



Stock Assessment Form

Demersal species

Joint assessment of the Deep sea rose shrimp *Parapenaeus longirostris* of GSA 01,03 and 04.

Reference year: 2017

Reporting year: 2018

ABSTRACT: This document summarises the data used, methods adopted and the results of the joint stock assessment carried out during the CopeMed II working group on demersal species. The assessment was performed using length frequency distributions (LFD) of 2015 to 2017 as well as the average 2015-2017 catches, analyses were performed jointly, raised to the total landings. A pseudocohorte analysis (VIT) is carried out after slicing LFD to Catch at age data. Current fishing mortality and references points were assessed. The results are discussed to provide some elements for scientific advice to the fisheries exploiting *P. longirostris* in the Alboran area;

Stock Assessment Form version 1.0

Uploader: *Ainouche Nawel*

Stock assessment form

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1 Basic Identification Data

Scientific name:	Common name:	ISCAAP Group:
Parapenaeus longirostris	Deep sea rose shrimp	45
1st Geographical sub-area:	2nd Geographical sub-area:	3rd Geographical sub-area:
[Northern Alboran Sea GSA_1]	[Southern Alboran Sea GSA_3]	[Southern Alboran Sea GSA_4]
4th Geographical sub-area:	5th Geographical sub-area:	6th Geographical sub-area:
1st Country	2nd Country	3rd Country
[SPAIN]	[MOROCCO]	[ALGERIA]
4th Country	5th Country	6th Country
Stock assessment method: (indirect)		
LCA / Y/R		
Authors:		
[Authors]		
<i>AINOUCHE Nawel³, FILALI Tahar³, BENCHOUCHA Said, SETTIH Jamal², PÉREZ GIL, José Luis¹; HERNÁNDEZ, Pilar⁴</i>		
Affiliation:		
¹ IEO, Centro Oceanográfico de Fuengirola, Spain ² INRH-Nador and INRH-Tangier, Morocco ³ CNRDPA, Algeria ⁴ FAO - CopeMed II.		

2 Stock identification and biological information

2.1 Stock unit

The assessment covers the complete stock unit in the GSA1 (Northern Alboran Sea), GSA03 and the western part of the GSA04 (Ghazaouet and BeniSaf).

2.2 Growth and maturity

Size at first maturity (Tableau 2.2.1), natural mortality (M) vector by age (table 2.2.2) calculated using PRODBIOM (Abella *et al*, 1999 spreadsheet version 2017) and growth parameters (table 2.2.3) estimated by INRH (2012), were used to run the joint stock assessment.

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

Somatic magnitude measured LC (mm)				Units	
Sex	Fem	Mal	Combined	Reproduction season	All year: with peak in summer.
Maximum size observed	44	34	44	Recruitment season	
Size at first maturity	21			Spawning area	Shelf and upper slope
Recruitment size to the fishery			10	Nursery area	Continental shelf

Table 2.2.2. M vector and proportion of matures by age (Combined Males-Females).

Age	% Maturity	Natural mortality
0	0.02	1.49
1	0.23	0.76
2	0.63	0.44
3	0.84	0.35
4	1	0.30
5	1	0.24

**Natural mortality vector, PRODBIOM. (Abella et al., 1999, version 2017).

Table 2-3: Growth and length weight model parameters

		Sex				
		Units	female	male	Combined	Years
Growth model	L_{∞}	mm			43	
	K	γ^{-1}			0.58	
	t_0	γ^1			-0.28	
	Data source	INRH 2012				
Length weight relationship	a				0.0019*	
	b				2.6113*	
	M (scalar)				0.46	
	sex ratio (% females/total)	0.5 (Mal/Fem)				

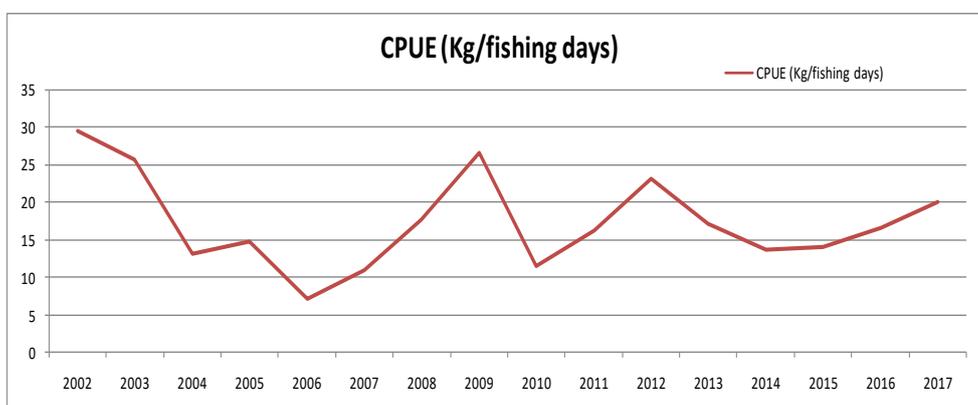
3 Fisheries information

3.1 Description of the fleet

. Description of the fleet

- **Spain (GSA 01)**

Deep-water rose shrimp (*Parapenaeus longirostris*) is one of the main crustacean species for trawl fisheries in the GFCM geographical sub-area Northern Alboran (GSA 1, Spain). It is an important component of landings in some ports and occasionally a target species of the trawl fleet composed of approximately 100 vessels (average 2011-2017), that operates on the upper slope. The annual landings (Y) showed a very sharp decrease at the beginning of the maximum observed in 2009 (250 t). Landings remained relatively stable during the period 2014-2015, fluctuating around 100 t, and increased in 2016 increased slightly to 133 t in 2016. Abundance indices from MEDITS trawl survey, showed the same trend.



CPUE (Kg/fishing days) from 2002 to 2017 in GSA 01.

- **Morocco (GSA 03)**

The trawl fishing fleet in Moroccan GSA 03 is heterogeneous. The number of trawlers operating in GSA 03 is 72. *Parapenaeus longirostris* in GSA 03 is found at depths ranging from 100 to 300 m.

