Stock Assessment Form

Demersal species

2012

For the updating of hake stock status in GSA 18 different methods and different sources of data (fishery dependent and fishery independent) have been used. Given the results from this analysis, based on the whole information from the area, the stock is in overfishing (F0.1=0.21; Fcurrent=0.92) and it is necessary to consider that a remarkable reduction of the fishing mortality is necessary. The reference point F0.1 can be gradually achieved by multiannual management plans.

Likewise the outcomes in 2011, the fishing mortality from the Italian bottom trawlers represents about 80% of the total F in the GSA and that of the Italian long-lines is accounting for about 9.5%, with an overall percentage of about 90%, while Montenegrin trawlers account only for about 1% of the F exerted on the GSA and Albanian trawlers of about 9.7%. Moreover, the production of hake in GSA 18 is split in 12.5% caught by Italian long-lines, 77.2% by Italian trawlers, about 1% by Montenegrin trawlers and about 9.4% by Albania trawlers.

Stock Assessment Form version 0.9

Uploader: Miguel Bernal

Stock assessment form

1 Basic Identification Data

Scientific name:	Common name:	ISCAAP Group:
Merluccius merluccius	European hake	32
1st Geographical sub-area:	**2nd Geographical sub-area:**	**3rd Geographical sub-area:**
GSA18	—	—
1st Country	**2nd Country**	**3rd Country**
Italy	Montenegro	Albania
Stock assessment method: (direct, indirect, combined, none)		
COMBINED (Trawl survey, SURBA, ALADYM, Y/R, LCA)		
Authors:		
Spedicato M.T.[1], Bitetto I.[1], Lembo G.[1], Carbonara P.[1], Casciaro L.[1], Facchini M.T.[1], Milone N.[2], Ceriola L.[2], Joksimovic A.[3], Ikica Z.[3], Markovic O.[3], Djurovic M.[3], Kolitari J.[4], Gjurgji I.[4], Kroqi G.[4]		
Affiliation:		
[1] COISPA Tecnologia & Ricerca, Bari – Italy; [2] AdriaMed; [3] Institute of Marine Biology Kotor – Montenegro; [4] University of Tirana – Albania		

The ISSCAAP code is assigned according to the FAO 'International Standard Statistical Classification for Aquatic Animals and Plants' (ISSCAAP) which divides commercial species into 50 groups on the basis of their taxonomic, ecological and economic characteristics. This can be provided by the GFCM secretariat if needed. A list of groups can be found here:

http://www.fao.org/fishery/collection/asfis/en

Direct methods (you can choose more than one):

- Acoustics survey
- Egg production survey
- Trawl survey

Trawl survey time series, SURBA

- ICA
- VPA
- LCA
- AMCI
- XSA
- Biomass models
- Length based models
- Other (please specify)

LCA and Y/R (VIT)

Combined method: you can choose both a direct and an indirect method and the name of the combined method (if it does exist)

2 Stock identification and biological information

The stock of European hake was assumed in the boundaries of the whole GSA 18 where it inhabits depths from several meters in the coastal area down to 800 m in the South Adriatic Pit. However the species is most abundant at depths between 100 and 200 m, where the catches are mainly composed of juveniles. In the southern Adriatic the largest individuals are caught in waters deeper than 200 m, whereas medium-sized fish appear in the waters not deeper than 100 m.

2.1 Stock unit

2.2 Growth and maturity

Incorporate different tables if there are different maturity ogives (e.g. catch and survey). Also incorporate figures with the ogives if appropriate. Modify the table caption to identify the origin of the data (catches, survey).

Table 2.2-1:Maximum size, size at first maturity and size at recruitment.

Somatic magnitude measured (LH, LC, etc)*			Lt		**Units***	cm
Sex	**Fem**	**Mal**	**Both**	**Unsexed**		
Maximum size observed			93		**Reproduction season**	All year (late spring and winter peaks)
Size at first maturity			33.4		**Reproduction areas**	
Recruitment size			~6		**Nursery areas**	Continental shelf

Table 2.2-2: Growth and length weight model parameters

			Sex			
		Units	**female**	**male**	**both**	**unsexed**
Growth model	**L_∞**	cm			104	
	K	$Year^{-1}$			0.2	
	t_0	Year			-0.01	
	Data source					
Length weight relationship	**a**	Cm; g			0.0043	
	b	Cm; g			3.155	

M* (vector by length or age)	0	1	2	3	4+
	1.16	0.53	0.40	0.35	0.32

sex ratio (% females/total)	

* PRODBIOM, 1999. Abella A., Caddy J.F., Serena F.

3 Fisheries information

3.1 Description of the fleet

The fleet data are referred to the whole GSA and are from the GFCM Statistical Bulletin 2008. Catch data in the table 3.1.2 below reported are referred to the year 2011 (DCF data for Italy, and data from ADRIAMED pilot study and National Statistics for Albania and Montenegro). The operational units ITA18E0333-DPS, ITA18F0333-DPS, ALB 18 E 03 33-DPS and ALB 18 F 03 33-DPS include also demersal slope fishing (mixed demersal according to DCF classification).

