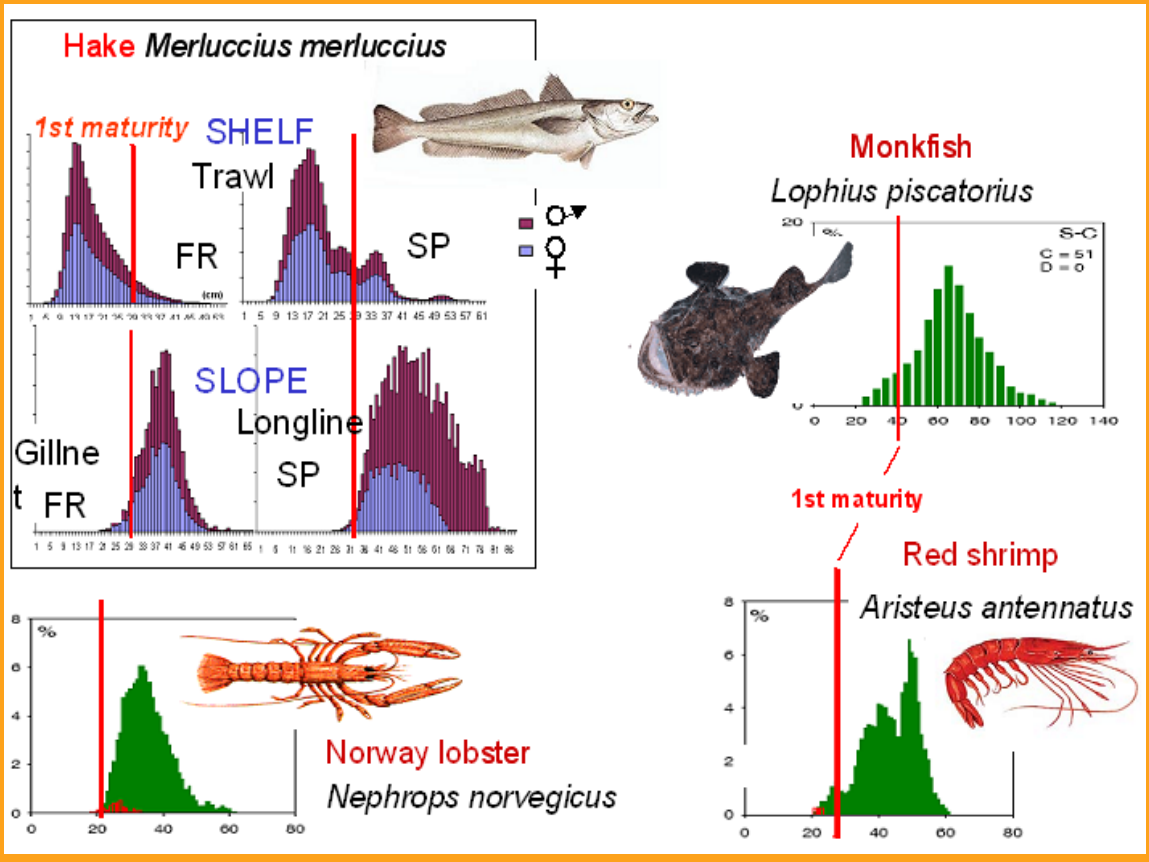
United Nations Environment Programme
Mediterranean Action Plan
Regional Activity Centre For Specially Protected Areas

FISHERIES IN THE GULF OF LIONS



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1. General description

The Gulf of Lions supports fisheries that include bottom and pelagic trawls, purse seines, gill nets and longlines, and is furthermore an important spawning area for many pelagic and demersal species. The demersal fisheries are multi-species and multi-gears fisheries. The marine living resources of the Gulf of Lions are a “shared stock” which is essentially exploited by French and Spanish fishing boats. The main part of the fishing grounds exploited by these boats cover the entire continental shelf from the coastline to the 200 metres isobath, with an area of some 14 000 square kilometres covered by sandy deposits. This particular geomorphology has been conducive to the development of trawling there *(82, 42, 47).*
Off the French coasts, the Spanish fishing activity was confined at first in a restricted zone included between 6 and 12 miles, from the French-Spanish border up to Cap Leucate (the so called "zone of the border treaty" 1967-68). At the beginning of the 80s this activity extended offshore and to the east of the continental shelf.

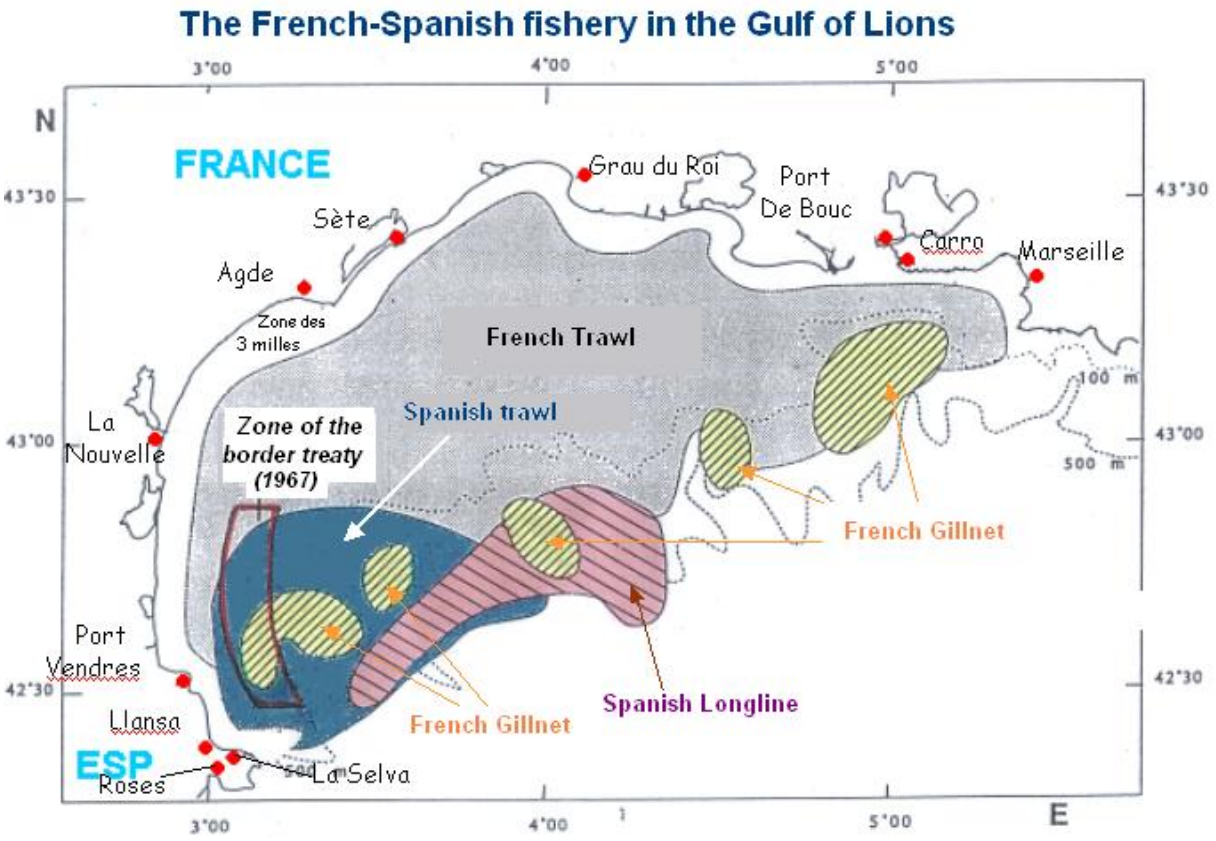


Fig.1- The fishing sectors of the various components of the French-Spanish fleet

2. The Fleets

The boats exploiting the marine resources of the Gulf of Lions are mainly based in the French ports of Sète and Le Grau du Roi which group more than 60 % of the boats and insure about 70 % of the halieutic production of the Gulf of Lions and in the Spanish ports of Roses and Port de la Selva. *(42).* In 2010, 220 boats were involved in the demersal fishery: 111 French bottom trawlers, 67 French gillnetters, 27 Spanish bottom trawlers and 15 Spanish long-liners (tab.1), while 14 French purse seiners and 6 Spanish ones where fishing small pelagics in 2007-2008. Both fleets are subject to the rules of the EC Common Fisheries Policy, concretely to the management framework established by Council Regulation No 1967/2006 concerning management measures for the sustainable exploitation of fishery resources in the Mediterranean Sea.