Landings are made at 4 fishing ports: Beni Nsar (Nador), Al Hoceima, M'diq and Tangier. The port of Nador is the most important in terms of *Parapenaeus longirostris* production (86%) and with regard to the fishing effort (84%). In 2017, the number of trawlers targeting *Parapenaeus longirostris* in GSA 03 was 72 with an average engine power of 230 HP and a mean GRT of 50 Tx (Table 3.1).

Table 3-1. Segment fleet characteristics in Moroccan GSA 03 (Average (years)).

Ports	Number of trawlers	Mean HP	Mean GRT
Nador	48	357	55
Al Hoceima	10	307	51
M'diq	21	200	28
Total	72	-	-

- **Algeria (GSA 04).**

The demersal species of great interest in Algeria are *Merluccius merluccius*, *mullus barbatus*, *Pagellus acarne*, *Octopus vulgaris*, *Aristeus antennatus* and *Parapenaeus longirostris*.

Parapenaeus longirostris is distributed throughout the Algerian coast from east to west from 50 to 600 meters depth with a high abundance between 200 -500 meters. Sizes range from 13 to 41 mm in cephalothorax length, with an average length in the catch of 25.27mm. The minimum landing size of the deep-water rose shrimp is set to 20 mm cephalothorax length. Sex ratio is slightly in favor of females (54.06%).

The GSA 04 is extended from the Moroccan boundaries at the west until the Tunisian ones in the eastern part. Regarding the geographical limit of the Alboran sea, the catch data and biological sampling used in this assessment come exclusively from two ports: Ghazaouet and Bénisaf). The landings of *Parapenaeus longirostris* in these ports represent about 22% of national production and the mean landings by year are estimated to 967 T from 2013 to 2017.

In 2017, 102 trawlers were operating in the ports of Ghazaouet and Beni saf are in average 19 meters length, 501 HP power and tonnage of 45 GRT. The total number of fishing days is 9047 days.

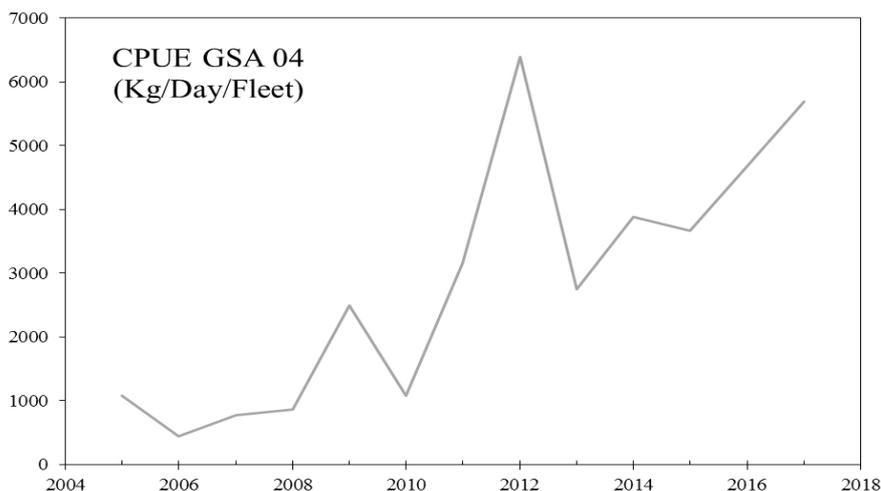


Table 3.1.1. Segment fleet characteristics in GSA 04 (year 2016).

Ports	Number of trawlers	Mean HP
Ghazaouet	71	501
Bénisaf	31	501

Table 3-1: Description of operational units exploiting the stock

	Country	GSA	Fleet Segment	Fishing Gear Class	Group of Target Species	Species
Operational Unit 1*	[ESP]	[GSA01]	[E-Trawl 12-24 m]	03-Trawls	[34 – Demersal slope species]	DPS
Operational Unit 2	[MOR]	[GSA03]	[E-Trawl 12-24 m]	03-Trawls	[34 – Demersal slope species]	DPS
Operational Unit 3	[DZ]	[GSA04]	[E-Trawl 12-24 m]	03-Trawls	[34 – Demersal slope species]	DPS

Table 3.1-2: Catch, bycatch, discards and effort by operational unit in the reference year

Operational Units*	Fleet (n° of boats Average 2015-2017)*	Catch (T of the species assessed Average 2015-2017)	Other species caught (names and weight)	Discards (species assessed)	Discards (other species caught)	Effort (units) Average 2015-2017
[03-Trawls-GSA01]	98	142.12				8667
[03-Trawls-GSA03]	83	276.95				5787
[03-Trawls-GSA04]	100	337.43				8327
Total	90	763.72				7594