The catch data from the whole GSA18 including the east side are below reported:

Table 3.1-1: Description of operational units in the stock

	Country	GSA	Fleet Segment	Fishing Gear Class	Group of Target Species	Species
Operational Unit 1*	ITA	18	C - Minor gear with engine (6-12 metres)	07 - Gillnets and Entangling Nets	33 - Demersal shelf species	HKE
Operational Unit 2	ITA	18	E - Trawl (12-24 metres)	03 - Trawls	33 - Demersal shelf species	HKE
Operational Unit 3	ITA	18	I - Long line (12-24 metres)	09 - Hooks and Lines	33 - Demersal shelf species	HKE
Operational Unit 4	ITA	18	D - Trawl (6-12 metres)	03 - Trawls	33 - Demersal shelf species	HKE
Operational Unit 5	ITA	18	F - Trawl (>24 metres)	03 - Trawls	33 - Demersal shelf species	HKE
Operational Unit 6	MNE	18	E – Trawl (12-24 metres)	03 – Trawls	33 - Demersal shelf species	HKE
Operational Unit 7	ALB	18	D - Trawl (<12 metres)	03 – Trawls	33 - Demersal shelf species	HKE
Operational Unit 8	ALB	18	E - Trawl (12-24 metres)	03 – Trawls	33 - Demersal shelf species	HKE
Operational Unit 9	ALB	18	F - Trawl (>24 metres)	03 – Trawls	33 - Demersal shelf species	HKE

* Data are based on the 2008 GFCM Task 1 Statistical Bulletin

Table 3.1-2: Catch, bycatch, discards and effort by operational unit

Operational Units*	Fleet (n° of boats)*	Kilos or Tons	Catch (species assessed)	Other species caught	Discards (species assessed)	Discards (other species caught)	Effort units
ITA 18 C 07 33 - HKE	839	Tons					
ITA 18 E 03 33 - HKE	579	Tons					
ITA 18 I 09 33 - HKE	37	Tons					
ITA 18 D 03 33 - HKE	40	Tons					
ITA 18 F 03 33 - HKE	61	Tons					
MNE 18 E 03 33 - HKE	15	Tons					
ALB 18 D 03 33 - HKE	5	Tons					
ALB 18 E 03 33 - HKE	144	Tons					
ALB 18 F 03 33 - HKE	39	Tons					
Total	1556						

Table 3.1-3: Catches as used in the assessment

Classification	Catch (tn)
OTB (ITA, MNE, ALB) + LLS (ITA)	
2008	4639
2009	4580
2010	4390
2011	4231

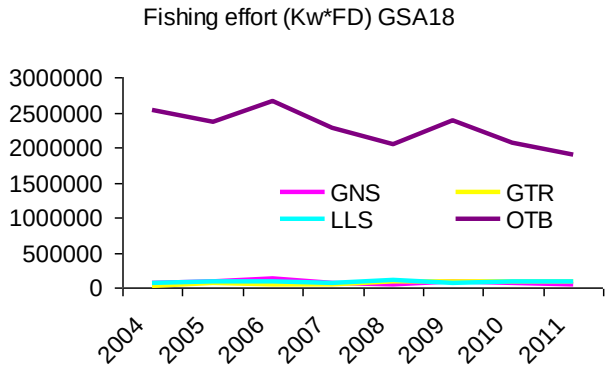
Total	

3.2 Historical trends

Time series of landing data from the whole GSA is short (see the table below). The production in 2011 is lower than in the other years if the whole GSA is considered (weight in tons).

Year	Italy-LLS	Italy-OTB	Montenegro	Albania	Total Landings
2008	550	3640	59	390	4639
2009	532	3540	52	456	4580
2010	597	3372	46	375	4390
2011	534	3285	37	402	4258

Also the fishing effort of the western side, that is the major component of fishing effort in the area, is decreasing.



Fishing effort is from the west side

3.3 Management regulations

In Italy management regulations are based on technical measures, closed number of fishing licenses for the fleet and area limitation (distance from the coast and depth). In order to limit the over-capacity of fishing fleet, the Italian fishing licenses have been fixed since the late eighties and the fishing capacity has been gradually reduced. Other measures on which the management regulations are based regards technical measures (mesh size), minimum landing sizes (EC 1967/06) and seasonal fishing ban, that in southern Adriatic has been mandatory since the late eighties. Regarding long-lines the management regulations are based on technical measures related to the number of hooks and the minimum landing sizes (EC 1967/06), besides the regulated number of fishing licences. Regarding small scale fishery management regulations are based on technical measures related to the height and length of the gears as well as the mesh size opening, minimum landing sizes and number of fishing licenses for the fleet.In 2008 a management plan was adopted, that foresaw the reduction of fleet capacity associated with a reduction of the time at sea. Two biological conservation zone (ZTB) were permanently established in 2009 (Decree of Ministry of Agriculture, Food and Forestry Policy of 22.01.2009; GU n. 37 of 14.02.2009) along the mainland, offshore Bari (180 km2, between about 100 and 180 m depth), and in the vicinity of Tremiti Islands (115 km2 along the bathymetry of 100 m) on the northern border of the GSA where a marine

protected area (MPA) had been established in 1989. In the former only the professional small scale fishery using fixed nets and long-lines is allowed, from January 1st to June 30, while in the latter the trawling fishery is allowed from November 1st to March 31 and the small scale fishery all year round. Recreational fishery using no more than 5 hooks is allowed in both the areas. Since June 2010 the rules implemented in the EU regulation (EC 1967/06) regarding the cod-end mesh size and the operative distance of fishing from the coasts are enforced.

In Montenegro, management regulations are based on technical regulations, such as mesh size (Official Gazette of Montenegro, 8/2011), including the minimum landing sizes (Official Gazette of Montenegro, 8/2011), and a regulated number of fishing licenses and area limitation (no–fishing zone up to 3 NM from the coastline or 8 NM for trawlers of 24+ m LOA). Currently there are no MPAa or fishing bans in Montenegrin waters.

