SAC GFCM
Sub-Committee on Stock Assessment

Date*	24	November	2009	Code*	NEP0509Gui

Authors*

Guijarro, Beatriz; Valls, María; Ordines, Francesc and Massutí, Enric

Affiliation*

IEO- Centre Oceanogràfic de les Balears; Moll de Ponent s/n, 07015 Palma de Mallorca (Spain)

Species Scientific name*

1 ***Nephrops norvegicus - NEP***
Source: GFCM Priority Species

2
Source: -

3
Source: -

Geographical area*

05 - Balearic Islands

Geographical Sub-Area (GSA)*

05 - Balearic Island

Combination of GSAs
1
2
3

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Assessment form — **Sheet #0** — **Basic data on the assessment**

Code: NEP0509Gui

Date*	24	Nov	2009	Authors*	Guijarro, Beatriz; Valls, María; Ordines, Francesc and Massutí, Enric

Species Scientific name*	Nephrops norvegicus - NEP	Species common name*	Norway Lobster

Data Source

GSA*	05 - Balearic Island	Period of time*	2002-2008

Description of the analysis

Type of data*	Size composition of commercial trawl catches and official landings, CPUE data from bottom trawl survey and	Data source*	IEO, Fishermen Association, Ministry of Fisheries and Regional Government
Method of assessment*	LCA- Pseudocohort analysis	Software used*	VIT programme (Lleonart and Salat, 1992)

Sheets filled out

B	P1	P2a	P2b	G	A1	A2	A3	Y	Other	D	Z	C
1	1	1	1	---	2	1	2	1	---	1	1	1

Comments, bibliography, etc.

- North-eastern Iberian Peninsula and Balearic Islands:

Sardà F. and J. Lleonart.- 1993. Evaluation of the Norway lobster (Nephrops norvegicus, L.) resource off the "Serola" bank off Barcelona (western Mediterranean). Scientia Marina, 57 (2-3): 191-197.

Merella P., F. Alemany, A. Carbonell and A. Quetglas.- 1998. Fishery and biology of Norway lobster (Decapoda: Nephropidae) in Mallorca (western Mediterranean). Journal of Natural History, 32: 1631-1640.

Sardà F.- 1998. Symptoms of overexploitation in the stock of the Norway lobster (Nephrops norvegicus) on the "Serola Bank" (Western Mediterranean Sea off Barcelona). Scientia Marina, 62 (3): 295-299.

Maynou F. and F. Sardà.- 2001. Influence of environmental factors on commercial trawl catches of Nephrops norvegicus. ICES Journal of Marine Science, 58: 1318-1325.

- European Mediterranean waters:

Abelló P., A. Abella, A. Adamidou, S. Jukic-Peladic, P. Maiorano and M. T. Spedicato.- 2002. Geographical patterns in abundance and population structure of Nephrops Norvegicus and Parapenaeus longirostris (Crustacea: Decapoda) along the European Mediterranean coasts. Scientia Marina, 66 (Suppl. 2): 125-141.

Comments, bibliography, etc.

- European Mediterranean waters:

Sardà F. (Editor).- 1998. Nephrops norvegicus: comparative biology and fishery in the Mediterranean Sea. Scientia Marina, 62 (Suppl. 1): 5-143.

Sardà F., J. Lleonart and J.E. Cartes.- 1998. An analysis of the population dynamics of Nephrops norvegicus (L.) in the Mediterranean Sea. Scientia Marina, 62 (Suppl. 1): 135-143.

- Other papers (methodological aspects):

Abella A. and P. Righini.- 1998. Biological reference points for the management of Nephrops norvegicus stocks in the northern Tyrrhenian Sea. Journal of Natural History, 32: 1419-1430.

Abella A., A. Belluscio, J. Bertrand, P.L. Carbonara, D. Giordano, M. Sbrana and A. Zamboni.- 1999. Use of MEDITS trawl survey data and commercial fleet information for the assessment of some Mediterranean demersal resources. Aquatic Living Resources, 12 (3): 155-166.

Morello E.B., C. Froglia and R.J.A. Atkinson.-2007. Underwater television as fishery-independent method for stock assessment of Norway lobster (Nephrops norvegicus) in the central Adriatic Sea (Italy). ICES Journal of Marine Science, 64: 1116–1123.