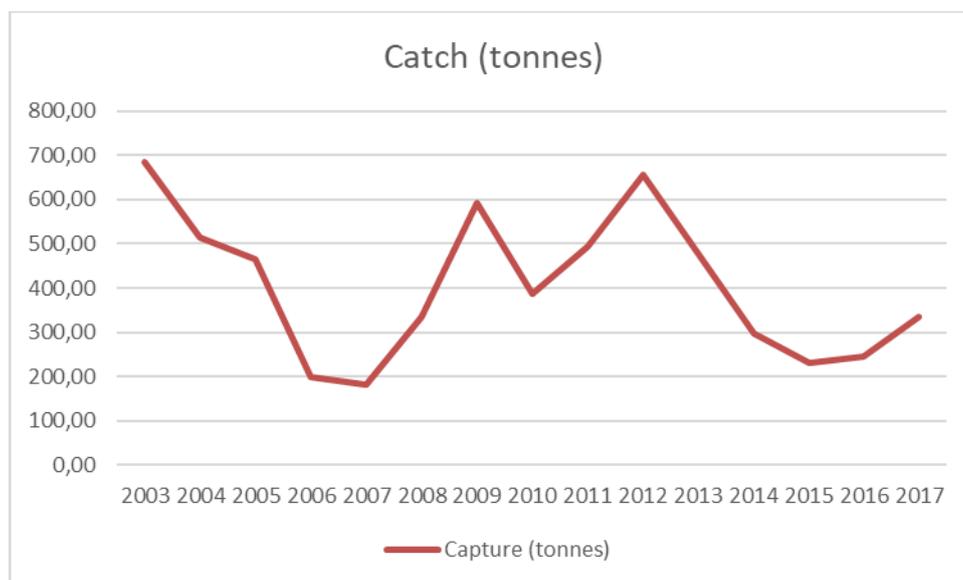
3.2 Historical trends

GSA 01

Deep-water rose shrimp (*Parapenaeus longirostris*) is one of the main crustacean species for trawl fisheries in the GFCM geographical sub-area Northern Alboran Sea (GSA-1). It is an important component of landings in some ports and occasionally a target species of the trawl fleet composed of approximately 123 vessels (98 captured Deep-water shrimp in 2017) that operates on the upper slope. The annual landings in this area fluctuated during all the assessed series and increased in the last three years reaching up 207 t in 2017.

GSA 03

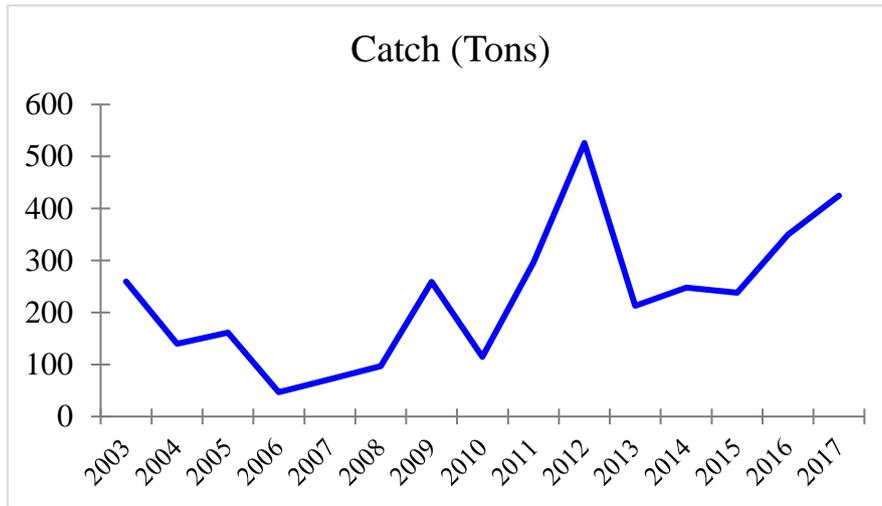
Deep-water rose shrimp (*Parapenaeus longirostris*) is one of the main crustacean species for trawl fisheries in the GFCM geographical sub-area Southern Alboran Sea (GSA-3). It is a target species of the trawl fleet composed of approximately 83 vessels that operates on the upper slope. The annual landings in this area fluctuated during all the assessed series and increased in the last three years reaching up 335 t in 2017.