In Albania, a new law "On fishery" has now been approved, repealing the Law n. 7908. The new law is based on the main principles of the CFP, it reflects Reg. 1224/2009 CE ; Reg.1005/2008 CE; Reg. 2371/2002 CE; Reg. 1198/2006 CE; Reg. 1967/2006 CE; Reg. 104/2000; Reg. 1543/2000 as well as the GFCM recommendations. The legal regime governing access to marine resources is being regulated by a licensing system. Regarding conservation and management measures, minimum legal sizes and minimum mesh sizes is those reflected in the CE Regulations. Albania has already an operational vessel register system. It is forbidden to trawl at less than 3 nautical miles (nm) from the coast or inside the 50m isobath when this distance is reached at a smaller distance from the shore.

3.4 Reference points

Table 3.4-1: List of reference points

Criterion	Current value	Units	Reference Point	Trend	Comments
B	31.59	g			
SSB	19.34	g			
F	0.92		0.21		Fcurrent in 2011 is slightly lower than in the previous three years, but the time series is short
Y	29.08	g			
CPUE					

4 Fisheries independent information

4.1 {NAME OF THE DIRECT METHOD}

Fill in one section for each of the direct methods used. The name of the section should be the name of the direct method used.

4.1.1 Brief description of the chosen method and assumptions used

Description of the method and assumptions used. One of several tables would have to be chosen: Egg Production Method, Acoustic survey, Trawl.

Direct methods: trawl based abundance indices

Table 4.1-1: Trawl survey basic information

Survey	MEDITS	**Species**	HKE	**Trawler/OV**	
Sampling season	summer				
Sampling design	Stratified sampling design with the number of hauls proportional to the strata surface				
Sampler (gear used)	GOC73				
Cod –end mesh size as opening in mm	20 mm				
Investigated depth range (m)	10-800 m				

Table 4.1-2: Trawl survey sampling area and number of hauls

Stratum	**Total surface (km^2)**	**Trawlable surface (km^2)**	**Swept area (km2)**	**Number of hauls**
10-50	3430			12
51-100	6435			20
101-200	9664			31
201-500	4761			13
501-800	4718			14
Total (10 – 800 m)	29008			90

Table 4.1-3: Trawl survey abundance and biomass results

Stratum	**Years**	**kg per km^2**	**CV or other**	**Relative * biomass** **All age groups**	**CV or other**	**N per km^2**	**CV or other**	**Relative * abundance** **All age groups**	**CV or other**
	……								
	……								
	……								
	……								
	……								
Total (… – … m)	……								

* with catchability coefficient assumed =1

Comments

- Specify the other index of variability of mean
- Specify sampling design (for example random stratified with number of haul by stratum proportional to stratum surface; or systematic on transect;…)

Direct methods: trawl based length/age structure of population at sea

Table 4.1-4: Trawl survey slicing method

Survey		**Species**		**Trawler/RV**	
Total area (km^2)					
Age slicing method					
Maturity scales (females and males)					

Table 4.1-5: Trawl survey results by length or age class

N (Total or sex combined) by Length or age class	**Year**			
	2008	**2009**	**2010**	**2011**
Total				

Comments

- Specify if numbers are per km^2 or raised to the area, assuming the same catchability .
- Specify the ageing method or the age slicing procedure applied, specify the maturity scale used.
- In case maturity ogive has not been estimated by year, report information for groups of years.
- Possibility to insert graphs and trends

Direct methods: Trawl based mortality rates

Table 4.1-6: Trawl survey methods for the estimation of mortality rates

Survey		**Species**		**Trawler/RV**	
Z estimation	Report formula, or method and/or reference				
F estimation	Report formula, or method and reference				
M estimation	Report value (if scalar), formula, or method and reference				

Note: In case of average mortalities specify the age class, specify the age class included

Table 4.1-7: Trawl survey; method for natural mortality estimates

M by age per Survey	**Report formula, or method and reference**				
Year	**Age 0**	**Age 1**	**Age 2**	**Age 3**	**Age 4+**
1996	0.87974	1.64061	0.95194	0.99069	0.99069
1997	0.85317	1.59107	0.9232	0.96077	0.96077
1998	0.92761	1.72988	1.00374	1.04459	1.04459
1999	0.7667	1.4298	0.82962	0.86339	0.86339
2000	0.7171	1.3373	0.77595	0.80754	0.80754
2001	0.82291	1.53462	0.89044	0.92669	0.92669
2002	0.72271	1.34776	0.78202	0.81385	0.81385
2003	0.81442	1.51879	0.88126	0.91713	0.91713
2004	0.69783	1.30137	0.7551	0.78584	0.78584
2005	0.81381	1.51766	0.8806	0.91645	0.91645
2006	1.065	1.9861	1.15241	1.19932	1.19932
2007	0.67885	1.26598	0.73457	0.76447	0.76447

2008	0.72334	1.34894	0.7827	0.81456	0.81456
2009	0.90767	1.69269	0.98216	1.02214	1.02214
2010	1.22805	2.29017	1.32884	1.38293	1.38293

Table 4.1-8: Trawl surveys; total mortality estimate

Years	Total mortality rates (Z)	Years	Total mortality rates (Z)	years	Total mortality rates (Z)
Year					

Table 4.1-9: Trawl surveys; fishing mortality estimates

Years	Fishing mortality rates (F)	Survey	Fishing mortality rates (F)	Survey	Fishing mortality rates (F)
Year					