Country	Gear	Target sp	no of boats	
FR	Trawl	Demersal	111	50,45%
FR	Gillnet	Demersal	67	30,45%
SP	Trawl	Demersal	27	12,27%
SP	Longline	Demersal	15	6,82%

Tab.1- Composition of the French-Spanish fleet in 2010

French trawlers are the main component of the fleet exploiting the marine resources of the Gulf of Lions. This fleet can be divided into two main components, one (around 50 boats) directed to the catch of small pelagic species (mainly anchovy *Engraulis encrasicholus* and sardine *Sardina pilchardus*), the other characterised by the exploitation of a great diversity of demersal species.

After the first uses of small engine-driven trawlers in the early nineties, the arrival of more important units from Algeria in 1962 had a determining effect on the trawling in the gulf *(42).* Their technical characteristics allowed to exploit the resources situated more offshore and to obtain better profits. Then followed a renewal of the trawlers fleet of the Gulf of Lions marked by an increase of the dimension and the power of the boats until modern current units endowed with sophisticated electronic and hydraulic equipments and using trawl nets with big vertical openings.
The General trends of trawlers fleet and exploitation in Sete can be followed from 1957; it shows that several phases in the evolution of the fishery can be distinguished Based on the data obtained from the local Fishery Administration or collected by IFREMER *(95, 26).* these phases can be summarised as follows *(6)* :

- 1957-61 : small scale fishery with small size and low horse powered boats (27 vessels, total nominal horsepower 2700 hp in 1961) ; traditional trawl gear with 2 panels and a small vertical opening ; restricted fishing area on the continental shelf.

- 1962-70: increase of the number of vessels, of their size and horsepower (28 units in 1962, total nominal horsepower 2800 hp; 45 units in 1970, 12720 hp). Traditional gear ; fishing areas extending more offshore.

- 1971-73 : fishing effort still increasing in spite of the limitation of trawler number (fishing licenses) and of individual maximum horsepower (430 hp); 46 units, total nominal horsepower 13270 hp in 1971, 14180 hp in 1973.
- 1974-87 : increase of the total fishing power of fleet, technical improvements (fish detection, net drums...) ; 44 units in 1974, total nominal horsepower 14120 hp; 48 units in 1984, 19940 hp. New types of trawlnets with 4 panels and vertical opening as high as 6 m in 1974 and 11m in 1980. Higher catch of small pelagic fish.

- 1988-94 : partial displacement of fishing effort towards small pelagic fish (up to 50 % of the trawler fleet according to years) ; the apparent decrease of fishing effort on demersal resources being balanced partly by a real increase of the fishing power of trawlers. About 45 units with a smooth trend to decrease for the recent years. New types of pelagic trawls with very high vertical opening up to 20 m in 1988 and to 40 m high since 1992, these gear being used close to the bottom. It must be noticed that since the middle eighties, the nominal horsepower of trawlers could be no more considered as a satisfying index for fishing effort: some of the trawlers were fit out with more powerful engines (up to 1000 hp) and varying pitch propellers and nozzles became of general use. These improvements resulted in an increase of the real fishing power of the trawler fleet.

In 1998 the French fleet was composed of 140 trawlers of 2 types *(23):* approximately three quarters of these ships practiced only the bottom trawling catching various species (hake, red mullets, gurnards, angler fishes, lines), between 10 and 150 m of depth, during daily trips of about 12 to 15 hours. The remaining quarter has a mixed activity of bottom trawling and pelagic trawling targeting mainly the sardine and the anchovy on the whole continental shelf.

During the last decade the number of French trawlers decreased until 90 units in 2010 with a total tonnage of 8900 GT and an overall power of 28000 KW. About half of these trawlers operate out of Sète.

In 2010 eleven small French purse seine boats with a total tonnage of 374 GT and an overall power of 2600 KW where still using the "lampara" technique (light attraction) to fish the anchovy. However this fishing technique is in decline. Three quarters of the remaining seiners equipped with lampara nets operate out of Port-Vendres and the remainder operate out of Marseille.

Small scale fleet

The part of the fleet devoted to small-scale *fisheries* is defined by default as all fishing vessels except licensed trawlers and tuna and sardine vessels licensed to catch pelagic fish. Vessels that can catch pelagic fish with lampara nets are also excluded when they use those nets but are included when they pursue a different *métier.* The small scale boats operating in the Gulf of Lions are essentially French ones. They are split over 45 sites along the coastline of the Languedoc-Roussillon region *(23, 69).* The fleet is very diversified and composed from boats of 3-4 m until units from 10 to 16 m. There are almost 50 different "métiers", among which most are very specific in certain sectors. The gillnets and the trammel nets are the most used gears, along with trolling lines, longlines and many other

gears. About 60 % of the activities of the small scale boats are operating in the shallow waters of the coastal zone, between 0 and 20 m depth. Some of the biggest boats also fish at depths of more than 100 m and even in the canyons of the continental slope, in particular the gillnetters targeting the hake.

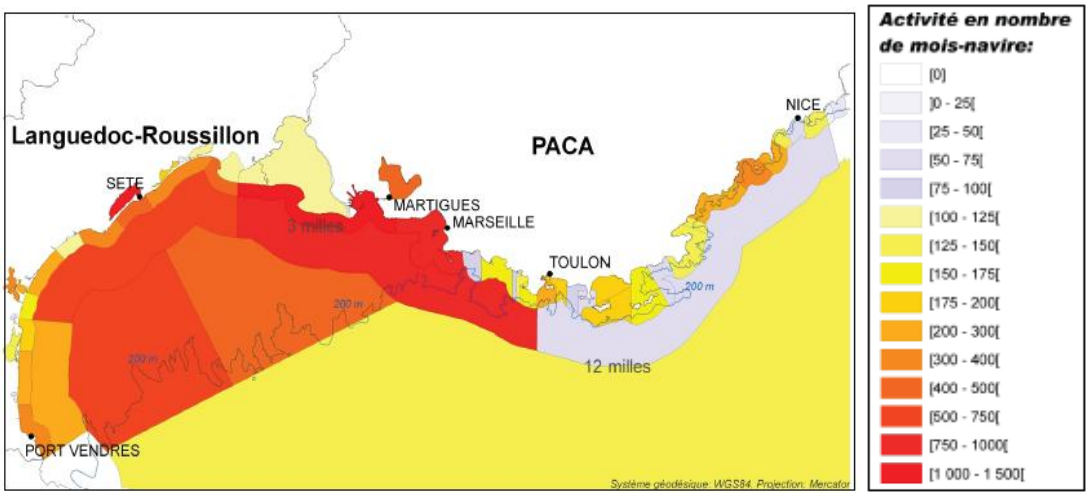
In general the small scale fleet of the Gulf of Lions is declining as it decreased about two thirds during the last decades. However this activity is still much to the fore, with 769 registered active entities and 81% of total manpower in 2008. A total of 171 boats where registered in Port- Vendres, 222 in Sète, 175 in Martigues and 201 in Marseille *(75).* In 2010 the small scale fleet of the Languedoc-Rousillon was composed of 897 boats (tab.2)

Type	**nb boats**	**ratio**	**total GT**	**total KW**
Gill& Trammelnetters	669	74,58%	2 077,10	49 510,00
Lonliners	180	20,07%	247,3	8 499,00
Dredges	45	5,02%	116,2	3 143,00
Beach seines	2	0,22%	3,9	220
Liners	1	0,11%	40	316
Total	**897**		**2484,5**	**61688**

Trawlers	90	89,11%	8 914,10	27 957,00
Purse seiners	11	10,89%	374	2 603,00
Total	**101**		**9288,1**	**30560**

Tab.2- Composition of the fleet of the Languedoc-Roussillon Region in 2008 *(7).*

Fig.2- Spatial distribution of the activity of the French fleet in 2006



*Activité **2006** des navires de pêche de la région **Languedoc-Roussillon** © Ifremer, Juillet 2008*

3. Species distribution

In the Gulf of Lions, there are several commercially important populations of demersal species of fishes, crustaceans and molluscs. A number of these species are clearly coastal, i.e. grey mullets (*Mugilidae*), sea breams (*Sparus aurata*), sea bass (*Dicentrarchus labrax*), some shrimps and many molluscs. The upper zones of the continental shelf are inhabited by species like red mullets (*Mullus barbatus, Mullus surmuletus*), sole (*Solea solea*), gurnards (*Trigla sp.*), poor cod (*Trisopterus minutus capelanus*), Black Sea whiting (*Merlangius melrangus*), and some shrimps. On the continental slope there are many fish species of great economic interest. Thus in the upper part of the slope (200 and 400m) there are hake (*Merluccius merlucci*us), Norway lobsters (*Nephrops norvegicus*) and various shrimps (e.g. *Peneus longirostris*). In deeper waters, from 400 to 600m, the dominant species are the greater forkbread (*Phycis blennoides*), the blue whiting (*Micromesistius poutassou*) and the red shrimps (*Aristeus antennatus, Aristaemorpha foliacea*) *(6).*

Table 3 shows the distribution of the main species fished in the Gulf of Lions according to the distance to the coast. It shows that several demersal species are split between the coastal zone and the wide (hake, monkfishes, red mullets, sea breams, gurnards); some of them are distributed exclusively in the coastal zone (sole, sea bass, clams) *(23).*

Espèce	Lagunes	0 – 3 milles	3 – 6 milles	6 – 12 milles	au delà 12 milles
Merlu		++	++	++	+++
Capelan					+++
Rougets barbets		+++			+++
Baudroies				++	+++
Raie bouclée					+++
Grondin gris				+++	+++
Saint Pierre					+++
Pageot acarné		++	++	++	+++
Pageot commun		+++	+++	+++	+++
Sole	+++	+++	+++	+++	
Bar (loup)	+++	+++			
Dorade royale	+++	+++			
Palourde	+++				
Telline		+++			

Tab.3- Zones of maximum concentration of the main commercial demersal species of the Gulf of Lions according to the distance to the coastline.

