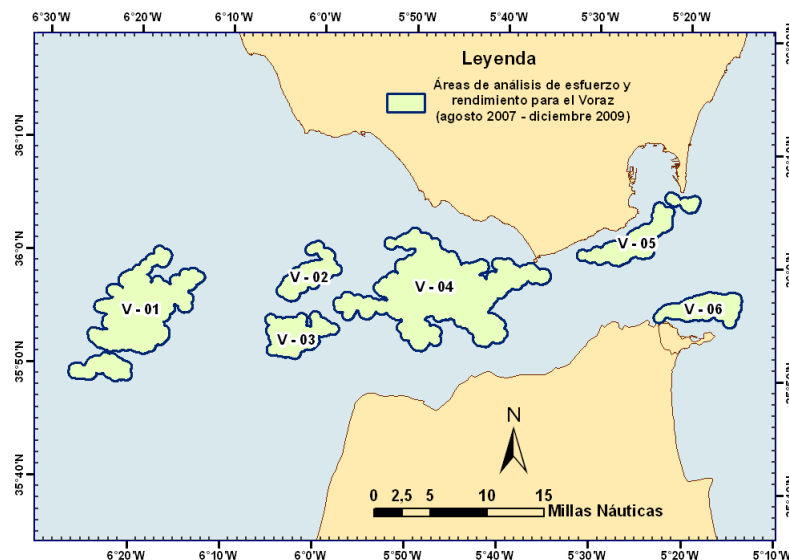


Figure 3. Main fishing grounds of the Spanish blackspot seabream fishery. Information from the Location and Track System for Andalusian Fishing Vessels (SLSEPA) of the Junta de Andalucía.

INRH experts identified the areas 02, 03, 04 and 06 of the Spanish fishing grounds as the main important fishing areas for the Morocco fleets. Based on the available information the WG agreed to delimit the area for the joint assessment around the Strait of Gibraltar area where 90% of the landings come from.

2.1. Sampling methodology:

Improvement in Morocco (random sampling in different boats).

The Morocco's sampling plan adopted by the INRH Regional Center in Tangier use as sample unit the catch per boat at fishing port. The boat's sampling was done randomly (1

out of 10 boats, once a week). Total length distribution was performed with a unique random sample on the total catches of the chosen vessel. Since March 2012, two fish lengths samplings are taken (fork and total lengths) to standardize sampling measures with the Spanish samples.

Only the Tangier port has length samples of the majority of the longliners and few samples of the artisanal fleet. Table 3 presents the length samplings frequency by year in Morocco.

Year	2005	2006	2007	2009	2010	2011
Total fish measured	274	65	145	635	156	184
N° of samplings	23	6	5	15	5	9

Table 3. *Pagellus bogaraveo* length samplings frequency by year in Morocco.

Sampling results in Spain. Updating of the sampling database and methodology used.

The Spanish IEO length sampling protocol was outlined. The sampling unit is the commercial categories. The samplings of the different categories are done randomly, two times per month. Since 1997, ad-hoc monthly length samplings from the different commercial sizes are performed to estimate the length distribution of landings (2 per month) in the most important fishing ports (Algeciras, Tarifa and Conil). Previous length distributions (1983-1996) were estimated by raising categorized length distribution to landings by commercial size. In 1989 there was a change in the classification of commercial categories, so samplings from 1983 to 1989 should be taken into account only as a proxy. Table 4 presents the length sampling frequency in Spain by year since 2001. Data between 1997 and 2000 were not available at this meeting. Since 2009, biological samples are not available due to financial problems.

Year	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Total fish measured	7000	8390	6594	6530	6564	6722	6452	6669	5777	5652	6713
N° of samplings	10	24	19	19	19	19	19	31	18	18	18

Table 4. *Pagellus bogaraveo* length samplings frequency by year in Spain.

Needs and possibilities to the standardization of biological and statistical sampling protocols in Morocco and Spain.

The WG discussed on the problems to standardize the sampling protocols in Morocco and Spain. The sampling unit in Morocco is the vessel whereas in Spain, is the commercial category. A document⁶ dealing with the problems of the change of the commercial categories during the commercialization was presented. The WG agreed that this issue should not become a problem as the samples are taken before the classification by commercial categories in Morocco. In Spain, all commercial categories are sampled at the fishing port.