Table 4.1-10: Trawl surveys; total mortality estimates by age

Z by age per Survey	Age 0	Age 1	Age 2	Age 3	etc
year					

Table 4.1-11: Trawl surveys; fishing mortality estimates by age

F by age per Survey	Age 0	Age 1	Age 2	Age 3	etc
year					

Direct methods: trawl based Recruitment analysis

Table 4.1-12: Trawl survsys; recruitment analysis summary

Survey	**MEDITS**	**Species**	**HKE**	**Trawler/RV**	
Survey season		Summer			
Cod –end mesh size as opening in mm		10 mm			
Investigated depth range (m)		10-800 m			
Recruitment season and peak (months)		Winter and late spring			
Age at fishing-grounds recruitment					
Length at fishing-grounds recruitment					

Table 4.1-13: Trawl surveys; recruitment analysis results

Years	**Area in km²**	**N of recruit per km²**	**CV or other**	**Relative recruitment (N of individuals)**	**CV or other**
2011	29000				

Comments

- Specify type of recruitment:
  - continuous and diffuse
  - discrete and diffuse
  - discrete and localised
  - continuous and localised.

- Specify the method used to estimate recruit indices

- Regarding the relative recruitment and the total number of individuals be consistent with the raising procedure adopted in the Sheet TS1

- Specify if the area is the total or the swept one

- Possibility to insert graphs and trends

Direct methods: trawl based Spawner analysis

Table 4.1-14: Trawl surveys; spawners analysis summary

Survey	**MEDITS**	**Species**	**HKE**	**Trawler/RV**	
Survey season			Summer		
Investigated depth range (m)			10-800 m		
Spawning season and peak (months)			Summer and winter		

Table 4.1-15: Trawl surveys; spawners analysis results

Surveys	**Area in km²**	**N (N of individuals) of spawners per km²**	**CV or other**	**SSB per km²**	**CV or other**	**Relative SSB**	**CV or other**

Comments

- Specify type of spawner:
  - total spawner
  - sequential spawner
  - presence of spawner aggregations

- Regarding the total number of individuals and biomass be consistent with the raising procedure adopted in the Sheet TS1

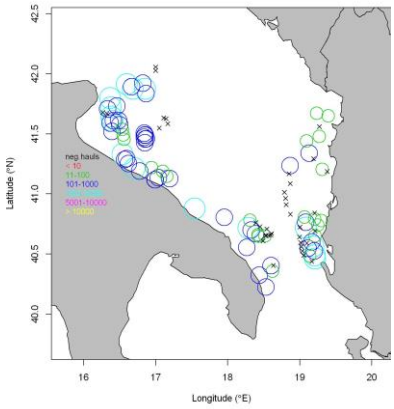
- Specify if the area is the total or the swept one

Possibility to insert graphs e trends

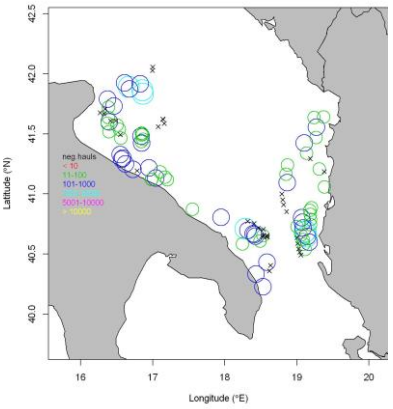
4.1.2 Spatial distribution of the resources

Bubble plots of recruits distribution

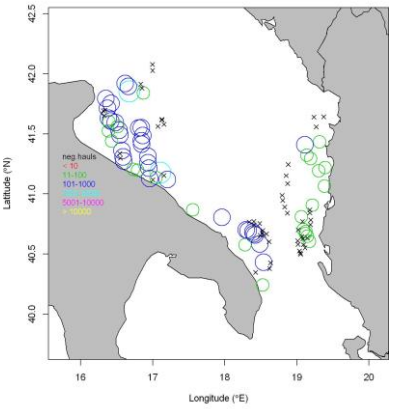
MERL MER - Recruits (N/km2) in GSA 18 - 1996



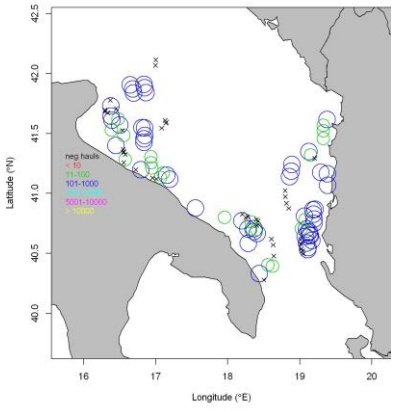
MERL MER - Recruits (N/km2) in GSA 18 - 1997



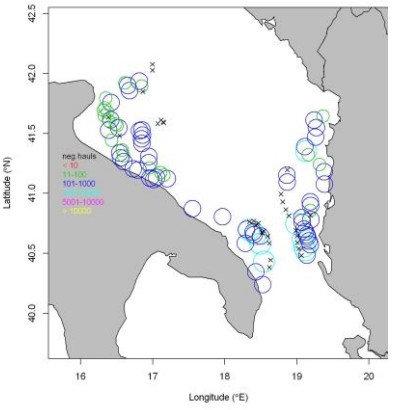
MERL MER - Recruits (N/km2) in GSA 18 - 1998