Experimental fishing with gillnets done in 1977 offshore the French-Spanish border at depth comprised between 100 and 150m depth *(29)* showed a great abundance of selacians (more than 70% of the total catch in weight). The bony fishes represented 22% among which the most abundant where the hake (*Merluccius merluccius*) the horse mackerel (*Trachurus trachurus*) the rosefish (*Helicolenus dactylopterus*) the monkfish (*Lophius piscatorius*) and the axillary sea bream (*Pagellus acarne*). In general all of these fishes where adults having reached or exceeded their size at first maturity.

The bottom trawl surveys carried out by the Fishery Laboratory of IFREMER on the continental shelf and the upper part of the slope of the Gulf of Lions between 1983 and 2009. have provided quantitative biological data, geographic distribution and abundance indices of the main demersal resources.

These works give information on more than 40 species. Altogether, their results confirm older observations *(89)* and show that the distribution of most of these species is mainly linked to the bathymetry and to the types of substratum.

The abundance indices of the main species are presented in the following table :

Species	Common name	Nom commun	Average abundance (kg/km²)		
			Total	Shelf	Slope
Trisopterus minutus	Poor cod	Capelan	88	108	1
Trachurus trachurus	Horse mackerel	Chinchard commun	61	72	15
Micromesistius poutassou	Blue whiting	Merlan bleu	58	20	225
Merluccius merluccius	Hake	Merlu	47	52	22
Lopius budegassa	Monkfish	Baudroie rousse	34	39	15
Galeus melastomus	Black mouth dogfish	Chien espagnol	34	0	179
Eutrigla gurnardus	Grey gurnard	Grondin gris	31	38	3
Eledone cirrhosa	White octopus	Poulpe blanc	26	29	13
Scyliorhinus canicula	Dogfish	Petite roussette	22	22	19
Lophius piscatorius	Monkfish	Baudroie blanche	20	9	66
Pagellus acarne	Axillary seabream	Pageot blanc	16	17	11
Octopus vulgaris	Octopus	Poulpe de roche	13	16	1
Helicolenus dactylopterus	Rosefish	Sébaste chèvre	13	0	66
Nephrops norvegicus	Norway lobster	Langoustine	12	1	59
Trachurus mediterraneus	Horse mackerel	Chinchard queue jaune	9	11	2
Mullus barbatus	Striped mullet	Rouget de vase	9	11	0
Boops boops	Bogue	Bogue	9	11	0
Eledone moschata	White octopus	Poulpe musqué	6	8	0
Lepidorhombus boscii	Four spot megrim	Cardine à 4 taches	6	5	10
Phycis blennoides	Greater forkbeard	Phycis de fond	6	1	27
Raja clavata	Thornback ray	Raie bouclée	6	4	15
Aspitrigla cuculus	Red gurnard	Grondin rouge	6	6	3
Pagellus bogaraveo	Red sea bream	Dorade rose	5	1	22
Citharus linguatula	Spotted flounder	Feuille	5	6	0
Zeus faber	John dory	Saint-Pierre	4	4	1
Illex coindetii	Shortfin squid	Encornet rouge	4	4	1
Pagellus erythrinus	Common pandora	Pageot commun	3	3	0
Solea vulgaris	Common sole	Sole commune	2	2	0
Aristeus antennatus	Red shrimp	Crevette rouge	2	0	9
Mullus surmuletus	Red mullet	Rouget de roche	2	2	1
Spicara flexuosa	Picarel	Mendole	1	1	0
Spicara smaris	Picarel	Picarel	1	1	0
Loligo vulgaris	Common squid	Encornet	0	0	0
Trigla lucerna	Tub gurnard	Grondin-perlon	0	0	0
Trigloporus lastoviza	Streaked gurnard	Grondin strié	0	0	0
Parapenaeus longirostris	Deep Rose shrimp	Crevette rose du large	0	0	0
Sepia officinalis	Cuttlefish	Seiche commune	0	0	0
Aristeomorpha foliacea	Aristeid shrimp	Gambon rouge	0	0	0

Tab.4- List of the main species caught during the trawl surveys in the gulf of Lions during the period 1994-2009 with their abundance indices *(22)*

The distribution of the species according to an east-west gradient has also been repeatedly confirmed, as well as the big spatiotemporal stability of the specific structures characteristic of the coastal zone, the continental shelf and the continental slope of the Gulf of Lions *(18, 57, 77,105)*.
The distribution and the seasonal abundance of the most commercially important species has remained particularly stable in time from many years. This situation is due to the presence of the canyons of the continental slope, situated outside the traditional fishing sectors, which are "reservoirs" sheltering fishes having escaped the fishery of juveniles on the continental shelf and being able to reach the adulthood, reproduce and insure the perpetuity of the resources *(42)*.

The spatial and bathymetric distribution of the adults and juveniles individuals of some main commercial species are presented in the annexes 1 to 5.

The case of the Hake

The hake (*Merluccius merluccius* L., 1758) is a demersal species very widely distributed in the Gulf of Lions since the very coastal sector, near 30m depth, until 800 m. The species is mainly present between 80 and 150 m *(47).* Eggs and larvae are present preferentially on the continental shelf with a peak of abundance between 100 and 200 m. The O group is very abundant from June till November between 100-150m.
The higher densities are located on the upper border of the slope *(47)* at depths lower than 200 m *(100).* The age group 1 (15-18cm) is dominant in these same places but can also be met in the coastal zone while the group 2+ occupies the whole shelf with variable but particularly important spatiotemporal concentrations on the border of the continental slope and on the upper part of the canyons *(30, 47, 51).*

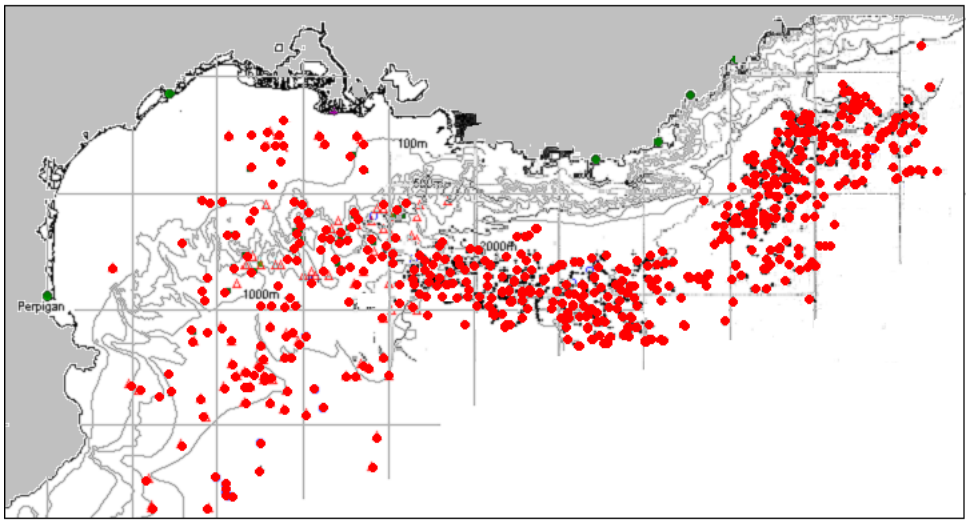
The juveniles do not seem to show a preference for a precise geographical sector but show a distribution varying in time and space between 80 to 150 m depth. The adults are more scattered in spring and in summer than in autumn and winter. They are found from 100 m to areas deeper than 400 m in spring and in summer. However several observations *(51)* suggest an influence of the water of the Rhône river on the biology of the young hakes (5-14cm) as they are mainly concentrated in the area off the Rhône delta. Besides, they have in general a better hepato-somatic index and a better condition factor in that area. This can be explained by the fact that the part of the continental shelf near the delta benefits very probably from a strong primary phytoplanctonic production who could infer a greater production of the essential preys of the juvenile hake.

Annex 3 Shows the spatial distribution of the various age classes of hake in the gulf of Lions for the period 1994-1999.