⁶ CopeMed 2012. Revision of the commercial categories of Blackspot seabream (*Pagellus bogaraveo*) used in Morocco and Spain and possible effects on the evaluation of the stock of the Gibraltar Strait area. Discussion paper for the meeting of the WG between Morocco and Spain to evaluate the stocks to be held in Tangier (19-21 March; Morocco). GCP/INT/028/SPA-GCP/INT/006/EC. CopeMed II Occasional Paper N° 11: 9 pp.

The WG discussed on the best protocol to conduct the sampling process, the vessel or the commercial category, recognizing the difficulties to standardize the length samplings protocols as the commercial categories of blackspot seabream catch data in Morocco were not available. These data were necessary to raise the samplings based on the commercial categories to the total categories catches. The WG then recommended executing a joint study to evaluate which of both sampling methods is statistically more robust before taking a final decision.

Since March 2012, Morocco has started the process to change the length sampling measures from the fork length to the total length.

There is a big concern for the WG as, at present, there is not available biological sampling for this resource in Spain and Morocco.

2. Pagellus bogaraveo joint Morocco and Spain stock assessment

Advances in the stock assessment already done for P. bogaraveo and in the stock assessment alternatives based on the previous discussed existing information in each country.

The WGs revised the assessments presented in the ICES and GFCM-SAC meetings in 2010. The ICES assessment was based on the Virtual Population Analysis (VPA) and was carried out with the Lowestoft Suit software (Darby and Flatman, 1994). This assessment was made with the Div IXa Spanish and Portuguese catch data. This analytical assessment has the disadvantage of using a single (combined) age-length key (ALK) for all series analyzed. Hence, a constant growth is assumed for the whole period, thus producing not realistic or appropriate results. The WG decided not to update this assessment because of the exposed reason and the lack of biological and tuned data for the last few years.

The 2010 GFCM-SAC assessment was based on a Length-Cohort Analysis (LCA) and was carried out with the VIT software (Lleonart and Salat, 1992). Moroccan and Spanish length distributions in 2005-2007 were used and the biological parameters were obtained from the Spanish information.

The WG decided to update the LCA assessment with the Moroccan and Spanish length frequencies (2009-2011) using the VIT software. The biological parameters were the same used in the 2010 assessment (Gil, 2006) because there was no new information available for these data. The WG agreed to run an assessment using the Depletion-Corrected Average Catch (DCAC).

Data preparation for the P. bogaraveo joint assessment exercise. The WG agreed on creating a database with all the available Moroccan and Spanish assessment data, with information on total catches, length distribution and effort by country.

Assessment methodologies and ad-hoc software. The WG decided to update the LCA assessment with the Moroccan and Spanish length frequencies data (2009-2011) using the VIT software and agreed to run a Yield Per Recruit (YPR) analysis (Beverton and Hold, 1957) and a Spawning Stock Biomass per Recruit analysis (Gabriel et al, 1989) to calculate the biological reference points F_{max} , $F_{0.1}$ and $F_{40\%}$ with the output results of the VIT.

Selection of biological data and parameters. The WG updated the LCA assessment with the Tangier (Morocco) and the Spanish total length frequencies (2009-2011) to make a pseudo-cohort (Annex I). The biological parameters were the same used in the 2010 assessment because there is not new biological information available. The values of the

parameters used for the length-weight relationship and the von Bertalanffy growth function are presented in Table 5.

Length-weight relationship		von Bertalanffy	
a	0.014	K	0.162 year ⁻¹
b	3.014	Linf	62 cm
		t ₀	-0.34

Table 5. Parameters values used in the assessment.

Female L₅₀ maturity was assumed = 35.73 cm. This value comes from fitting the observed values to a logistic function. The values of the parameters of the logistic function were the following (Table 6):

Parameter	Value
a	-14.47
b	0.40
R square	0.82

Table 6. Parameters values of the logistic function fitted to the observed maturity data and the R².