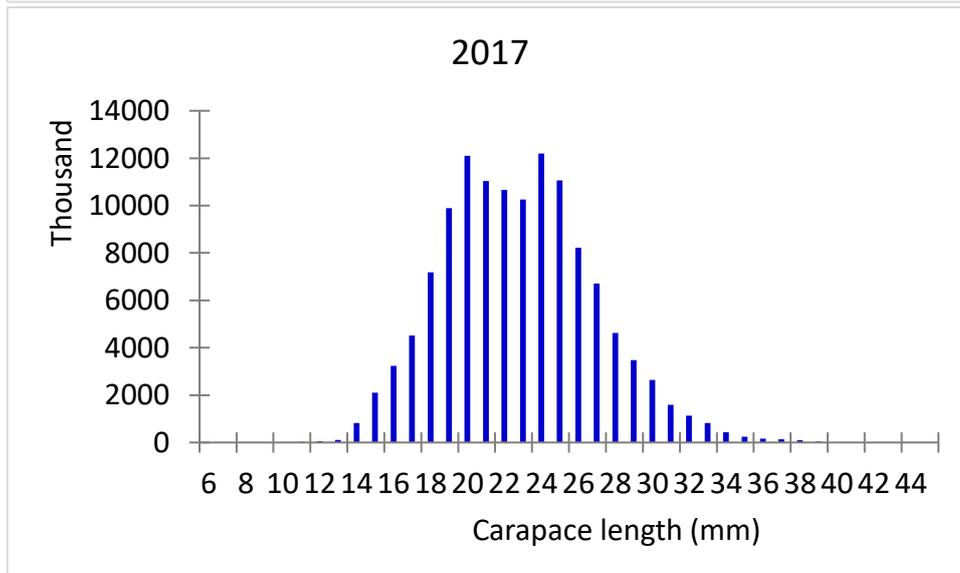
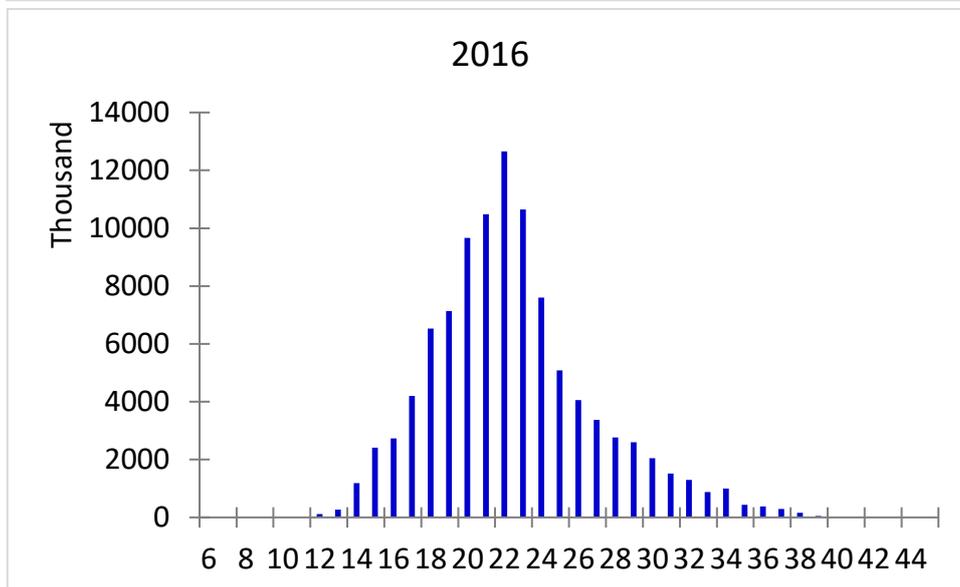
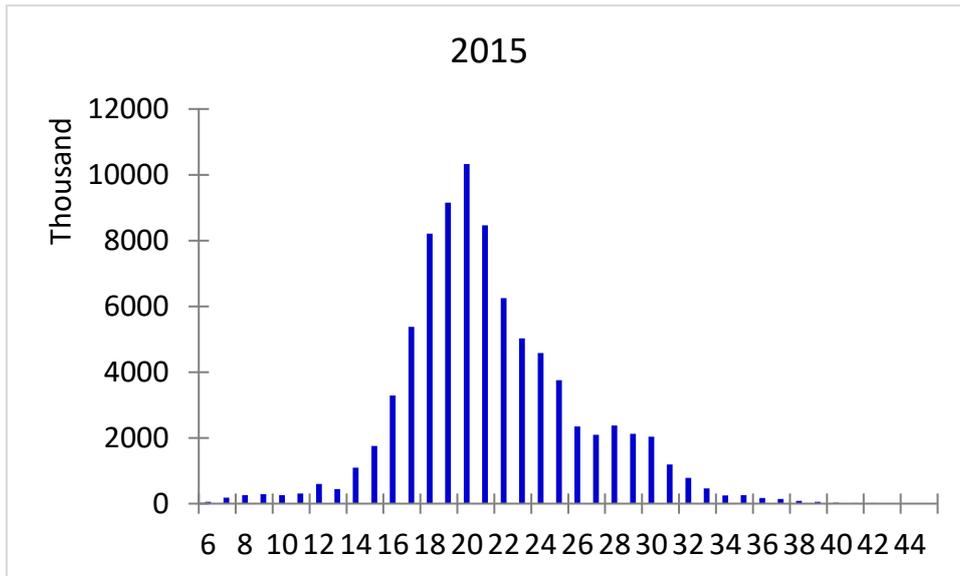
Trend of the landing of *Parapenaeus longirostris* of GSA 03 from 2003 to 2017

GSA 04

Trend in catch of deep-water rose shrimp (DPS) of the Algerian trawl fleets since 2005 is shown in Figure 4. The catch in GSA 04 shows an increase in 2009 and 2012. The number of trawlers targeting *Parapenaeus longirostris* has also increased since 2005. In 2017 an increase in the total catch (t) in the two ports of the Algerian Alboran part is noted and is raised from 349.55T to 424.63 T. The trend of the CPUE is also increasing from 2014.



Historical trend of the landings of *Parapenaeus longirostris* in GSA 04.



Length frequency distribution of the joint GSA 01,03 and western part of the GSA04 (2015 to 2017).

Table 3.2.1. Catches as used in the assessment (tonnes)

Year	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Landings GSA 04 (t)	259.34	140.05	161.28	46.767	71.44	97.024	259.188	114.678	296.391	525.88	212.83	247.66	238.112	349.546	424.63
Landings GSA 01 (t)	187	118	103	38	56	109	254	98	172	242	149	100	109	137	202
Landings GSA 03 (t)	683.51	512.85	465.85	198.75	182.50	334.11	591.88	387.69	494.48	657.22	476.14	298.01	231.16	244.14	355.56
Fleet:OTB (GSA1)	186	181	182	176	163	129	124	126	124	128	124	116	113	101	98
Fleet:OTB (GSA3)					80		100	85	158	112	95	115	71	72	83
Fleet:OTB (GSA4)			84	88	94	95	99	99	102	103	105	108	100	102	100

3.3 Management regulations

In GSA01

- Fishing license: fully observed
- Engine power limited to 316 KW or 500 HP: not fully observed
- Mesh size in the codend (40 mm square or 50 mm rhomboidal): fully observed
- Fishing forbidden within upper 50 m depth: not fully observed
- Time at sea (12 hours per day and 5 days per week): fully observed
- Minimum landing size (20 mm CL), (EC regulation 1967/2006): mostly fully observed

In GSA03

The Regulations in force and degree of observance of regulations in GSA 03 are listed below:

- Fishing licence: Fully observed
- Trawl mesh size : ≥ 50 mm (mesh stretched).
- Minimum landing size = 20 mm.
- Interdiction of fishing under 1,5 nautical miles in the area between Tangier (Cap Spartel) and Al HOCEIMA.

In GSA 04

Regulations concerning trawlers activity are listed below:

- Interdiction of fishing under 50m depth.
- Closed season for trawlers under 03 miles (From 1st May to 31 Aout).
- Cod end Mesh size = 40 mm (diamond mesh).
- Minimum landing size = 25 mm of cephalothoracic length.

4 Fisheries independent information

4.1 {TYPE OF SURVEY}

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

4.1.1 Brief description of the direct method used

Description of the survey and method applied. 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 in GSA 01

Survey	MEDITS	Trawler/RV	Miguel Oliver
Sampling season	Spring		
Sampling design	Depth stratified sampling with random drawing of the positions within each stratum. The number of position in each stratum is proportional to the area of this strata		
Sampler (gear used)	GOC73		
Cod –end mesh size as opening in mm	20 mm of mesh opening		
Investigated depth range (m)	10-800		

4.2. Trawl survey GSA 03

GSA 3 Survey.