Small pelagics stocks

Most of the small pelagic species are in general distributed close to the coast, over the continental platform. The majority of these species undertake rather well defined seasonal migrations, which explains the seasonal character of their fisheries. Sardine, anchovy, mackerel and horse mackerel move close to the coast during the summer months, which corresponds to the main fishing period of these species. During the winter they move away from the coast and shift to more or less deeper waters.

Large pelagics: the bluefin tuna *(Thunnus thynnus, Linné,1758)*



4. Status of the resources

In the early 1970s, the demersal resources of the Gulf of Lions were still considered under-exploited *(24).* First diagnoses of overexploitation in this area occurred after the rapid development of the bottom trawling fleet in the mid-seventies *(39, 95).*

Demersal stocks

Trends in populations from "direct" evaluations by experimental trawl surveys:

In the Gulf of Lions, trends in populations during the eleven last years show some contrasted situations *(39).* For this period, nine populations exhibit significant time trends in population abundance, with almost the same number of populations decreasing (4 populations) and increasing (5 populations). The decreasing trends concerned mainly species vulnerable to trawling, like the gurnard *Aspitrigla cuculus* and one of the last species of selacians significantly sampled in the area (*Scyliorhinus canicula*). On the other hand, most of the species whose abundance increased (*Parapenaeus longirostris*, *Spicara flexuosa*, *Spicara smaris*, *Nephrops norvegicus* and *Helicolenus dactylopterus*) are not important trawling target species in the Gulf of Lions. Five species showed a significant increasing trend in mean length, while four species had a decreasing mean length. This decrease may be due to different forcing factors: impact of fishing, strong recruitment, change in survey dates. Concerning *Helicolenus dactylopterus*, an increase of mean length associated with an increase of abundance suggests an improving of the status of the population.
The recent trawl surveys made by IFREMER in the Gulf confirm that there is an east-west gradient and that the average sizes and the abundances of several target species are smaller in the western part of the continental slope, where they are exploited at the same time by the French and Spanish boats, than in the eastern part where the fishing effort effort is less important

.

Status of some stocks from "indirect" evaluations using mathematical models based on the samplings of the demography of the landings and on the knowledge of the fishing efforts and the biological characteristics of the species:

On the basis of the available data most of the demersal stocks are either fully exploited, or overexploited. This conclusion has been first supported by global assessments (GFCM 1988) and more recently by single stock assessments using analytical models (VPA, cohort analysis). Indeed, most of the diagnoses available referring to single stocks have concluded to a high fishing pressure and at a status of full exploitation or overexploitation. It is particularly the case for *Merluccius merluccius* *(3, 7, 57),* or for *Dicentrarchus labrax*, *Sparus aurata* or *Solea vulgaris* *(48)* and Red mullet (*Mullus barbatus*) *(57).*
The available models can only lead to foretell a passage to a state of overfishing, in the best case, if the general tendency to a growing effort of the various segments of the fleet was carried on according to the pattern prevailing during the recent past *(98).* A decreasing trend in the catches per unit of effort of the trawlers can be observed; furthermore in most of the cases a situation of "growth overfishing" leading to low average ages in the stocks is confirmed in a evident way by the observation of a decreasing trend in individual lengths of fishes in the landings *(42).* In general, the juveniles are under the most important fishing pressure. This situation results essentially from the fact that the sizes at first catch are very often similar to those at which fishes appear in the fisheries (recruitment) in particular on the continental shelf where the trawling activity is the most intensive. However, the concerned stocks do not seem threatened by a "recruitment overfishing" which could affect their capacity to be renewed at the current levels *(42).*

The artisanal fleets affect more the adult population, even though there is some degree of overlap.

Hake stock status :

The exploitation levels of the hake stock have been regularly assessed and the results presented to the GFCM Sub Committee for Stock Assessment. Since the first French-Spanish joint assessment of hake *(7),* several assessments with longer data series and more sophisticated procedures have been carried out. In all cases hake populations in the Gulf of Lions appeared to be heavily growth overexploited with serious indications of recruitment overfishing. Although recruitments higher than the average recruitments over the past 10 years have been observed during the very recent years, the last assessment *(66)* has confirmed the existence of a more or less pronounced chronic situation of growth overexploitation, with a risk of recruitment overexploitation in particular in case of a possible development of the exploitation of the spawners on the submarine canyons of the continental slope. The average ages in the stock are low, and the landing sizes of the fishes are decreasing. The fishing mortality is important since the first years of life and particularly high for the age group 1. Fishing mortality is maximum for the group 4 and the main part of this mortality is due to trawlers. Gillnets and longlines are exploiting essentially the adults of 4 and 5 years. The analysis of the yield per recruit shows that the rate of exploitation exceeds the level of maximal biological yield for both sexes. The respect of the legal size and an increase of mesh size to 50 mm would end in the long term in an increase of the yield per recruit and a resulting increase of production of about 6 % for the trawlers and of 30 % for the gillnetters.

The management measures recommended by the GFCM concern a reduction of the fishing mortality by technical measures: reduction of time at sea, of the fishing power, increase of the size at first capture (generalization of the 40 mm square mesh for the trawl nets). Other proposals concern the spaciotemporal closure of the zones of nurseries, and\or spawning areas.

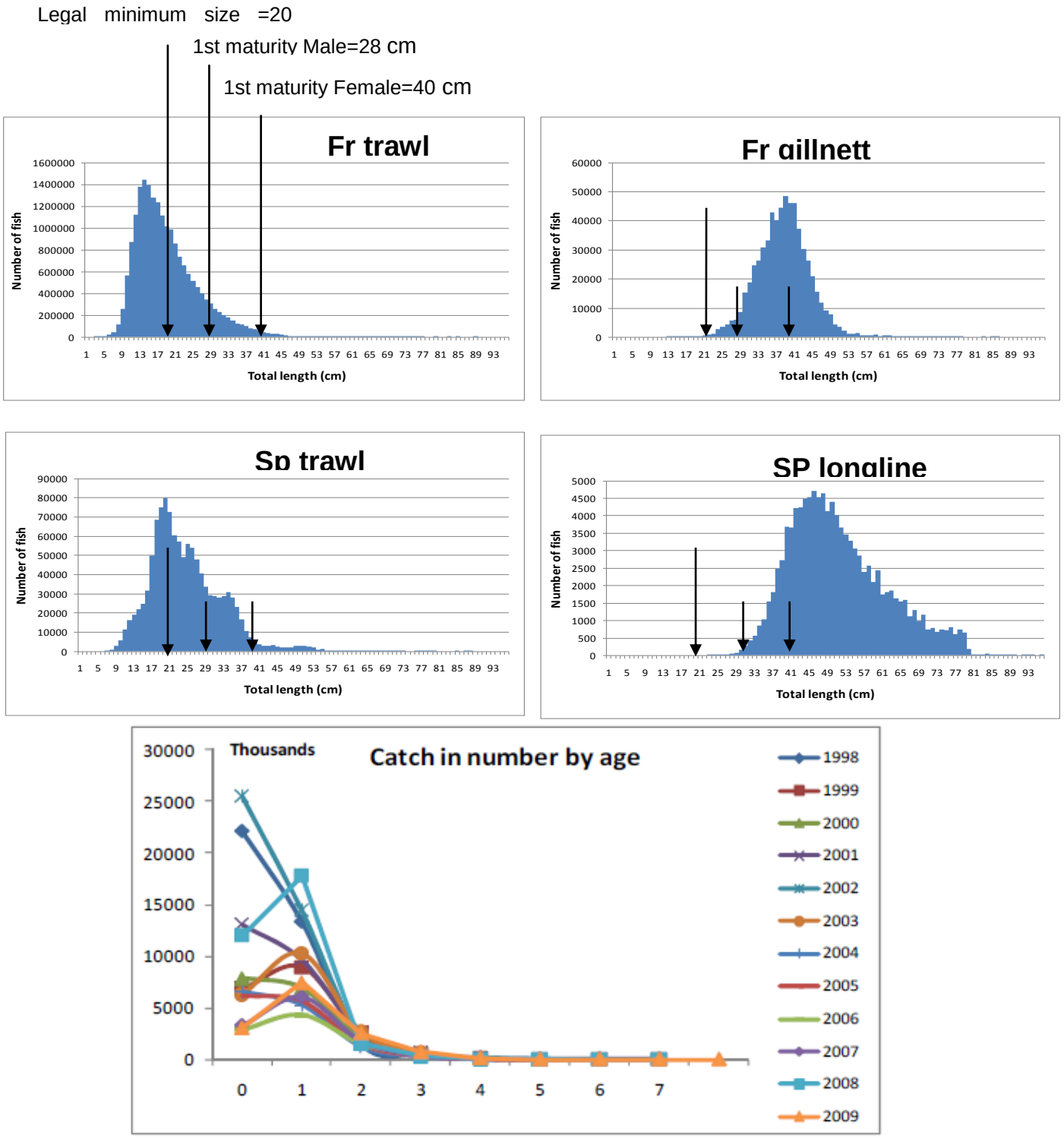
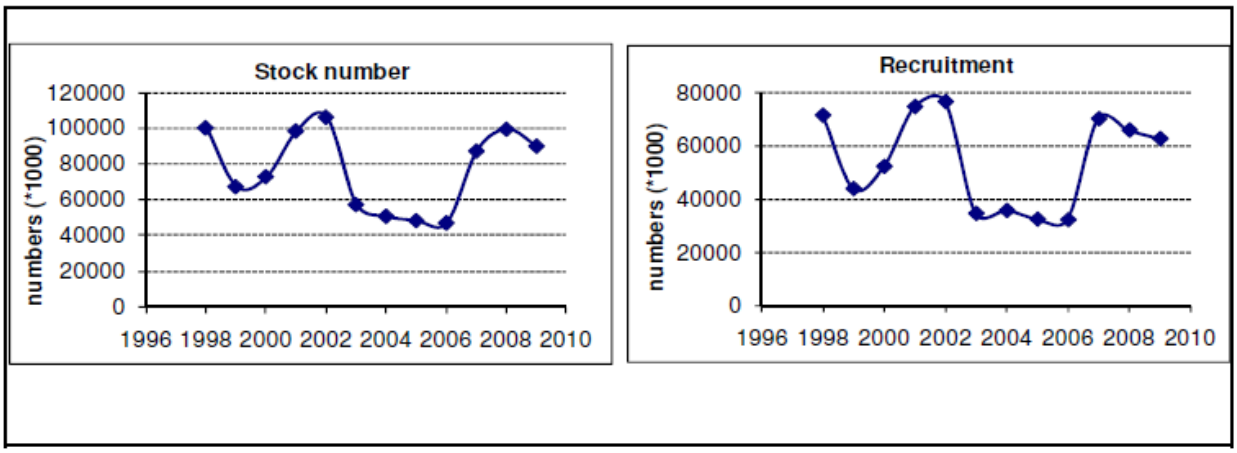