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Assessment form	**Sheet B** **Biology of the species**

Code: NEP0509Gui

Biology

Somatic magnitude measured (LH, LC, etc)*		Carapace length		Units*	mm

Sex	Fem	Mal	Both	Unsexed		
Maximum size observed	65	80			Reproduction season	see comments
Size at first maturity		See comments			Reproduction areas	
Recruitment size	18*	19*			Nursery areas	

Parameters used (state units and information sources)

			Sex			
		Units	female	male	both	unsexed
Growth model	L∞		67	86.8		
	K		0.15	0.1		
	t0		-0.33	-0.3		
	Data source	Sardà et al. (1998) for the Catalan Sea (GSA-06)				
Length weight relationship	a		0.552	0.479		
	b		3.075	3.118		
	M		0.29***	0.21***		

sex ratio (mal/fem)	****

Comments

(*) Minimum size in catches

- Size at first maturity:

For the assessment we have considered data from Sardà et al. (1998): "The size at first maturity has been considered to span the sizes ranging from 21 to 30 mm CL, with an estimated increase of 10% in the proportion of mature individuals with each additional mm in CL."

Sardà F., J. Lleonart and J.E. Cartes.- 1998. An analysis of the population dynamics of Nephrops norvegicus (L.) in the Mediterranean Sea. Scientia Marina, 62 (Suppl. 1): 135-143.

Other information (females): 30-36**

- Reproductive season:

Ovarian maturation: maximum peaks in spring or at the beginning of summer**

Brooding period: summer and autumn peaks**

(**) Orsi-Relini L., A. Zamboni, F. Fiorentino and D. Massi.- 1998. Reproductive patterns in Norway lobster Nephrops norvegicus (L.), (Crustacea Decapoda Nephropidae) of different Mediterranean areas. Scientia Marina, 62 (Suppl. 1): 25-41.

Comments

(***): from Pauly's method (1980)

Pauly D.- 1980. On the interrelationships between natural mortality, growth, parameters, and mean environmental temperature in 175 fish stocks. Journal du Conseil International pour l'Exploration de la Mer, 39 (2): 175-192.

(****) Sex-ratio was estimated from length frequency distributions (see sheet P2a)

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Assessment form

Sheet P1
General information about the fishery

Code: NEP0509Gui

Data source*	IEO, Fishermen Association, Ministry of Fisheries and Regional Government	Year (s)*	2002-2007
Data aggregation (by year, average figures between years, etc.)*	Average 2002-2008		

Fleet and catches (please state units)

	Country	GSA	Fleet Segment	Fishing Gear Class	Group of Target Species	Species
Operational Unit 1*	ESP	05	E - Trawl (12-24 metres)	03 - Trawls	34 - Demersal slope species	NEP
Operational Unit 2						
Operational Unit 3						
Operational Unit 4						
Operational Unit 5						

Operational Units*	Fleet (n° of boats)*	Kilos or Tons	Catch (species assessed)	Other species caught	Discards (species assessed)	Discards (other species caught)	Effort units
ESP 05 E 03 34 - NEP	37	Tons	9.4	See comments	Almost null	See comments	1065**
Total	37		9.4				

Legal minimum size	

Comments

Norway lobster catches from the Balearic fleet comes exclusively from bottom trawl. Fleet and catch data correspond to average 2000-2008 from Mallorca island, represent around >75% of the Balearic Islands.

(*) Total number of bottom trawlers

(**) Estimated standardised effort in days (average 2000-2008; from Palmer et al., 2008): Four different fishing tactics (shallow shelf : SS; deep shelf: DS; upper slope: US; middle slope: MS) and their combinations.
US & US+SS & US+DS & US+MS = 1065 days

OTHER SPECIES CAUGHT on US (350-600 m): important by-catch of big Merluccius merluccius, Lepidorhombus spp., Lophius spp. and Micromesistius poutassou (Guijarro and Massutí 2006).