Natural mortality was assumed constant for all ages, length classes and years. The value assumed in this assessment was 0.2. Three different values for the terminal fishing mortality in the VIT program were tried: 0.3, 0.5 and 0.8. The DCAC was run for the catches from 1983 to 2011 (Annex I). The values of the parameters being used and their variability are presented in Table 7.

	Value	Distribution	STD Deviation
Natural Mortality	0.2	Lognormal	0.5
FMSY to M	0.8	Lognormal	0.2
Depletion Delta	0.47	Lognormal	0.3
BMSY / B0	0.4	Beta	0.1

Table 7. Parameters values used in the DCAC model and their assumed variability distribution.

The input values used in the YPR and SSB/R analysis for the exploitation pattern were obtained from the VIT results (Table 8):

Age	Select. F	Select. M	Stock Weight	Catch Weight	SSB Weight	Maturity
1	0.002	1	0.175	0.175	0.175	0.010
2	0.160	1	0.345	0.345	0.345	0.044
3	0.610	1	0.553	0.553	0.553	0.228
4	0.548	1	0.794	0.794	0.794	0.612
5	0.346	1	1.048	1.048	1.048	0.869
6	0.278	1	1.301	1.301	1.301	0.958
7	0.370	1	1.544	1.544	1.544	0.981
8	0.480	1	1.773	1.773	1.773	0.992
9	1.000	1	1.979	1.979	1.979	1.000

Table 8. F and M selectivity, stock, catch and Spawning Stock Biomass (SSB) weights in kg and maturity proportion.

Assessment exercise. Main results, conclusions and recommendations. With the available data, the WG tried different assessment models. The first one was an update of assessment

made in 2010 with the VIT model. The analytical assessment exercise was carried out using pseudo-cohorts (2009-2011) with the VIT software.

LCA and VPA were performed in a first step for all size length composition Figure 4 presents the F values obtained by length classes. Taking into account the anomalous F variation obtained in the older length classes and the small number of fish in these classes, the WG decided to make a plus group from the size class = 50 cm.

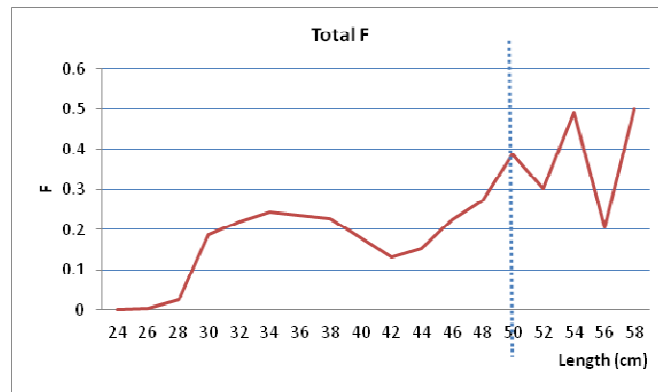


Figure 4. VIT results for total F, by length classes.

After this first step, the WG carry out the analysis using three different terminal F values: 0.3, 0.5 and 0.8. To point out that ages are relative to the first length of the analyses, Figure 5 shows the results for F, by age and length classes, of the three different terminal F.

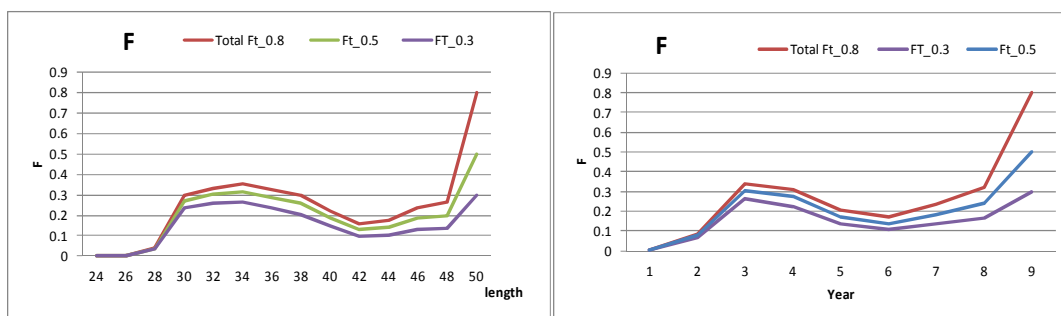


Figure 5. VIT results for F by length classes and age for three different levels of terminal F (0.3, 0.5 and 0.8).