4.2.1. Brief description of the direct method used

Trawl surveys using the Moroccan (INRH) research boat, using a stratified random sampling.

Table 0-1: Trawl survey basic information

Survey		Trawler/RV	
Sampling season	Spring, winter, (summer sometimes)		
Sampling design	Stratified Random sampling		
Sampler (gear used)	trawl		
Cod –end mesh size as opening in mm	40mm		
Investigated depth range (m)	Coast-800 meters		

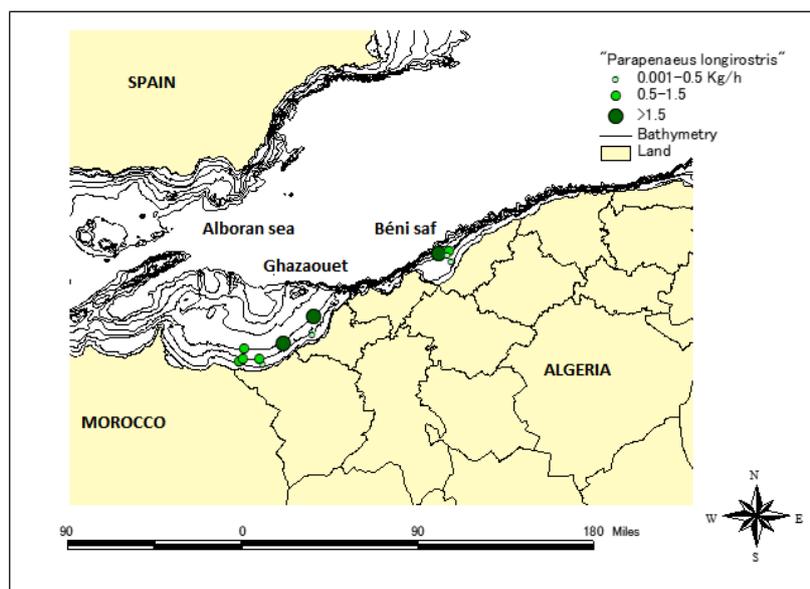
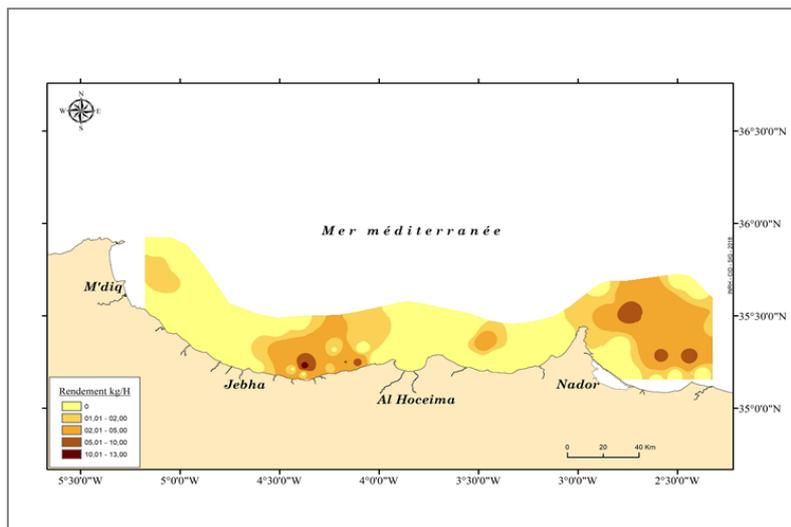
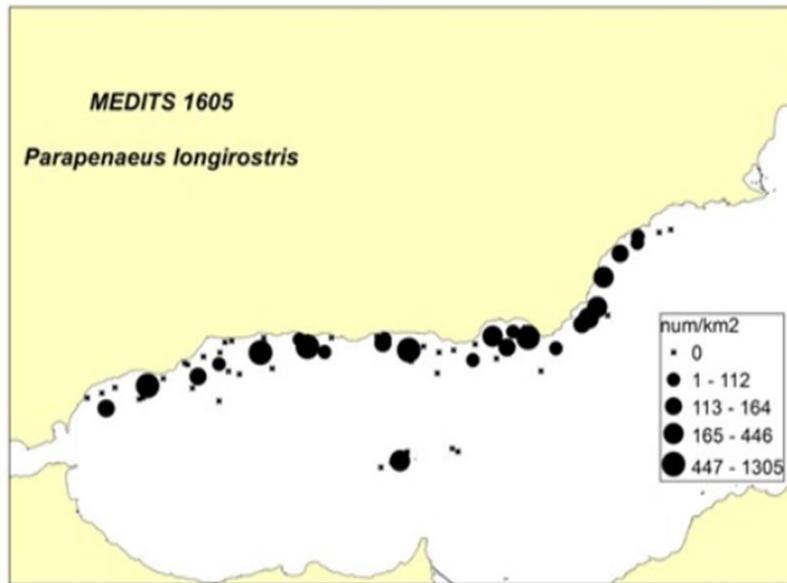
4.3. Trawl survey GSA 04

A spring demersal trawl survey is carried out once a year along the Algerian coasts following the MEDITS protocol; the trawlable area is no more than 30% of the total area so that it reduces the area to trawlers to practise fishing activities. 60 hauls were carried out during the ALDEM 2017 (Algerian Demersal trawl survey).

Direct methods: trawl based abundance indices

Table 0-1: Trawl survey basic information

Survey	ALDEM	Trawler/RV	Belkacem GRINE
Sampling season	Spring -Summer (May-June)		
Sampling design	MEDITS		
Sampler (gear used)	GOC73		
Cod –end mesh size as opening in mm	20mm		
Investigated depth range (m)	20-800 Meters		



Abundances index (Kg/h) of *Parapenaeus longirostris* from trawl survey (ALDEM 2017).