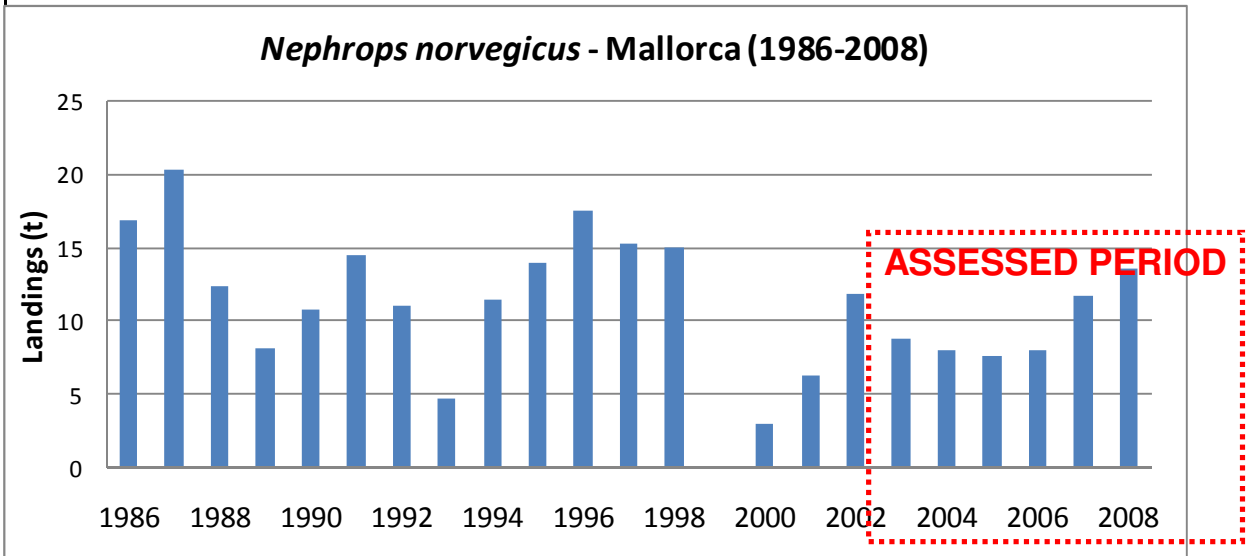
DISCARDS on US have been estimated up to 18% (autumn) 45% (spring) of captured biomass. They are mainly composed by the following species (Guijarro and Massutí 2006):

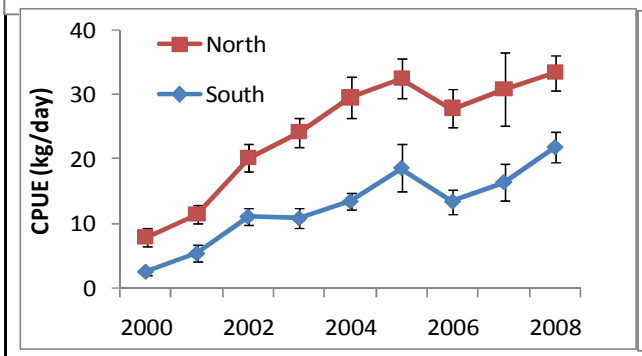
Comments

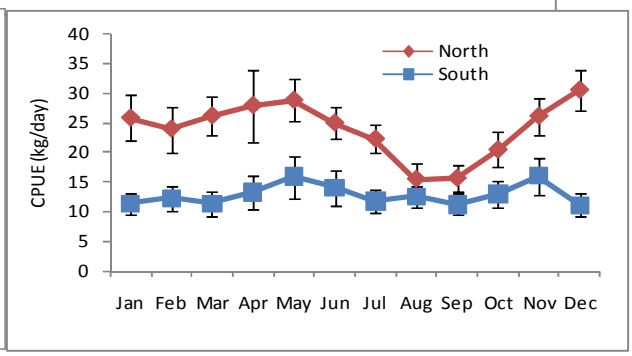
- Elasmobranchs: Dipturus oxyrinchus, Scyliorhinus canicula and Galeus melastomus.
- Teleosts: Argentina sphyraena, Argyropelecus hemigymnus, Arnoglossus rueppelli, Bathysolea profundicola, Capros aper, Cetrolophus niger, Chauliodus sloani, Citharus linguatula, Conger conger, Epigonus telescopus, Epigonus denticulatus, Gadiculus argenteus, Hoplostethus mediterraneus, Lepidopus caudatus, Molva dypterigia , Myctophidae, Notacanthus bonapartei, Notolepis rissoi, Peristedion cataphractum, Stomias boa, Symphurus nigrescens, Synchiropus phaeton, Caelorinchus caelorinchus, Hymenocephalus italicus and Nezumia aequalis.
- Crustaceans: Macropipus tuberculatus, Munida spp., Paromola cuvieri, Pasiphaea sivado, Pasiphaea multidentata, Plesionika heterocarpus and Sergestes arcticus.
- Cephalopods: Bathypolypus sponsalis, Octopus salutii, Histioteuthis spp. and Sepietta oweniana.
- Others: Echinidae, Gryphus vitreus, Porifera and Salpidae.