F values for the older ages and length groups are more stable and the F values for most important lengths (30-45) and ages (3-7) present in the catches are quite similar and independent of the terminal F assumed. The VIT estimates of fishing mortality by age and the fishing mortalities averaged over the ages 2-6 (F_{bar}) are listed in Table 9.

Class age	Ft_0.8	Ft_0.5	FT_0.3
1	0.001	0.001	0.001
2	0.086	0.08	0.07
3	0.336	0.305	0.262
4	0.312	0.274	0.225
5	0.204	0.173	0.136
6	0.169	0.139	0.105
7	0.234	0.185	0.135
8	0.322	0.24	0.164
9	0.8	0.5	0.3
	Fbar2-6		
	Ft_0.8	Ft_0.5	FT_0.3
	0.2214	0.1942	0.1596

Table 9. VIT estimates of fishing mortality (F) by age and the fishing mortalities averaged over the ages 2-6 (Fbar) for the three different levels of terminal F (0.3, 0.5, 0.8).

The group take the VIT results for the terminal $F = 0.5$ as the best to try an YPR calculation with the NOAA software. The inputs for YPR analysis are in Table 8. In the Spawning Stock Biomass per Recruit (SSB/R) analysis, the WG used, as biological reference point, 40% of the virgin SSB base on studies made by Mace and Sissenwine (1993). The results of this study showed that this level of virgin SSB appears to be precautionary and sustainable and can be used as F_{msy} proxy for most of the demersal species analyzed.

Results of the YPR and SSB/R analyses are showed in Figure 6 and Table 10. These results displayed that the YPR curve shape is quite flat on its maximum. The main problem of the flat top curves is related with the undefined F_{max} value. Big F range gives similar yield per recruit as the maximum and small uncertainty in F_{max} estimation can cause big problems. This is not currently considered precautionary because if the fishing effort increases, the Y/R curve does not show any increase, while the SSB/R curve shows a big decrease. The proposed proxy value for F_{msy} in these cases is $F_{0.1}$. For the SSB/R analysis, $F_{40\%SSB}$ is usually adopted as F_{msy} proxy in demersal species like the blackspot seabream.

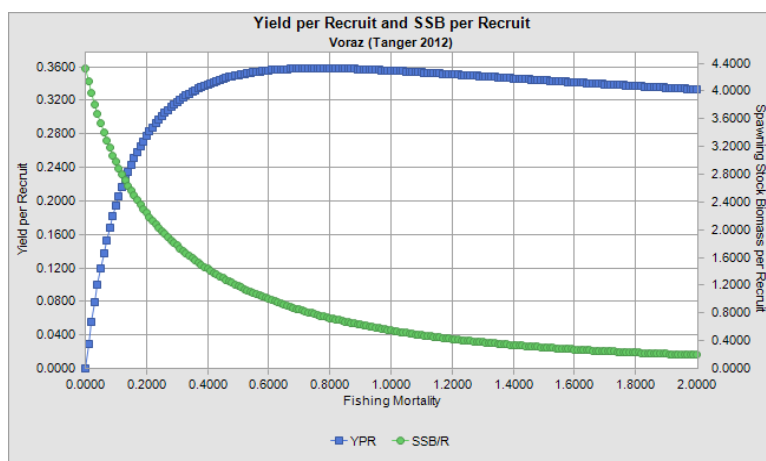


Figure 6. Yield Per Recruit (YPR) and Spawning Stock Biomass per Recruit (SSB/R) by F values refers to F at age 9.

Reference Point	F	YPR	SSB/R
F Zero	0	0	4.32697
F-0.1	0.2903	0.315	1.80879
F-Max	0.7608	0.35819	0.77204
F at 40 %MSP	0.3102	0.32073	1.73116

Table 10. Fishing mortality Biological References Points values and their Yield Per Recruit (YPR) and Spawning Stock Biomass per Recruit (SSB/R).