Fig.3- Size frequency distributions of the hakes caught by the French-Spanish fleet

Population in figures



Population in biomass

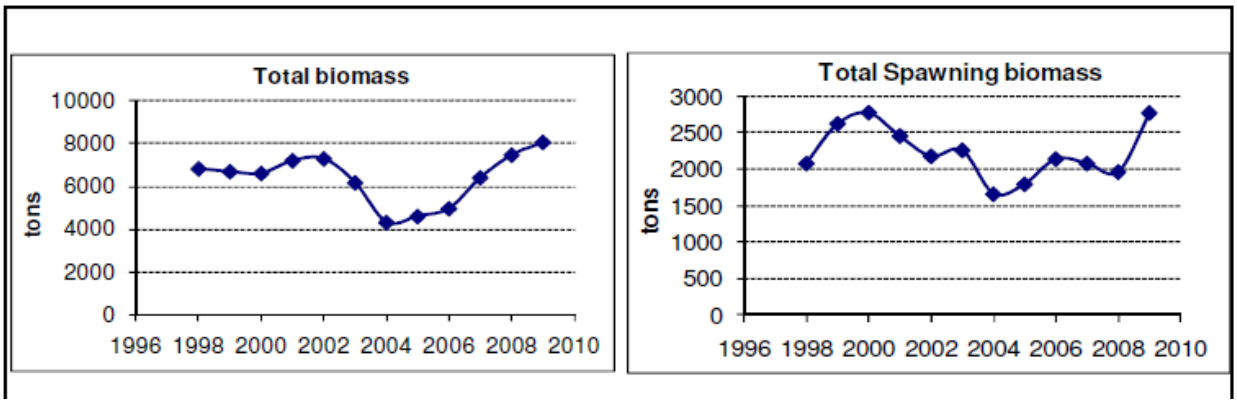


Fig.4- Some results of the hake stock analysis *(66)*

Fishing mortality rates

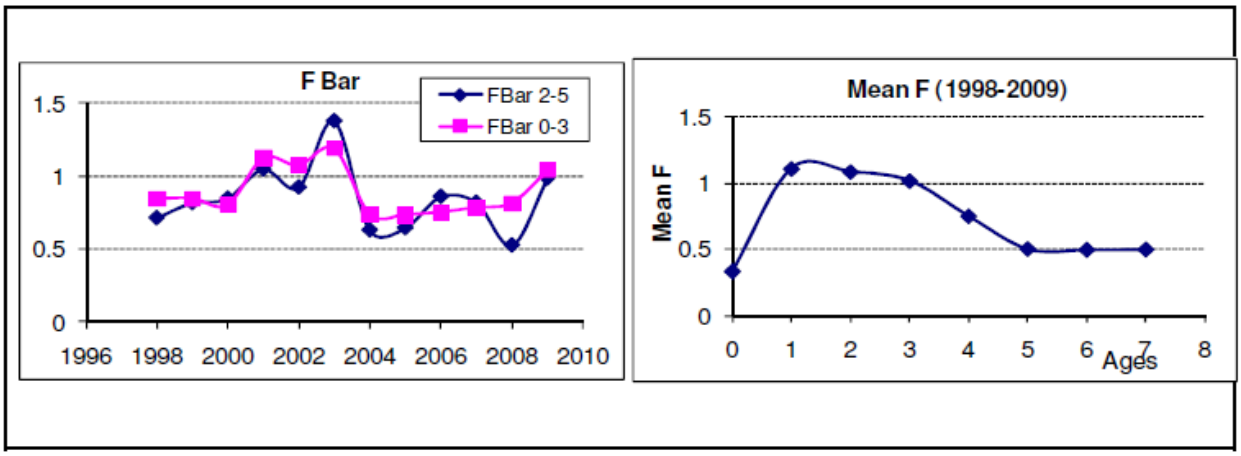


Fig.5- Some results of the hake stock analysis *(66)*

Red mullet (*Mullus barbatus* **) status :**

The analyses realized on this stock are still preliminary *(66),* but the first results show the signals of a status of growth overfishing.

Elasmobranchs (sharks and rays) status:

Differences in life history strategy, as well as initial abundance, could explain the differences between species. *R. clavata* and *R. asterias,* which were the most abundant in the early 70s in the Gulf of Lions, were still sampled in 1994 end of the precise monitoring at the Sète auction market. These two species were still recorded in 2009 but at a very low level. The survey data confirmed that negative changes have occurred in both species in the Gulf of Lions within a30-year period. It showed a reduction in the distributional area of the species which are is now only sporadically fished, a decline of the mean abundance index and a drastic decrease of the landings. Concerns about the sustainability of Rajidae populations in the Gulf of Lions were already addressed by scientists in the late 90's. Since the fishing effort has been increased steadily by the entry in the fleet of more powerful vessels. During the last 3 years, exploitation of demersal resources has increased drastically in the Gulf of Lions due the displacement of the pelagic trawlers towards demersal species as the consequence of the rarefaction of the sardines and anchovies. More recently, several vessels have been operating with twin trawls.

Long-term changes in diversity in relation to the evolution of the trawl fishery in the Gulf of Lions clearly occurred within this systematic group; a clear decline of commercial species took place since the middle eighties, firstly on the continental shelf, later on the slope *(6)* . This decline began on the continental shelf as far back as the sixties and was quite obvious in the year 1980-84. The species diversity was preserved for a longer period on the slope, but recent surveys show the same evolution pattern as on the continental shelf. Decreasing species were mainly fish with some economic value while the best preservation was observed for fish of commercial interest. Marketable species the abundance of which has declined include small sharks as *Mustelus mustelus, M. asterias, Scyliorhinus stellaris* and *Squalus blainvillei* and most of the rays. Only two species of rays, *Raja clavata* and *R. asterias*, being the most abundant and frequent in the area, could be fished during recent years. The situation observed over the last fourteen years regarding *R. clavata*, particularly the decrease of its biomass indices as well as the reduction of its distribution area, may constitute a strong signal of risk for the survival of this species in the Gulf of Lions *(18).*
Conversely, a good resistance of poorly or non commercial species has been verified even in cases of a low level of initial abundance, e.g. the three species of electric rays *Torpedo marmorata, T. torpedo, T. nobiliana* or the angular rough shark *Oxynotus centrina.* Equally, the dogfish, *Scyliorhinus canicula* on the continental shelf and the blackmouth catshark *Galeus melastomus* on the slope, seem to have taken the lead over all other Elasmobranchs. Results obtained from experimental surveys confirm that the decreasing trend in landings observed for sharks and rays is not due to the changes of fishing patterns or target species. It can be directly related to the continuous increasing fishing intensity and it corresponds to a general decline of stocks, the rarest species being no longer caught

Several factors linked to their biology and behaviour contributed to emphasise the impact of exploitation on the growing scarcity of Elasmobranchs. Main biological factors concern specific characters of reproduction compared to those of bony fish: a very low fecundity rate for all species, benthic eggs for oviparous and a very long incubation time (several months and up to twenty two months in the case of genus *Squalus*). Also large size or shoaling behaviour are factors to account with as far as they may increase fish vulnerability

Small pelagic stocks

Large-scale fluctuations in stock size occur for small pelagic resources which are as yet unexplained by science. It is presumed from the general similarity of such changes in several areas that they are environmentally driven, although the decline of some fisheries may suggest that some species are also subjected to excessive fishing.