Guijarro B. and F. Massutí (2006) Selectivity of diamond- and square-mesh codends in the deepwater crustacean trawl

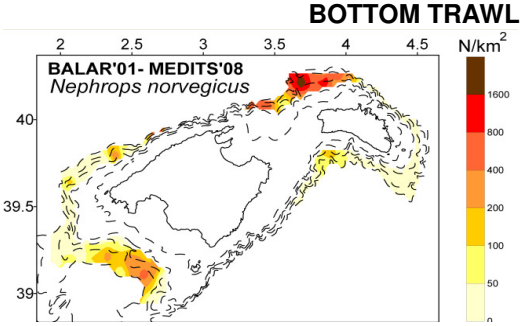
FISHERY: ANNUAL LANDINGS AND STANDARDIZED CPUEs

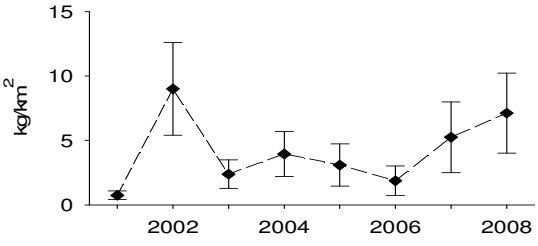






BOTTOM TRAWL SURVEYS (MEDITS)





Data source*	Size composition of commercial trawl catches from monthly sampling on board	OpUnit 1*	ESP 05 E 03 34 - NEP

Time series

Year*	2002	2003	2004	2005	2006	2007
Catch	11.87	8.84	8.07	7.66	8.13	11.83
Minimum size	23	22	19	19	18	21
Average size Lc	37	40	35	37	39	40
Maximum size	70	67	72	63	69	80
Fleet	27	27	26	22	31	31

Year	2008					
Catch	13.6					
Minimum size	16					
Average size Lc	34					
Maximum size	66					
Fleet	31					

Selectivity

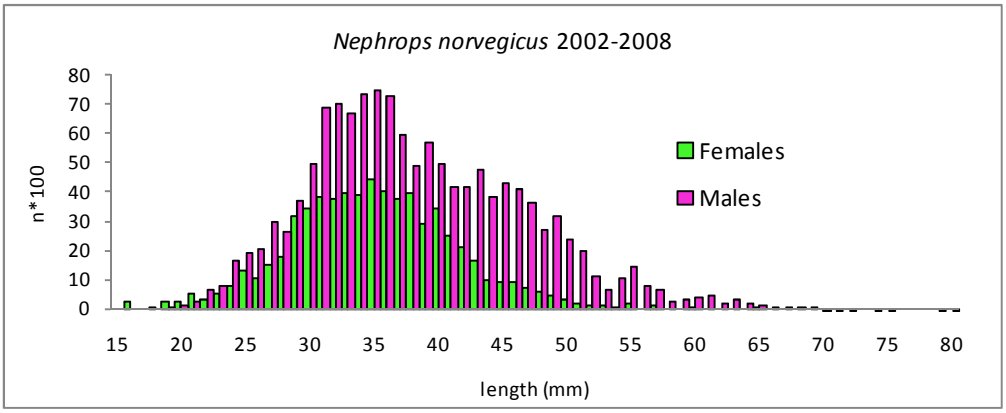
L25	15.32
L50	17.83
L75	20.34
Selection factor	0.44

Remarks

Mytilineou C., C.Y. Politou and A. Fourtouni.- 1998. Trawl selectivity studies on Nephrops norvegicus (L.) in the eastern Mediterranean Sea. Scientia Marina, 62 (Suppl. 1): 107-116.

Structure by size or age

L50= 22.82 (Stergiou et al., 1997). Stergiou K.I., G. Petrakis and C.Y. Politou.- 1997. Size selectivity of diamond and square mesh cod-ends for Nephrops norvegicus in the Aegean Sea. Fisheries Research, 29 (3): 203-209.

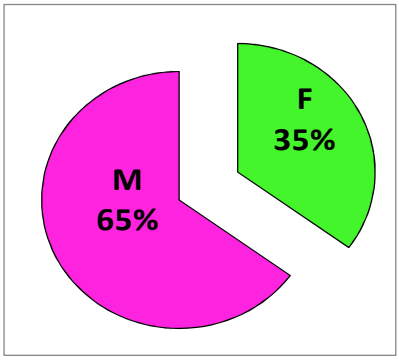


Structure by size or age

CATCHES

	Females (tons)	Males (tons)
2002	4.2	7.7
2003	3.1	5.7
2004	2.8	5.2
2005	2.7	5.0
2006	2.8	5.3
2007	4.1	7.7
2008	4.8	8.9