5 Stock Assessment

5.1. Pseudo-cohort analyses by VIT 1.3

Regarding available data provided by the expert, the working group decided to run a joint stock assessment of the deep sea rose shrimp *Parapenaeus longirostris* of GSAs 01, 03 and 04 using pseudo-cohort analysis of three years (2015 to 2017) with VIT software (Leonart and Salat, 1997).

Moroccan (GSA 03), Spanish (GSA 01) and Algerian (GSA 04) length-size composition (LC, mm) were used to make the pseudo-cohort analysis. Biological input data for relative and absolute growth, natural mortality (M) and maturity at age were also discussed and finally the group accepted the values shown in table 4.1.1 Length composition and landings were averaged for each GSA per year and finally summed for all GSA. Data were introduced in VIT software. Slicing was done with R.

The terminal fishing mortality value chosen for starting the calculations was $F_{\text{term}}=0.2$ and after several trials it was set at $F_{\text{term}}=0.5$.

5.1.1 Model assumption

For the pseudo-cohort analyses the data used are:

- Landings time series 2015-2017 (official landings Algeria, Morocco and Spain).
- Catch at length data converted to catch at age data using Slicing with R.
- Growth parameters (INRH, 2012)
- M vector by age using PRODBIOM spreadsheet.

5.1.2 Input data and Parameters

The catch-at-age data (thousand) are jointed for the GSA's and the result is given in the table.

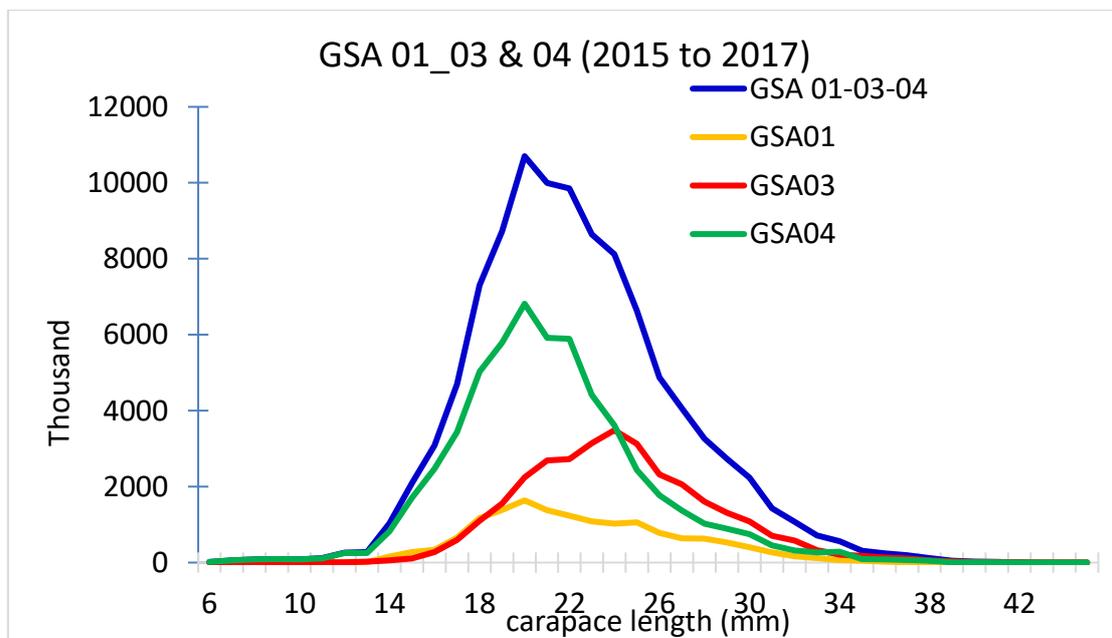
Catch-at-age (thousands)			
Age /year	2015	2016	2017
0	5241.2235	3986.31393	3130.92716
1	64411.3771	76725.56298	92130.83627
2	12159.8964	16349.2966	27261.41969
3	1747.5825	3609.22295	2639.36603
4	396.9062	830.45676	400.59073
5+	86.1647	57.54406	57.47804

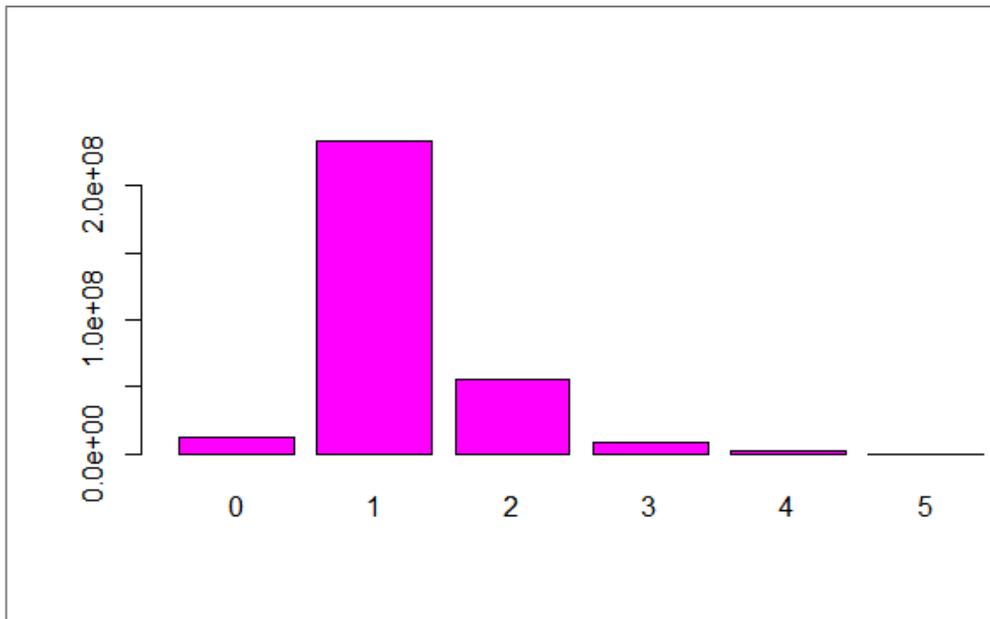
INPUT parameters

Table 4.1.1. Biological parameters used for deep water rose shrimp in GSAs 01, 03 and 04.