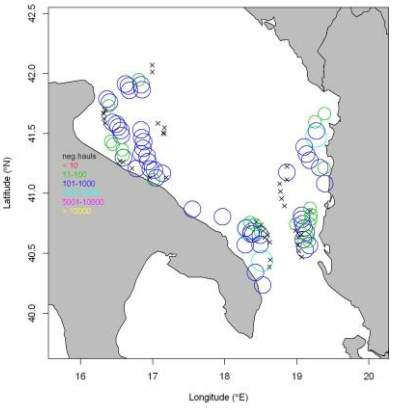
MERL MER - Recruits (N/km2) in GSA 18 - 1999



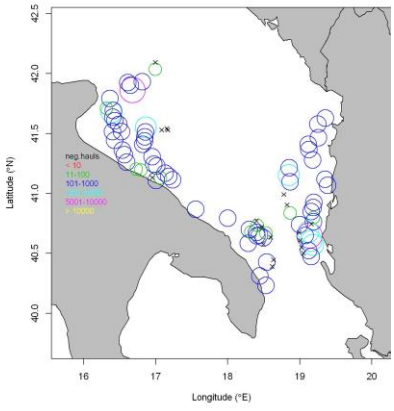
MERL MER - Recruits (N/km2) in GSA 18 - 2000



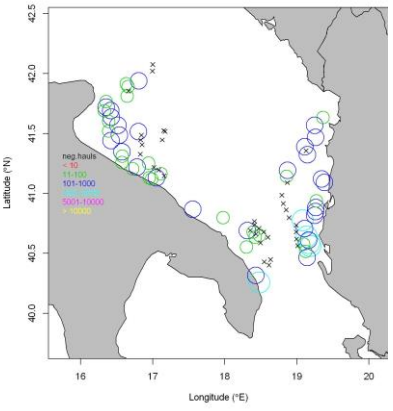
MERL MER - Recruits (N/km2) in GSA 18 - 2001



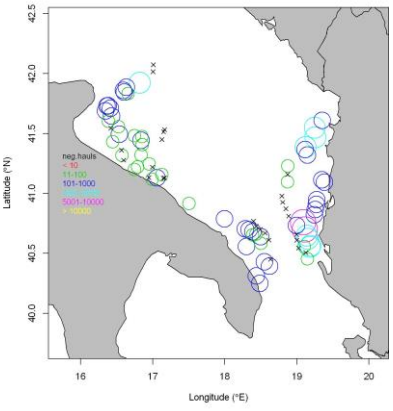
MERL MER - Recruits (N/km2) in GSA 18 - 2002