The more recent available data come from the Ifremer “PELMED” surveys at sea, which cover a zone extending the South of the Ebro river in Spain to the Rhône river in France between the latitudes 43°30'N and 41°10'N and the longitudes 2°10'E and 5°15'E. These surveys consist of a systematic echo sounding prospection on the whole continental shelf of the Gulf of Lions and on the upper part of the continental slope.

Anchovy status *(64, 71)* **:**

The total biomass of anchovy decreased very strongly between 2001 and 2005 and stays at a low level since. The demographic structure of the stock was strongly unbalanced in 2009 and 2010, with a very high proportion of juveniles (80 %) and a low abundance of anchovy of commercial size which were very common before 2007. The dynamics of this population is altered. The 2008 and 2009 age 1 cohorts did not generate the expected abundances of age 2 and 3 for 2009 and 2010. The biomass of 2-years old -or more- fishes is lower than 1 %. Currently very few fishes survive after 2 years. The condition factors, the growth rates and the size at first maturity are significantly and quickly decreasing. The measured fecundity is low and cannot explain the high levels of recruitments observed in this stock in 2008, 2009 and 2010; this suggests the existence of a spawning stock biomass external to the Gulf of Lions. The rates of exploitation were moderated for the anchovy in 2009 and 2010 (10 % on average), due to the very abundances of fishes of commercial sizes and provoke an important shifting of fishing effort on the demersal species.

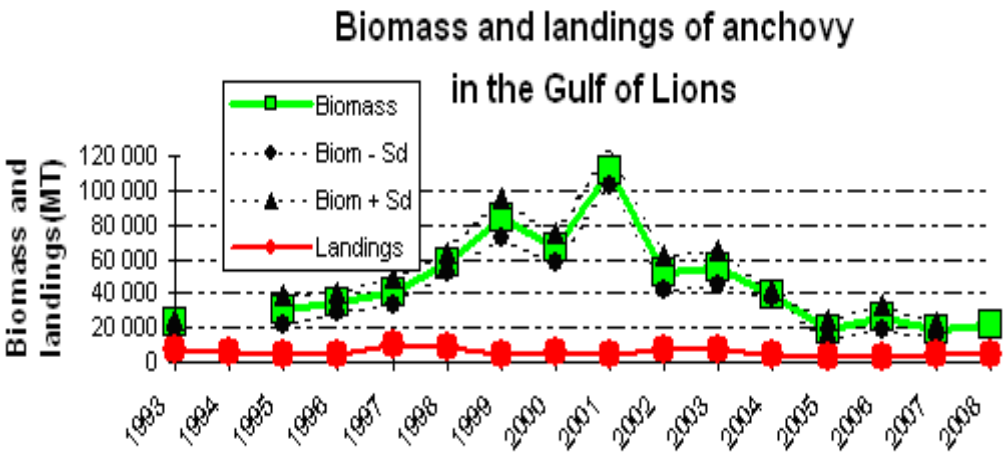


Fig.6- Comparison between calculated biomasses and landings of anchovy for the period 1993-2008

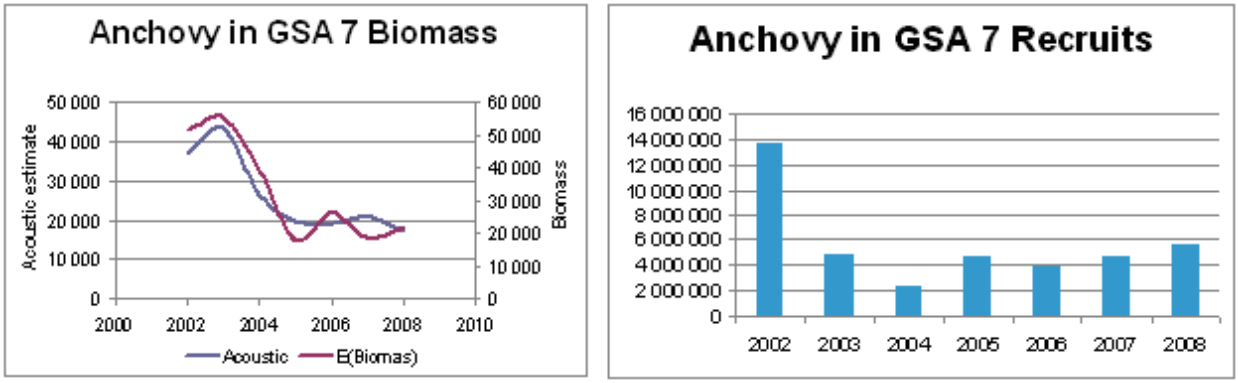


Fig.7- Some results of the anchovy asessments

Sardine status *(64, 71)*:

The total biomass of sardine has reached the lowest level of the period 1998-2010 (approximately 50 000 tons), after a peak in 2005. The spawning stock biomass is in constant decline since 2005 and was estimated at less than 5000 tons for 2010. The demographic and biological indices obtained in 2009 and 2010 indicate major demographic changes: 80 % of the biomass consisted of fishes of age 0 and the biomass of 2 years old fishes -or older ones- is lower than 1 %. The condition indices, the growth rates and the size at first maturity decrease significantly and quickly during the last 3 years. Like for the anchovy, the low fertility is contradictory with the high levels of recruitments observed in this stock in 2008, 2009 and 2010; like for the anchovy this result suggests the existence of a spawning stock biomass external to the Gulf of Lions. The rates of exploitation were moderated for the anchovy in 2009 and 2010 (10 % on average), due to the very abundances of fishes of commercial sizes and provoke an important shifting of fishing effort on the demersal species.

Consequently the fishing effort and the level of catches have been gradually reduced during the first half of 2009 and most of the boats stopped their activity on the sardine at the end of 2009. In 2010, the fishing effort on this species has been reduced to an exploratory activity.

A low value species, the sprat (*Sprattus sprattus*) which appeared in large quantities in 2008 in the Gulf of Lions seem to continue to colonize the places where the big sardine was present and its biomass has increased regularly from 5000 tons in 2008, to 8000 in 2009 and 14 000 in 2010.

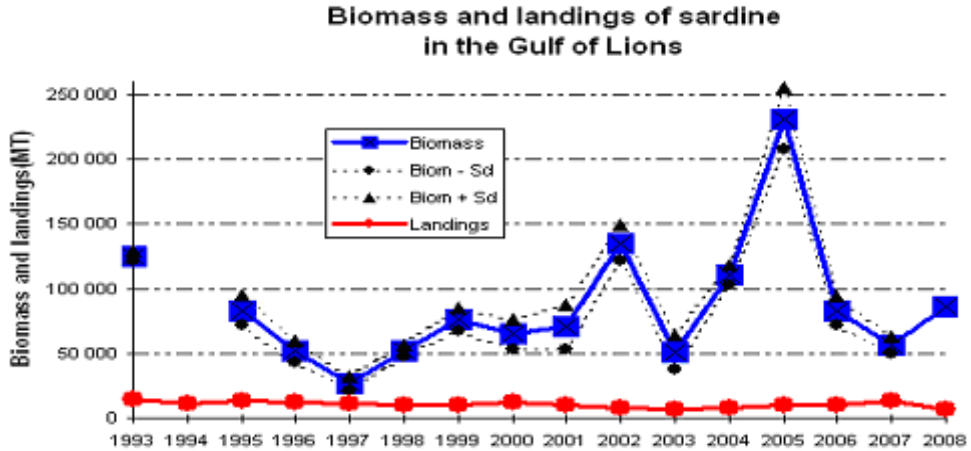


Fig.8- Comparison between calculated biomasses and landings of sardine for the period 1993-2008