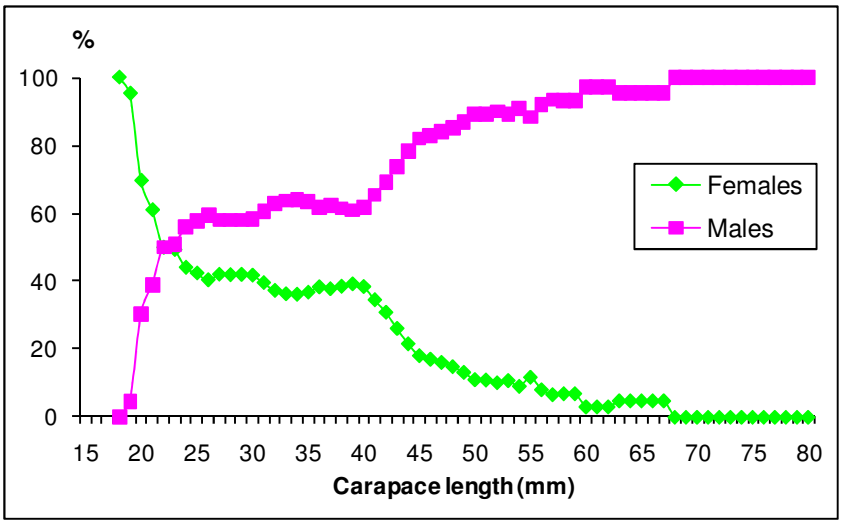
	Females (tons)	Males (tons)	TOTAL
2002-2008	3.5	6.5	10



SIZES

Talles	Females: min	Females: mean	Females: max	Males: min	Males: mean	Males: max
2002	23	36	54	25	37	70
2003	23	38	53	22	41	67
2004	19	33	55	19	36	21
2005	19	34	53	21	38	53
2006	18	37	52	24	40	95
2007	18	37	52	21	42	38
2008	16	33	52	19	36	66

SEX-RATIO



Data source*	IEO, Fishermen Association, Ministry of Fisheries and	OpUnit 1*	ESP 05 E 03 34 - NEP

Regulations in force and degree of observance of regulations

- Fishing license: fully observed

- Engine power limited to 316 KW or 500 HP: not observed (at least, doubled)

- Mesh size in the codend (diamond 40 mm stretched): fully observed

- Fishing forbidden shallower than 50 m depth: not fully observed

- Time at sea (12 hours per day and 5 days per week): fully observed

Accompanying species

Since Guijarro and Massutí (2006):

- Teleosts: Merluccius merluccius, Micromesistius poutassou, Lepidorhombus boscii, Lepidorhombus whiffiagonis, Lophius budegassa, Lophius piscatorius, Argentina sphyraena, Chelidonichthys cuculus, Chlorophthalmus agassizi, Citharus linguatula, Mullus surmuletus, Pagellus acarne, Pagellus bogaraveo, Peristedion cataphractum, Scorpaena elongata, Trachurus trachurus and Trigla lyra.

Elasmobranchs: Raja clavata and Squalus acanthias.

Crustaceans: Palinurus mauritanicus, Paromola cuvieri, Plesionika giglioli and Plesionika.
Cephalopods: Eledone cirrhosa, Scaergus unicirrhus, Illex coindetti, Sepia orbignyana and Todarodes sagitattus.

Guijarro B. and E. Massutí (2006) Selectivity of diamond- and square-mesh codends in the deepwater crustacean trawl fishery off the Balearic Islands (W Mediterranean). ICES Journal of Marine Science, 62: 52-67.

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

Assessment form

Sheet A1
Indirect methods: VPA, LCA

Code: NEP0509Gui

Sex*	F

Analysis # *	1

Time series

Data	Size	Age
(mark with X)		X

Model	Cohorts	Pseudocohorts
(mark with X)		X

Equation used	Catch equation	Tunig method	
# of gears	1	Software	VIT programme (Lleonart and Salat, 1992)
$F_{terminal}$	0.36 (see comments)		

Population results (please state units)

	Sizes	Ages		Amount	Biomass
Minimum	12.1*	1	Recruitment	242.8	0.69
Average	24.9	2.9	Average population	737.2	12.3
Maximum		9+	Virgin population		19.5
Critical	32	4	Turnover		52.70%
					SSB: 7.0
				Thousands	Tons

Average mortality

		Gear					
	Total	Bottom trawl					
F_1	0.244	0.244					
F_2	0.106	0.106					
Z	0.534						

(F1 and F2 represent different possible calculations. Please state them)

Comments

- Terminal F was estimated from the FLEDA package (Jardim and Azevedo, 2007)

(*) Lower size of first class. Mean length of first class (1.5 years of age): 15.8 mm CL.

- F1: mean F for all age classes (1-9+).

- F2: global F for all age classes (1-9+).

Jardim E. and M. Azevedo.- 2007. The "Exploratory Data Analysis for FLR" Package. Version 1.4-2.