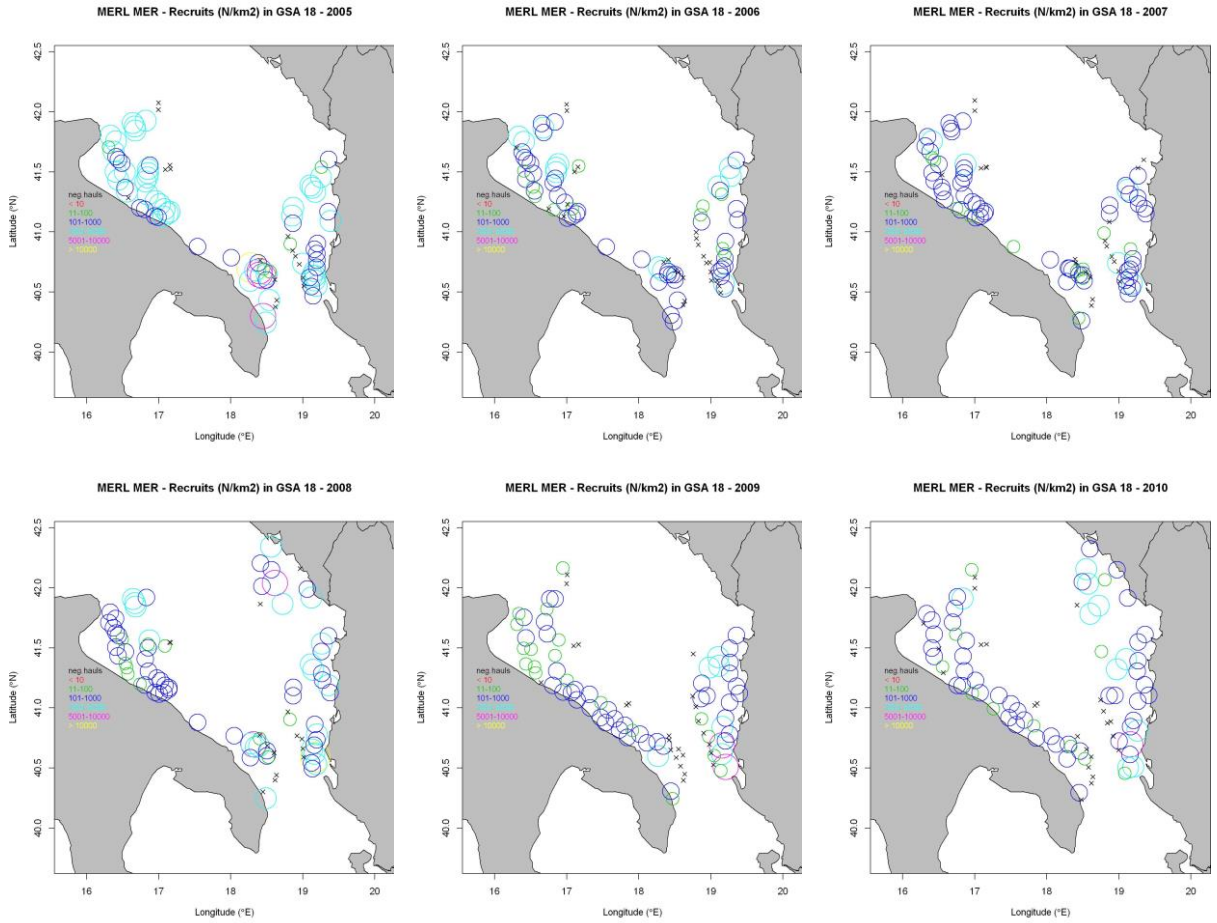


MERL MER - Recruits (N/km2) in GSA 18 - 2003



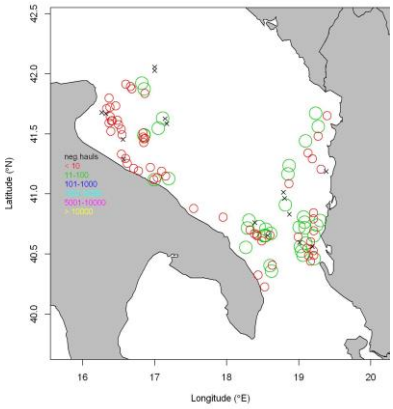
MERL MER - Recruits (N/km2) in GSA 18 - 2004



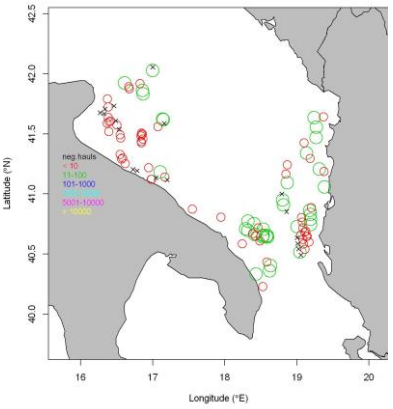


Bubble plots of spawners distribution

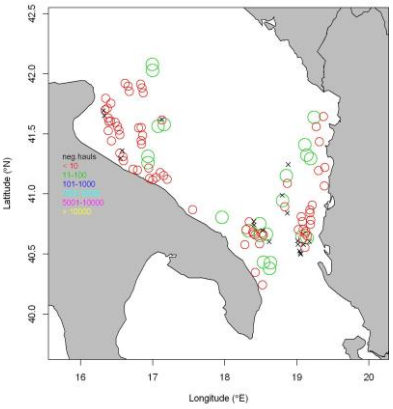
MERL MER - Spawners (N/km2) F - GSA 18 - 1996



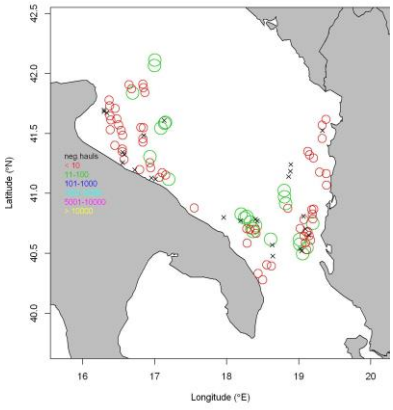
MERL MER - Spawners (N/km2) F - GSA 18 - 1997



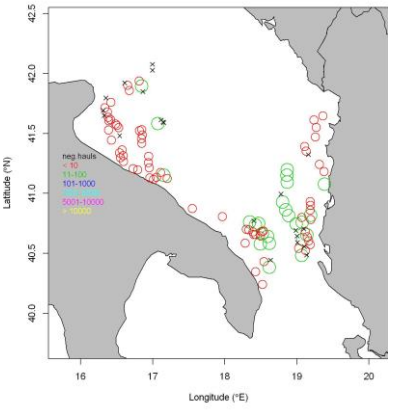
MERL MER - Spawners (N/km2) F - GSA 18 - 1998



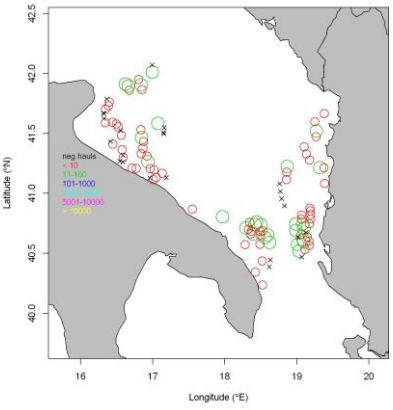
MERL MER - Spawners (N/km2) F - GSA 18 - 1999



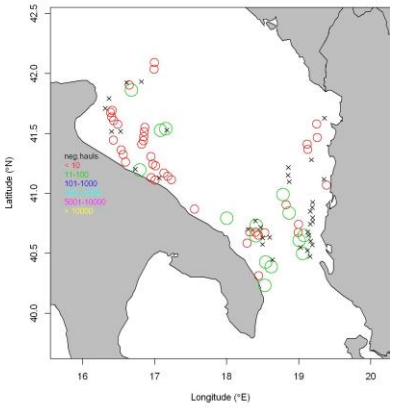
MERL MER - Spawners (N/km2) F - GSA 18 - 2000



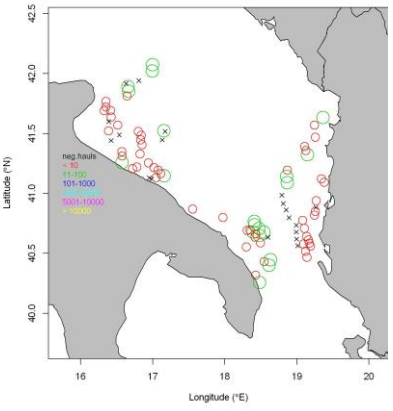
MERL MER - Spawners (N/km2) F - GSA 18 - 2001