DCAC model was run with the parameter values presented in Table 11 and the catch in the period 1983-2011. The parameter values were chosen based on the values proposed by MacCall (2009). Depletion Delta value was estimated based on the 2010 VPA results. The WG considered that the *P. bogaraveo* fishery started in 1983 and that, at this moment, there was the virgin biomass level. The actual biomass level in percentage of the virgin biomass was considered that was equivalent to the 2010 VPA results. Maximum Sustainable Yield (MSY) and percentiles estimated by the DCAC are in Table 11.

	5%	median	95%
MSY (ton)	198	329	474

Table 11. Maximum Sustainable Yield (MSY) and 10% percentile estimated by the DCAC.

Fbar for ages from 2 to 6 was calculated for all conducted models to compare the results among them. Yields for the different F Biological Reference Points were calculated based on the mean recruitment estimated by the VIT (1.500.764 recruits). Results of F and catches based on the mean recruitment are presented in the Table 12.

Age	Mean F 2009- 2011	F-01	F-Max	F at 40 %MSP	DCAC
1	0.001	0.001	0.002	0.001	
2	0.080	0.046	0.122	0.050	
3	0.305	0.177	0.464	0.189	
4	0.274	0.159	0.417	0.170	
5	0.173	0.100	0.263	0.107	
6	0.139	0.081	0.212	0.086	
7	0.185	0.107	0.281	0.115	
8	0.240	0.139	0.365	0.149	
9	0.500	0.290	0.761	0.310	
Fbar (2-6)	0.194	0.113	0.295	0.120	
Catches (tons)	411	473	538	481	331

Table 12. Exploitation pattern, mean F for 2 to 6 ages (Fbar 2-6), estimated catches based on the mean recruitment calculated by VIT for F (2009-2011), F Reference Points (F_{max} , $F_{0.1}$, $F_{40\%}$), and MSY estimated by the DCAC model.

The mean catches in the 2009-2011 period was 543 tons. This catch level is greater than the MSY calculated by the DCAC (331 tons) and the estimated catches for the $F_{0.1}$ (473

tons) or $F_{40\%}$ (481 tons), considered by the WG as the best proxies for F_{msy} . The WG pointed out that the three catch values were estimated with different methods and assumptions. The differences between the DCAC and the VIT catch estimation could be related, among others, to the equilibrium assumption made in the VIT model.

The actual level of fishing mortality ($F_{bar} = 0.19$) is higher than the values calculated for the F_{msy} proxies ($F_{0.1}$ or $F_{40\%} = 0.12$). Based on these results, the WG recommended that the actual effort level should be reduced to set the fishing mortality level to a more sustainable value.

Management Plans: situation of the recovery plans in which P. bogaraveo is included. . The main features of the current plan were presented in item 2.1.1. In the last years the catches exceeded the TACs included in the old fishing plans. For 2011-2012, in the Atlantic area, a minimum landing size of 35 cm (total length) shall be respected. However, 15 % of landings may have a total length minimum landing size of 30 cm (EU Regulation 1225/2010).

Spanish regulation in the Mediterranean Sea: the minimum size of the blackspot seabream specimens caught in the regulated area shall not be less than 33 cm in length or 350 gr. In any case, all the provisions of Council Regulation (EC) No 1967/2006 of 21 December 2006, concerning management measures for the sustainable exploitation of fishery resources in the Mediterranean Sea, and the Spanish Royal Decree 560/1995 of 7 April 1995 compels to fulfill the previous regulations. Blackspot seabream undersized cannot be retained on board, transshipped, landed, downloaded or deposit but to be returned to sea immediately after capture.

In Morocco there is not a specific management plan for *P. bogaraveo*. There are only general measures for the different fisheries carried out in the Strait of Gibraltar area. The unique direct measure for this species is the minimum landing size of 25 cm fork length, equivalent to 28 cm total length. This minimum landing size is inferior to the measure set by Spain.