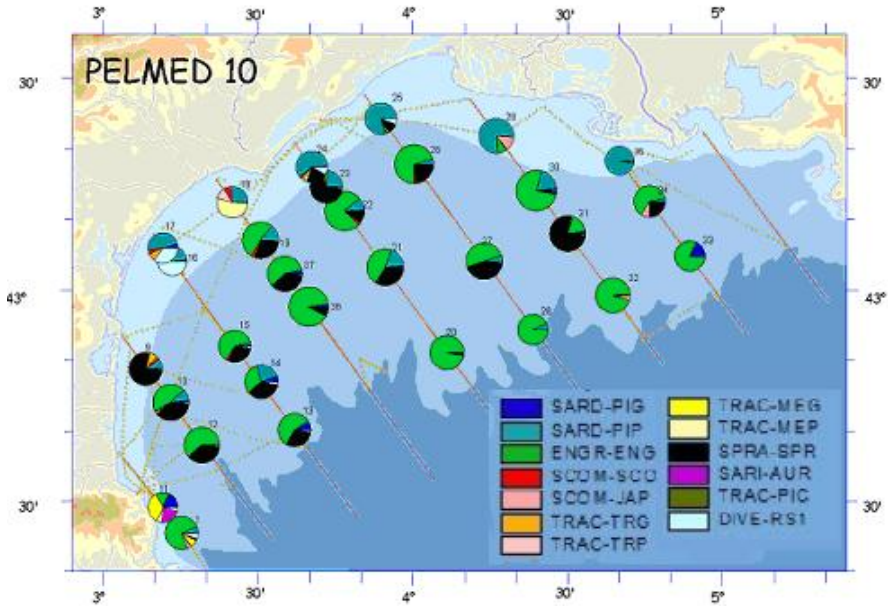


Fig.9- Distribution of the small pelagic species in 2010

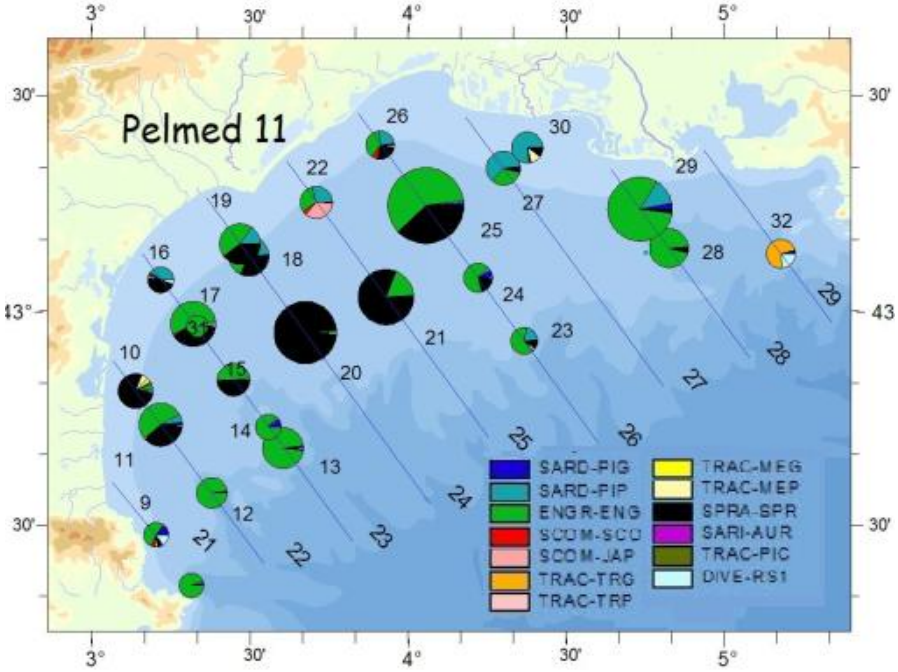


Fig.10- Distribution of the small pelagic species in 2011

The resources of the eastern part of the Gulf of Lions

The scientists working on the North Western Mediterranean Fisheries know that a relatively untouched spawning stock must exist somewhere, otherwise they cannot explain the situation of “sustainable overfishing” on juveniles, because the recruitment sustaining that fishery appears to be more or less constant. From several decades the fishing effort is

heavier on the western part of the gulf (i.e. near the boundary between France and Spain) due to the fact that the Spanish regulation do not allow its boats to stay at sea more than 2 consecutive days, which is not a sufficient time to reach the eastern part of the gulf, fish there and come back. In fact the western part of the gulf is particularly overexploited as shown by the data of the trawl surveys which indicate that the abundance indexes of many commercial species are much lower in the West than in the East (annex 6).

The lower shelf and slope of the Gulf of Lions is a spawning zone for many fish species. This has been confirmed by several French and Spanish scientific cruises realized in the gulf of Lions during the last ten years.

Accurate data on fish assemblages in the area was obtained during scientific cruises performed between 300 to 700m depth in the canyons of the continental slope in the eastern part of the Gulf of Lions**.** The presence of large mature individuals of several species of fishes and crustaceans has been particularly observed in a 598 NM^2 zone bounded by lines joining the following geographic coordinates: 42°40'N, 4°20' E; 42°40'N, 5°00' E; 43°00'N, 4°20' E and 43°00'N, 5°00' E, including three submarine canyons *(18)* (annex 6). A total of 88 fish species were recorded, of which 12 are priority species for the GFCM. Up to 17 species accounted for 90% of the biomass caught during these surveys. The available data show that individuals from species of high economic importance particularly relevant to fisheries like hake, monkfish and Norway lobster occurring in the area are large adult specimens; furthermore the yields obtained for several species of fishes and crustaceans of high economic importance (*Lophius piscatorius, Nephrops norvegicus, Aristeus antennatus, Merluccius merluccius, Trigla lyra* and *Lepidorhombus boscii)* are higher than the ones registered at the same time in the landings of the commercial French and Spanish fisheries (annex 6).

From 20 years it has been supposed that some of the most important Mediterranean fisheries are based (as opposed to the Atlantic Ocean) on the spawners refugia paradigm, meaning the existence of untouched spawners that supply juvenile recruits to the nearby fishery on the continental shelf *(25)* and the right way to manage fisheries has been presented according three simple indicators: “let them spawn, let them grow and let the mega-spawners live” *(52).* In fact large females are much more fecund because the number of eggs increases exponentially with length in most species. Their eggs also tend to be larger, thus giving a greater chance of survival to larvae. Furthermore reaching old ages is usually a sign of overall individual fitness and thus these mega-spawners are reservoirs and distributors of desirable genes.
The presence of reserves of spawners is of paramount importance to guarantee the sustainability of fisheries, and the exploitation of such reserves would impact very negatively on the whole fishery. The importance of the area as a refuge for spawners and even megaspawners is reinforced by the fact it is still relatively untouched by commercial fleets because it is difficult to trawl in such canyons which often exhibit very important slopes, attaining in some cases more than 20º, and local areas around the canyon heads with cliffs. The zones inter-canyons are less rough with slopes of 2º-3º between 180 and 2000 m. Until recent times trawling and bottom long-activity was limited mostly due to the inaccessibility of these deep zones, but due to the recent development of high technology fishing equipment, an increase of the fishing practices can be expected in the area.

This is why the establishment of a fisheries Restricted Area has been proposed to the General Fisheries Commission for the Mediterranean which mandate is to manage fisheries in the international waters ; in fact this area is located in international waters, outside of the Spanish Fishing Protected Area and inside the French “Zone de Protection Ecologique”. A part of the FRA corresponds to a depth beyond 1000 m, for which from 2005 a GFCM recommendation prohibit the use of towed dredges and trawling.

The FRA has been created officially in march 2009 (annex 6) and it has been adopted in conformity with the GFCM Agreement that the fishing effort for demersal stocks of vessels using towed nets, bottom and mid-water longlines, bottom-set nets shall not exceed the level of fishing effort applied in 2008 in the area.
Members and cooperating non-Members of GFCM shall communicate to the GFCM secretariat the list of vessels that have used towed nets, bottom and midwater longlines, bottom-set nets in the area together with the number of fishing days exerted by each vessel in the year 2008 and number of fishing days exerted in the fishery restricted area. They also shall indicate the legal conditions, as in force at 31 December 2008, as for the maximum time of daily fishing activity, the maximum number of days a vessel can stay at sea as well as the compulsory timing between the exit and return to the registered port of their fishing vessels.
These data will allow establishing a register of the fishing vessels authorized to fish in the area which ensure that the vessels not having records of fishing in the area prior 31 December 2008 are not authorized to start fishing therein.

Members and cooperating non-Members of GFCM shall ensure that fishing vessels operating in the area respect their obligation as in force at 31 December 2008 as for the maximum time of daily fishing activity, the maximum number of days a vessel can stay at sea as well as the legally compulsory timing to exit and return to the registered port. They also shall call the attention of the appropriate national and international authorities in order to protect this area from the impact of any other human activity jeopardizing the conservation of the features that characterize this particular habitat as an area of spawners’ aggregation.
The boundaries of the area and conditions to fish therein may change on the basis of SAC advice when additional information will be available.