Sex*	M

Analysis # *	2

Time series

Data	Size	Age
(mark with X)		X

Model	Cohorts	Pseudocohorts
(mark with X)		X

Equation used	Catch equation	Tunig method	
# of gears	1	Software	VIT programme (Lleonart and Salat, 1992)
$F_{terminal}$	0.22 (see comments)		

Population results (please state units)

	Sizes	Ages		Amount	Biomass
Minimum	17.8	2	Recruitment	463.3	3.05
Average		4.4	Average population	1664	51.1
Maximum		9+	Virgin population		69.6
Critical	40.6	6	Turnover		35.90%
					SSB: 37.1
				Thousands	Tons

Average mortality

		Gear					
	Total	Trawl					
F_1	0.139	0.139					
F_2	0.093	0.093					
Z	0.349						

(F1 and F2 represent different possible calculations. Please state them)

Comments

- Fterminal F was estimated from the FLEDA package (Jardim and Azevedo, 2007).

(*) Lower size of first class. Mean length of first class (2.5 years of age): 21.1 mm CL.

- F1: mean F for all age classes (1-9+).

- F2: global F for all age classes (1-9+).

Jardim E. and M. Azevedo.- 2007. The "Exploratory Data Analysis for FLR" Package. Version 1.4-2.

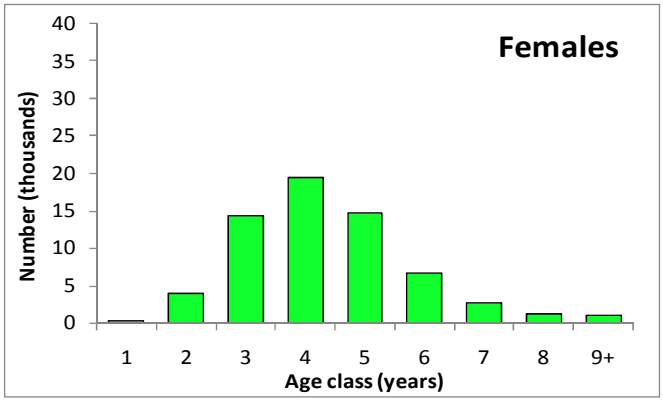
SAC GFCM - Sub-Committee on Stock Assessment (SCSA)	
Assessment form	**Sheet A2** **Indirect methods: data**

Code: NEP0509Gui

Sex*	Both	Gear*	Bottom trawl	Analysis # *	1 & 2

Data source	Size composition of commercial trawl catches from monthly sampling on board

Data



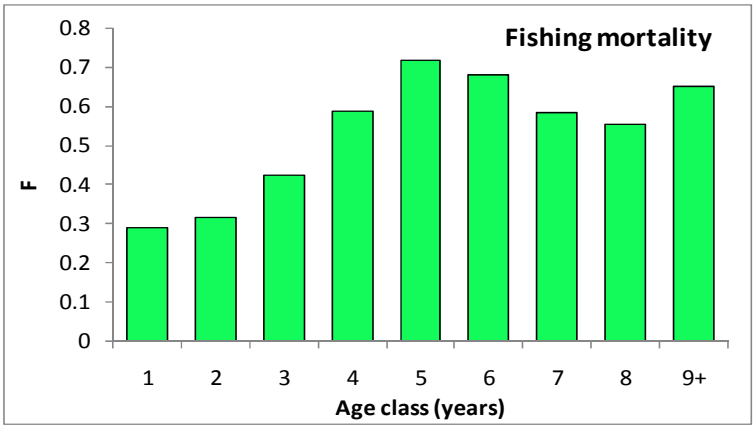
Biological parameters (growth, length-weight, maturity ogive and M) are explained in sheet B