3. Compilation of conclusions and recommendations

The main WGPB results, conclusions and recommendations were the following:

- The WG recommended carrying out a joint study to establish the *P. bogaraveo* stock structure in the ICES area IXa and in the GFCM Alboran Sea (GSAs 01 and 03) areas to delimit the stock area and to determine the management area.
- The Moroccan sample unit is the vessel whereas in the Spanish case is the commercial category. The WG recommended performing a study to evaluate which of both sampling methods is statistically better before choosing one of them.
- Considering the current level of data collection in both countries, the WG recommended carrying out joint activities to compile new suitable data for future joint stock assessments and the convenience of harmonizing the working methods and the biology studies on *P. bogaraveo* between the INRH and IEO experts.
- The WG decided to create a database with the available Moroccan and Spanish assessment data. All data used in the different assessments made during this WG were stored in this database.

- The actual level of fishing mortality ($F_{bar} = 0.19$) is higher than the values calculated for the F_{msy} proxies ($F_{0.1}$ or $F_{40\%} = 0.12$). Based on these results, the WG recommended that the actual effort level should be reduced to set the fishing mortality level to a more sustainable value.
- The WG recommended analyzing new alternative assessment methods for the blackspot seabream in the Strait of Gibraltar area such as non equilibrium production models, using available catch and effort data for this species, to compare the results with the assessment methods currently used
- The WG recommended installing green boxes (Track System for Andalusian Fishing Vessels, SLSEPA) in the most important Moroccan fleets targeting blackspot seabream. As a pilot experience the WG proposed to install the green boxes in the longline and artisanal Tangier fleet and in the artisanal Ksar Sghir fleet.
- The WG recommended rationalizing the management of this resource by establishing the same or similar management measures in both countries.

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Annex I: Catches, length and weight data used in the assessment.

Year/Port	Spain			Morocco		Total
	Tarifa	Algeciras	Conil	Tanger	Other Artisanal Ports	
1983	101					101
1984	166					166
1985	196					196
1986	225					225
1987	296					296
1988	319					319
1989	416					416
1990	428					428
1991	423					423
1992	631					631
1993	765					765
1994	854					854
1995	501	124				625
1996	659	110				769
1997	528	280				808
1998	280	239				519
1999	196	82				278
2000	193	111				305
2001	151	69		18		238
2002	147	19	26	35		227
2003	179	33	65	23		299
2004	187	54	38	33		312
2005	261	69	80	39		448
2006	273	73	32	74		453
2007	284	78	31	89		482
2008	291	125	19	76		511
2009	432	147	13	98		690
2010	232	134	13	105	41	525
2011	182	58	18	136	18	412

Table 1. Strait of Gibraltar area blackspot seabream total catches by country and fishing port for the period 1983-2011.

Stock	Spain-Morocco			Pseudocohort 2009/2011
length(2 cm)	2009	2010	2011	2009-2011
24	897	0	4633	1843
26	4869	637	1512	2339
28	12462	14893	25857	17737
30	113299	124213	110378	115963
32	138651	111084	90424	113386
34	116289	117377	70686	101451
36	100307	84240	50590	78379
38	81125	64146	34038	59770
40	51467	29012	32624	37701
42	37811	18277	13086	23058
44	34695	18749	13328	22257
46	39201	20060	16067	25109
48	33785	18654	13031	21823
50	29362	16212	11754	37528 Plus group
52	12549	5016	8608	
54	6697	3428	11714	
56	1983	468	1671	
58	111	149	175	
tonnes	690.4	484.1	394.3	522.9

Table 2. Blackspot seabream total length distribution (Spain and Morocco) for the period 2009-2011 in the Strait of Gibraltar area and 2009-2011 pseudo-cohort used in the VIT run.

Age class	Numbers
1	1728.23
2	94240.68
3	245483.03
4	135039.85
5	55593.07
6	31221.75
7	28986.79
8	24887.95
9	29725.37

Table 3. Pseudo cohort age distributions estimated by slicing (VIT) for the Strait of Gibraltar area.

Age class	Mean Weight	Maturity ratio	M
1	174.789	0.01	0.2
2	344.701	0.04418281	0.2
3	554.02	0.2283845	0.2
4	794.403	0.6123623	0.2
5	1048.463	0.8692113	0.2
6	1301.563	0.9575464	0.2
7	1544.944	0.9812083	0.2
8	1774.509	0.9918991	0.2
9	1983.601	1	0.2

Table 4. Mean weights (gr), maturity ratio a natural mortality by age used in the assessment.