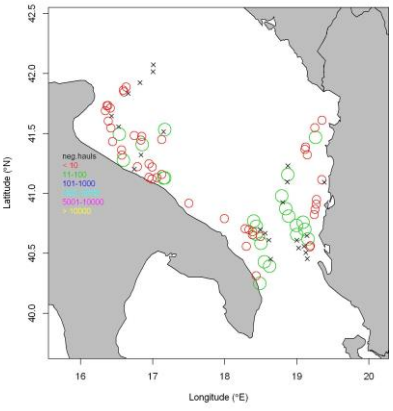
MERL MER - Spawners (N/km2) F - GSA 18 - 2002

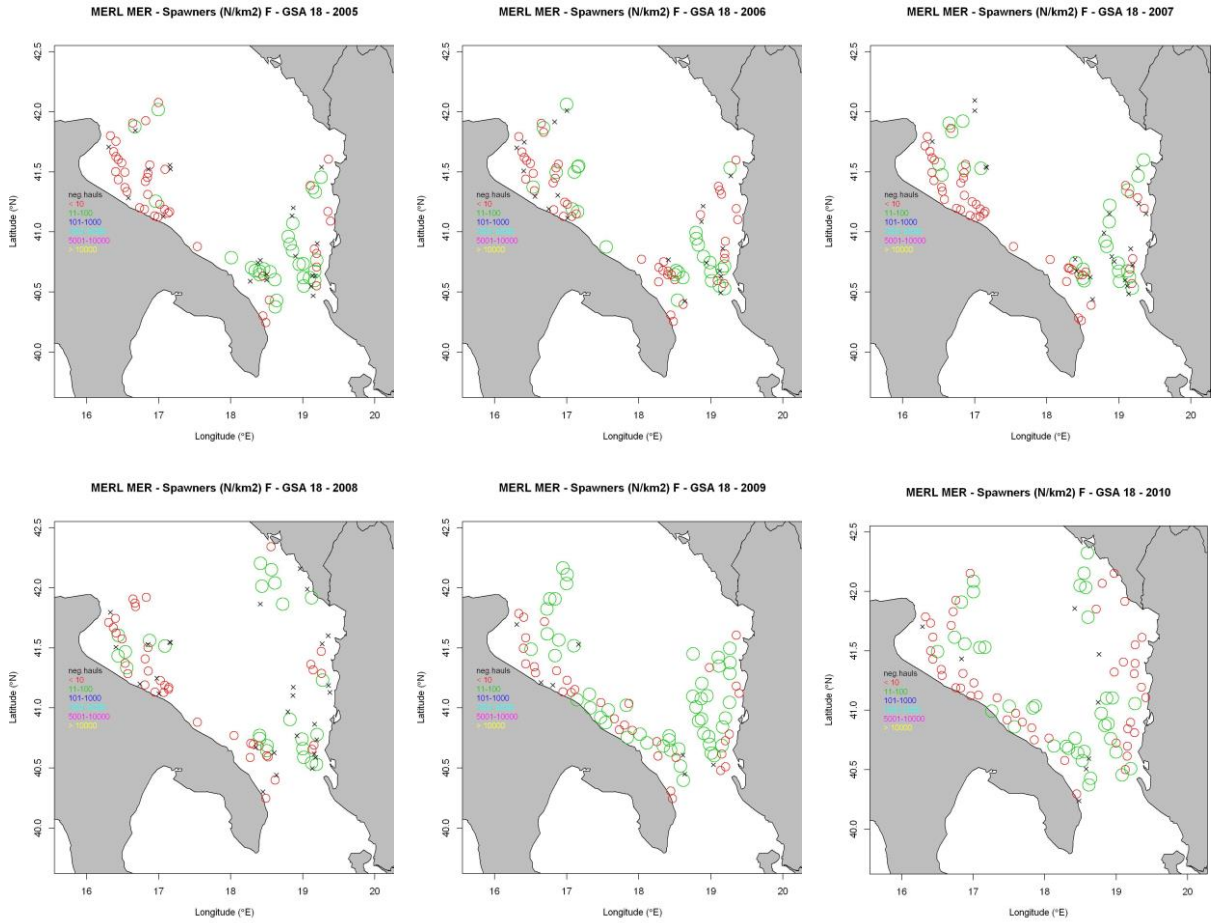


MERL MER - Spawners (N/km2) F - GSA 18 - 2003



MERL MER - Spawners (N/km2) F - GSA 18 - 2004





4.1.3 Historical trends

Figure with the observed trends in abundance, abundance by age class, etc. for each of the directed methods used.

Table with the raw data used for the figures above should also be provided and revised yearly.

5 Ecological information

5.1 Protected species potentially affected by the fisheries

A list of protected species that can be potentially affected by the fishery should be incorporated here. This should also be completed with the potential effect and if available an associated value (e.g. bycatch of these species in tn)

5.2 Environmental indexes

If any environmental index is used as i) a proxy for recruitment strength, ii) a proxy for carrying capacity, or any other index that is incorporated in the assessment, then it should be included here.

Other environmental indexes that are considered important for the fishery (e.g. that may affect catchability, etc.) can be reported here.

6 Stock Assessment

In this section there will be one subsection for each different model used, and also different model assumptions runs should be documented when all are presented as alternative assessment options.