		Units	Sex			Years
			female	male	Combined	
Growth model	L_{∞}	mm			43	
	K	γ^{-1}			0.58	
	t_0	γ^{-1}			-0.28	
	Data source					
Length weight relationship	a				0.0019	
	b				2.611	
	M (scalar)	γ^{-1}			0.46	
	sex ratio (% females/total)	0.5				

Length Frequency distribution





Terminal Fishing mortality (F)

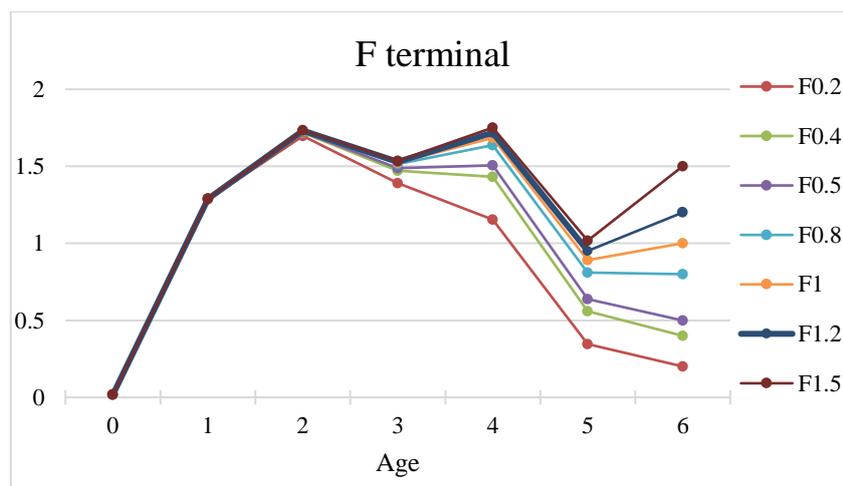
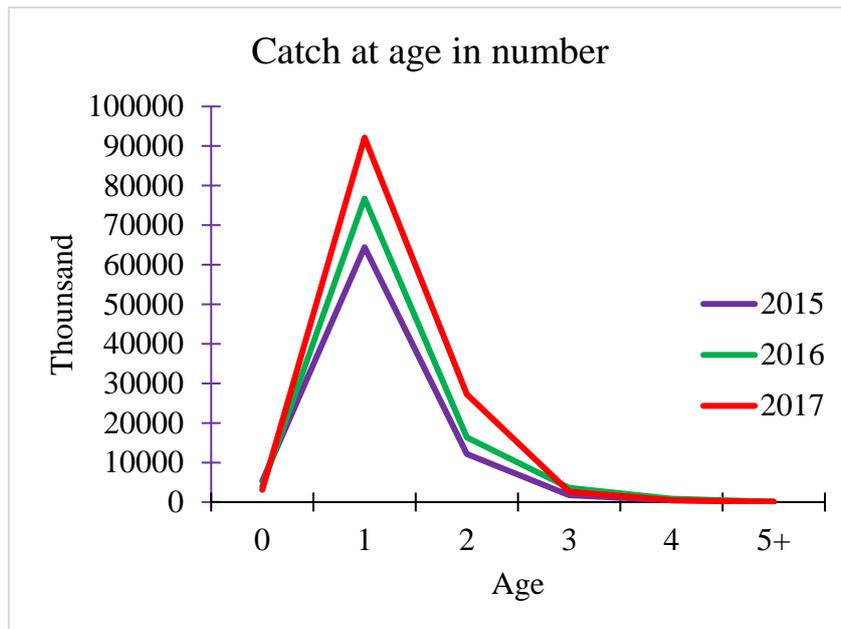


Fig.6. Terminal fishing mortality (F) by age.

5.1.3 Results

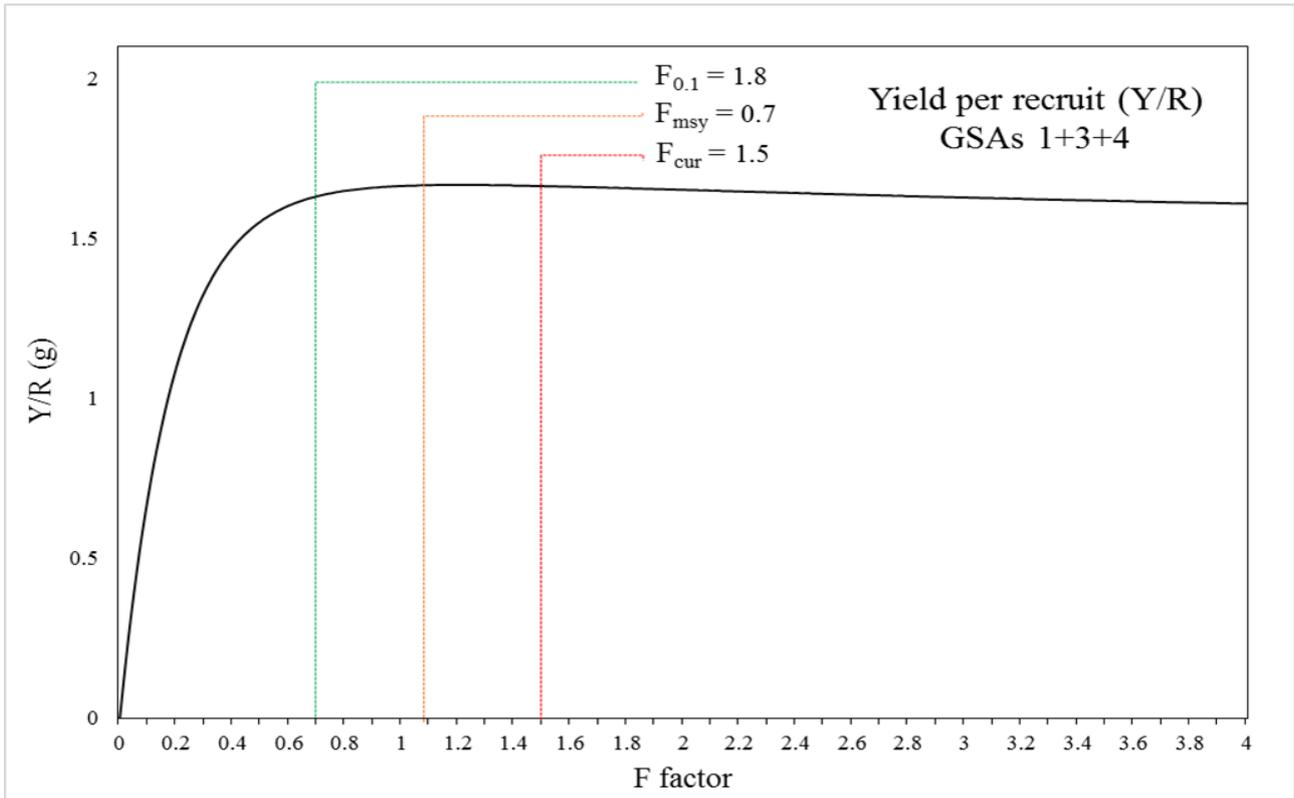
The results of the catch in numbers by age from the VIT software are represented by the figure bellowing showing that for the three GSA are concentrated mostly on the age 1 and less on the age 2.