Sex*	F	Gear*	Bottom Trawl	Analysis #*	1

Population in figures

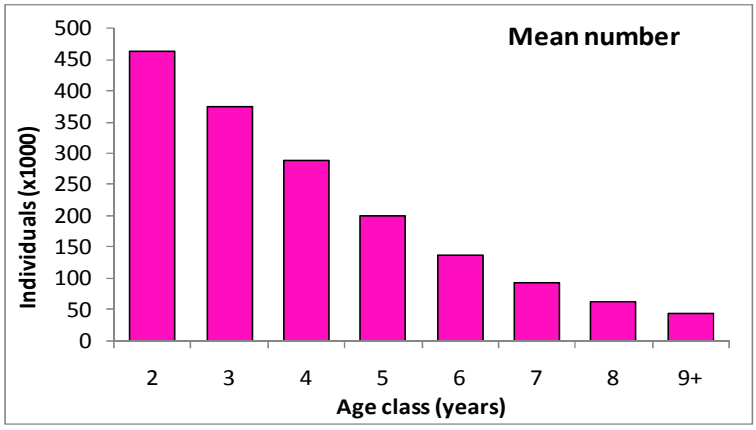
Population in biomass

Fishing mortality rates

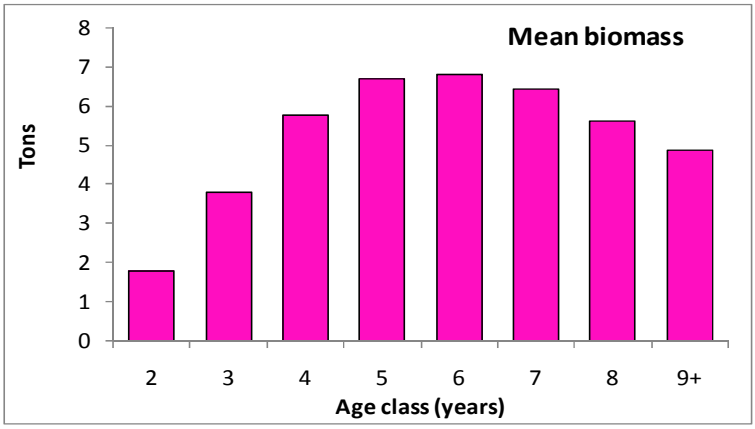


Sex*	M	Gear*	Bottom tralw	Analysis #*	2

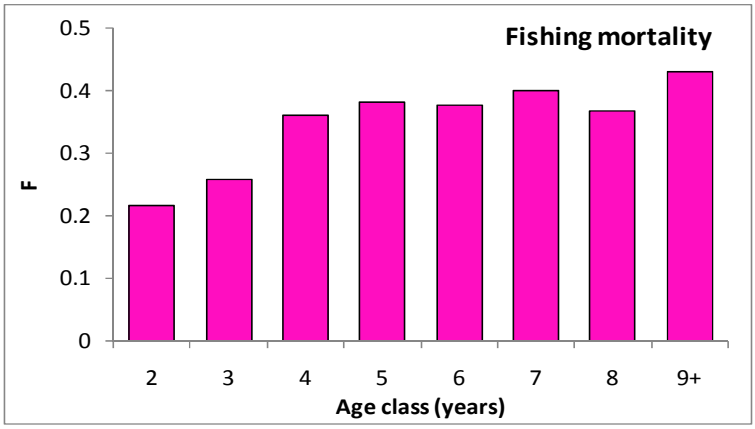
Population in figures



Population in biomass



Fishing mortality rates



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

Assessment form — **Sheet Y** — **Indirect methods: Y/R**

Code: NEP0509Gui

Sex	F / M

Analysis #	1 & 2

# of gears	1	Software	VIT programme (Lleonart and Salat, 1992)

Parameters used

Vector F	From pseudocohort analysis
Vector M	See sheet B
Vector N	From pseudocohort analysis