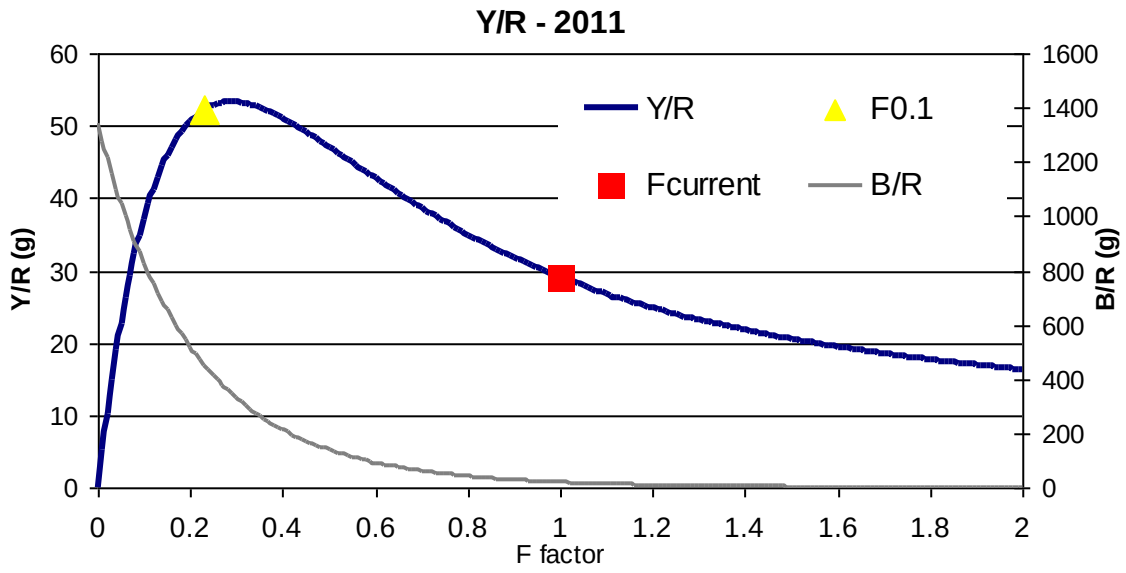
6.1 Yield per Recruit using Vit4Windows

6.1.1 Model assumptions

6.1.2 Scripts

If an script is available which incorporates the stock assessment run (e.g. if using FLR in R) it should be provided here in order to create a library of scripts.

6.1.3 Results



Historical figures of SSB, Recruitment, F or other outcomes of the stock assessment model

6.2 Robustness analysis

Retrospective analysis, comparison between model runs, etc.

6.3 Assessment quality

Stability of the assessment, evaluation of quality of the data and reliability of model assumptions.

7 Stock predictions

When an analytical assessment exist, predictions should be attempted. All scenarios tested (recruitment and/or fishing mortality) should be reported. The source of information/model used to predict recruitment should be documented.

7.1 Short term predictions

7.2 Medium term predictions

7.3 Long term predictions

8 Draft scientific advice

The stock is in overfishing as current fishing mortality exceed the $F_{0.1}$. levels (0.92 vr. 0.21) and thus it is necessary to consider a considerable reduction of the fishing mortality to allow the achievement of $F_{0.1}$.

The reference point F0.1 can be gradually achieved by multiannual management plans.

Objectives of a more sustainable harvest strategy could be achieved with a multiannual plan that foresees a reduction of fishing mortality through fishing limitations.

As observed in 2011, the fishing mortality from the Italian bottom trawlers represents about 80% of the total F in the GSA and that of the Italian longlines is accounting for about 9.5%, with an overall percentage of about 90%, while Montenegrin trawlers account only for about 1% of the F exerted on hake in the GSA and Albanian trawlers of about 9.7%.

Moreover, the production of hake in GSA 18 is split in 12.5% caught by Italian longlines, 77.2% by Italian trawlers, about 1% by Montenegrin trawlers and about 9.4% by Albania trawlers.

Table 7.3-1: Unidimensional stock status (choose one)

Unidimnsional	**Overexploited**. The fishery is being exploited at above a level which is believed to be sustainable in the long term, with no potential room for further expansion and a higher risk of stock depletion/collapse;
	Not known or uncertain. Not much information is available to make a judgment; **Underexploited, undeveloped or new fishery**. Believed to have a significant potential for expansion in total production; **Moderately exploited**, exploited with a low level of fishing effort. Believed to have some limited potential for expansion in total production; **Fully exploited**. The fishery is operating at or close to an optimal yield level, with no expected room for further expansion; **Overexploited**. The fishery is being exploited at above a level which is believed to be sustainable in the long term, with no potential room for further expansion and a higher risk of stock depletion/collapse; **Depleted**. Catches are well below historical levels, irrespective of the amount of fishing effort exerted; **Recovering**. Catches are again increasing after having been depleted or a collapse from a previous; **None** of the above.

Table 7.3-2: Bidimensional stock status

	Exploitation rate	**Stock Abundance**
Bidimensional		

Please note the two new definitions provided by the SAC:

Overfished (or overexploited) *- A stock is considered to be overfished when its abundance is below an agreed biomass based reference target point, like B0.1 or BMSY. To apply this denomination, it should be assumed that the current state of the stock (in biomass) arises from the application of excessive fishing pressure in previous years. This classification is independent of the current level of fishing mortality.*

Stock subjected to overfishing (or overexploitation) *- A stock is subjected to overfishing if the fishing mortality applied to it exceeds the one it can sustainably stand, for a longer period. In other words, the current fishing mortality exceeds the fishing mortality that, if applied during a long period, under stable conditions, would lead the stock abundance to the reference point of the target abundance (either in terms of biomass or numbers)*