Catch at age in numbers (thousand) for the joint GSA (GSA 01+03+04).

The current level of fishing mortality ($F_{bar} = 1.5$) (age 1 to 3) for the joint GSA is higher than both values calculated for the $F_{0.1}$ ($F_{0.1} = 0.7$) and $F_{M_{sy}}$ (0.45) showing that the stock status of the deep rose shrimp *Parapenaeus longirostris* currently overfished (Fig.8). The ratio of $F_{current}/F_{0.1}$ is higher than 1.6.

The results of the yield per recruit corresponding to each reference point are mentioned in the table 4.1.2.



Yield per recruit of GSA 01+02+04 VPA analysis.

Table 4.1.2. Results of the yield per recruit analysis (VIT).

age (1-3)	F cur (bar)	F0.1 absolue	Fcur/F0.1
2015-2017	1.5	0.7	2.2
2015	1.2	0.6	1.8
2016	1.3	0.6	2.0
2017	1.3	0.6	2.1

5.1.4 Assessment quality

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

6 Draft scientific advice

Based on	Indicator	Analytical reference point (name and value)	Current value from the analysis (name and value)	Empirical reference value (name and value)	Trend (time period)	Stock Status
Fishing mortality	Fishing mortality	$F_{0.1} = 0.7 \text{ an}^{-1}$ $F_{\text{current}} = 1.51 \text{ an}^{-1}$	$F_c / F_{0.1} = 2.2$			IO
	Catch (t) (3 years)					
Stock abundance	Biomass_(t) (3years)					
	SSB_(t) (3 years)					
Recruitment	R (3 years)					
Final Diagnosis	<ul style="list-style-type: none"> - In intermediate overfishing ($F_c = 1.51 > F_{0.1} = 0.34$) 					
Scientific advice for management	<ul style="list-style-type: none"> - Reduce F_{current} towards $F_{0.1}$ - Progressive reduction of the fishing effort 					

Explanation of codes

Trend categories

- 1) N - No trend
- 2) I - Increasing
- 3) D – Decreasing
- 4) C - Cyclic

Stock Status

Based on Fishing mortality related indicators

- 1) **N - Not known or uncertain** – Not much information is available to make a judgment;
- 2) **U - undeveloped or new fishery** - Believed to have a significant potential for expansion in total production;
- 3) **S - Sustainable exploitation**- fishing mortality or effort below an agreed fishing mortality or effort based Reference Point;
- 4) **IO –In Overfishing status**– fishing mortality or effort above the value of the agreed fishing mortality or effort based Reference Point. An agreed range of overfishing levels is provided;

Range of Overfishing levels based on fishery reference points

In order to assess the level of overfishing status when $F_{0.1}$ from a Y/R model is used as LRP, the following operational approach is proposed:

- If $F_c/F_{0.1}$ is below or equal to 1.33 the stock is in **(O_L): Low overfishing**
- If the $F_c/F_{0.1}$ is between 1.33 and 1.66 the stock is in **(O_I): Intermediate overfishing**
- If the $F_c/F_{0.1}$ is equal or above to 1.66 the stock is in **(O_H): High overfishing**

* F_c is current level of F

- 5) **C- Collapsed**- no or very few catches;

Based on Stock related indicators

- 1) **N - Not known or uncertain**: Not much information is available to make a judgment
- 2) **S - Sustainably exploited**: Standing stock above an agreed biomass based Reference Point;
- 3) **O - Overexploited**: Standing stock below the value of the agreed biomass based Reference Point. An agreed range of overexploited status is provided;

Empirical Reference framework for the relative level of stock biomass index

- **Relative low biomass**: Values lower than or equal to 33rd percentile of biomass index in the time series **(O_L)**
- **Relative intermediate biomass**: Values falling within this limit and 66th percentile **(O_I)**
- **Relative high biomass**: Values higher than the 66th percentile **(O_H)**

- 4) **D – Depleted:** Standing stock is at lowest historical levels, irrespective of the amount of fishing effort exerted;
- 5) **R –Recovering:** Biomass are increasing after having been depleted from a previous period;

Agreed definitions as per SAC Glossary

Overfished (or overexploited) - A stock is considered to be overfished when its abundance is below an agreed biomass based reference target point, like $B_{0.1}$ 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)