Model characteristics

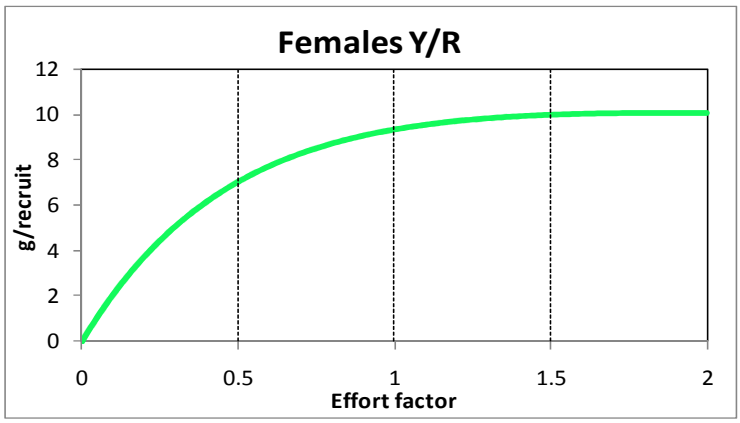
From calculated mean weights

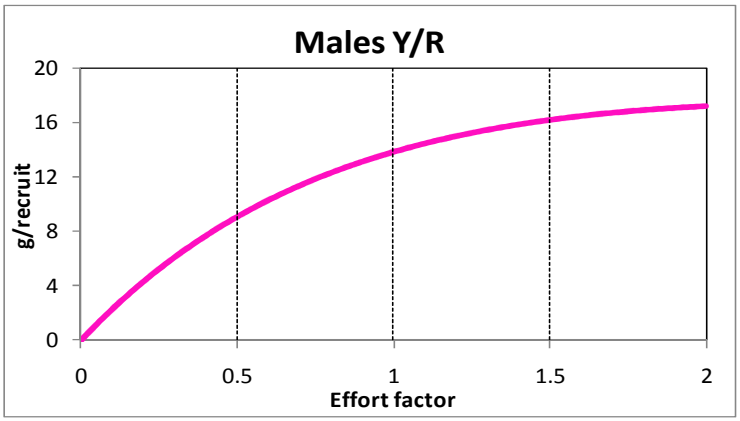
Results

	Total	Gear			
Current YR	9.3 / 13.8				
Maximum Y/R	10.1 / 17.2				
Y/R 0.1					
F_{max}	1.9 / 2.0				
$F_{0.1}$					
Current B/R	39.3 / 92.7				
Maximum B/R	27.6 / 63.4				
B/R 0.1					
	Females / Males				

Comments

Comments


Females Y/R
12
10
8
6
4
2
0
g/recruit
0
0.5
1
1.5
2
Effort factor


Males Y/R
20
16
12
8
4
0
g/recruit
0
0.5
1
1.5
2
Effort factor

SAC GFCM - Sub-Committee on Stock Assessment (SCSA)	
Assessment form	**Sheet D Diagnosis**

Code: NEP0509Gui

Indicators and reference points

Criterion	Current value	Units	Reference Point	Trend	Comments
B					
SSB					
F					
Y					
CPUE					

Stock Status* Use one (or both) of the following two systems for the stock assessment status description

Unidimensional

☐	? - (or blank) **Not known or uncertain**. Not much information is available to make a judgment;
☐	U - **Underexploited, undeveloped or new fishery**. Believed to have a significant potential for expansion in total production;
☐	M - **Moderately exploited**, exploited with a low level of fishing effort. Believed to have some limited potential for expansion in total production;
☉	F - **Fully exploited**. The fishery is operating at or close to an optimal yield level, with no expected room for further expansion;
☐	O - **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;
☐	D - **Depleted**. Catches are well below historical levels, irrespective of the amount of fishing effort exerted;
☐	R - **Recovering**. Catches are again increasing after having been depleted or a collapse from a previous;

Bidimensional

Exploitation rate

☐	No or low fishing
☉	Moderate fishing
☐	High fishing mortality
☐	Uncertain / Not assessed

Stock abundance

☐	Virgin or high abundance
☉	Intermediate abundance
☐	Low abundance

☐	Depleted
☐	Uncertain / Not assessed

Comments

CURRENT ASSESSMENT

Although the species seems to be "moderately exploited" and we could "believe to have some limited potential for expansion in total production", we believe that it is not possible this expansion, because other species such as Merluccius merluccius, which shows symptoms of over-fishing, are also captured in the bottom trawl fishery on the upper slope.

OTHER ASSESSMENTS:

For comparison purposes, the assessment carried out by Sardà et al. (1998) at different areas of the Mediterranean and adjacent Atlantic, applying the same methodology, concluded:

- Highly (fully) exploitation in the Catalan Sea, Adriatic Sea and Thyrrehnian Sea.

- Moderate exploitation in the Ligurian Sea and Euboikos Gulf .

- Lightly exploitation in Alboran Sea and in the Algarve (Portugal, Atlantic).

Sardà F., J. Lleonart and J.E. Cartes.- 1998. An analysis of the population dynamics of Nephrops norvegicus (L.) in the Mediterranean Sea. Scientia Marina, 62 (Suppl. 1): 135-143.

Code: NEP0509Gui

Management advice and recommendations*

Not increase the fishing effort.

To apply the Council Regulation (EC) 1967/2006, in force, concerning management measures for the sustainable exploitation of fishery resources in the Mediterranean Sea, in relation to the replacement of 40 mm diamond mesh in the bottom trawl cod-end by 40 mm square mesh. It could reduce the high proportion of discards in the bottom trawl fishery developed on the upper slope and targeted to Nephrops norvegicus (from 18-45% to 10% with respect to biomass), reducing also the capture of undersized marketable species, without looses in the commercial yields and earnings (Guijarro and Massutí, 2006).

Guijarro B. and E. Massutí (2006) Selectivity of diamond- and square-mesh codends in the deepwater crustacean trawl fishery off the Balearic Islands (W Mediterranean). ICES Journal of Marine Science, 62: 52

Advice for scientific research*

The monthly sampling on board bottom trawlers, developed in the Balearic Islands within the framework of the Spanish Data Collection Programme, might allow the assessment of Nephrops norvegicus in the GSA-05. However, further studies will be needed to estimate biological parameters (e.g. growth, first maturity) required as input parameters in the models.

Comments*

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