In order to increase the protection of spawning aggregations on the continental shelf edge and slope the GFCM Scientific Advisory Committee is requested to continue its work by extending the scope of advice to the entire canyons system in the French and Spanish northwestern Mediterranean coast. In order to reach this goal the next steps will be to carry out an analysis of the available information on distribution of spawning aggregations and nurseries areas of the main demersal stocks on the shelf edge and continental slope and to evaluate the biological effects and the possible socio-economic effects of a fishing effort displacement as a consequence of the establishment of one or more fishery restricted areas in the canyons system. Finally the SAC Intend to establish a multi-annual work programme for the extension of its advice to other canyons in the Mediterranean.

A proposal of FRA covering the Cap Creus Canyon (GSA 06: Northern Spain) was submitted to the GFCM Secretariat by WWF on the 9th October 2007. This first version was initially reviewed by the Sub-Committee on Marine Environment and Ecosystems (SCMEE), at its eighth session (Kavala, September 2007), without reaching consensus on its formal

adoption. The proposal was draw up according to a standard format proposed during the Workshop on MPAs (Tunisia, May 2007) and adopted by the GFCM-SAC Sub-Committee on Marine Ecosystems and Environment (SCMEE). A new version of this proposal was then submitted to the Tenth session of SAC (Cyprus, October 2007) for consideration, taking into account the comments and views submitted by the SCMEE experts to the Coordinator of the Sub-Committee with the aim to improve this proposal before its submission. The EC delegate noted that, aside the issue of procedure, scientific information on the deepsea corals aggregations for the above mentioned proposed FRA, could have been collected outside the concerned area and, that most of the area was already covered by the Recommendation GFCM/2005/1 prohibiting the use of towed nets and dredges beyond 1 000 metres. The Spanish Delegate further informed the Committee that his Government was about to present a joint proposal from the Ministry of Environment and the Ministry of Agriculture and Fisheries to the European Commission to protect the Cape of Creus canyon head and the surrounding area identified as “Spanish proposal for a Marine Protected Area off the Cape of Creus”

The text of the proposal submitted to the GFCM is presented in annex 7.

5. Production

The major part of the landings from the Gulf of Lions are done by the trawlers; during the last decade they were composed of around 1/3 of demersal fishes molluscs and crustaceans and around 2/3 of small pelagic species, mainly sardine and anchovy. According to the FAO FISHSTAT database this production fluctuates since thirty years between 30000 and 40000 tons per year (tab.5, fig.11)

	1995	1996	1997	1998	1999	2000	2001
Spain demersals	2565	2666	2305	1988	1055	2991	2268
Spain S.Pelagic	0	776	1115	1207	707	707	1024
Spain All spp.	2565	3442	3420	3195	1762	3698	3292

France demersals	4993	5777	7985	8070	8071	8307	9669
France S pelagics	19718	10902	14073	15308	21978	26969	24265
FranceALL sp	26277	17994	23616	24936	32633	38618	36836

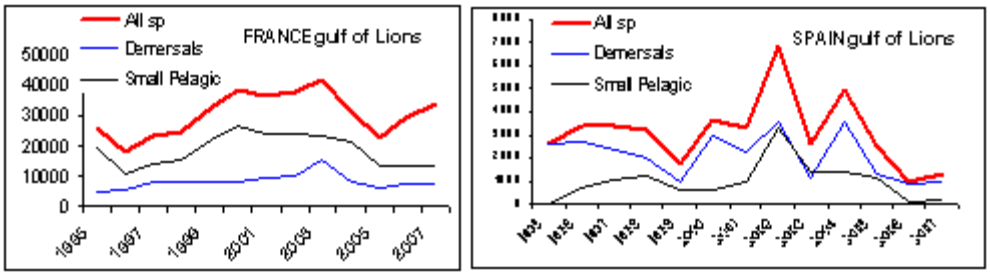
FR+SP, S Pelagics	**19718**	**11678**	**15188**	**16515**	**22685**	**27676**	**25289**
	72,29%	*58,04%*	*59,61%*	*62,15%*	*71,31%*	*71,01%*	*67,93%*
FR+SP, Demersals	**7558**	**8443**	**10290**	**10058**	**9126**	**11298**	**11937**
	27,71%	*41,96%*	*40,39%*	*37,85%*	*28,69%*	*28,99%*	*32,07%*
FR+SP Total All sp	**27276**	**20121**	**25478**	**26573**	**31811**	**38974**	**37226**

	2002	2003	2004	2005	2006	2007
Spain demersals	3551	1171	3539	1361	858	1055
Spain S.Pelagic	3277	1416	1416	1153	163	215
Spain All spp.	6828	2587	4955	2514	1021	1270

France demersals	9982	15457	7663	6324	7564	7525
France S pelagics	24161	23657	20888	13775	13776	13775
FranceALL sp	37760	41909	31289	22499	29699	34000

FR+SP, S Pelagics	**27438**	**25073**	**22304**	**14928**	**13939**	**13990**
	66,97%	*60,13%*	*66,57%*	*66,02%*	*62,34%*	*61,99%*
FR+SP, Demersals	**13533**	**16628**	**11202**	**7685**	**8422**	**8580**
	33,03%	*39,87%*	*33,43%*	*33,98%*	*37,66%*	*38,01%*
FR+SP Total All sp	**40971**	**41701**	**33506**	**22613**	**22360**	**22570**

Tab.5- Landings of demersals and small pelagic species caught during the period 1995-2007



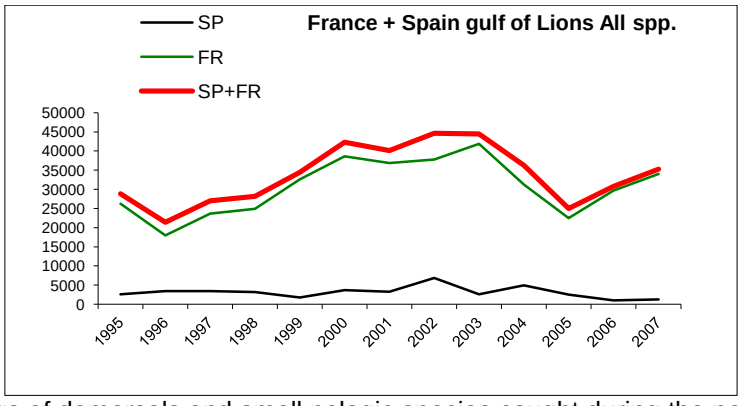


Fig.11- Landings of demersals and small pelagic species caught during the period 1995-2007

Demersals species:

The trawlers fishery exploits a highly diversified demersal species assemblage: Hake (*Merluccius merluccius*) Striped mullet (*Mullus barbatus*), Red mullet (*Mullus surmuletus*), Angler (*Lophius piscatorius*), Black-bellied angler (*Lophius budegassa*), European conger (*Conger conger*), Poor-cod (*Trisopterus minutus capelanus*), Fourspotted megrim (*Lepidorhombus boscii*), Soles (*Solea spp*.), horned octopus (*Eledone cirrhosa*), squids (*Illex coindetii*), Gilthead seabream (*Sparus aurata*), European seabass (*Dicentrarchus labrax*), Seabreams (*Pagellus spp*.), Blue whiting (*Micromesistius poutassou*), and the Tub gurnard (*Chelidonichtys lucerna*) are among the most important species caught *(42, 63).*

Some economic elements

In 2008, 19 % of the revenue of the bottom trawlers fleet resulted from landings of hake *(85).* The rest of the turnover resulted mainly from captures of octopuses (11 %), and from sea bass (8 %), squids (7 %) sole (6 %), sea breams (5 %) other species (44 %). Regarding the pelagic trawlers, this fleet depended mainly on the anchovy (44 % of the revenue) and of the sardine (31 %) while10 % of their revenue resulted from landings of hake.
The revenue of the French gillnetters operating offshore (> 3 miles) in 2008 where composed of hake (10 %), sea breams (7 %), bonitos (7 %), scorpion fishes, congers (5 %) and miscellaneous 71 %). For the gillnetters operating in the coastal zone (<3 miles) 38 % of the revenue came from hake. The rest resulted mainly from gilthead sea bream (11 % of captures in weight), of sea bream (6 %), sole (6 %), horse mackerel (5 %), mackerel (7%) and other species (27%).

Regarding the Hake the available data series for the period 1998-2009 (tab.6, fig. 12) indicate the yearly landings of this species by the French-Spanish fishery of the Gulf of Lions

have fluctuated between 1300 to 3800 tons following however an overall 20% decreasing trend during the period *(66).* As indicated before the overall fishing capacity of the trawlers fleet has shown in these last 10 years a progressive decrease; the number of French trawlers decreased of about 30% on the period. Most of the catches (70%) correspond to French trawlers with an average size of 20 cm, followed by French gillnetters 15%, average size 39 cm), Spanish trawlers 8%, average size 25 cm), and Spanish long-liners 7%, respectively, average size 54 cm).

	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
FR Trawl	1688	1525	1347	1835	2168	2024	1023	1002	1014	1282	2071	1642
FR Gillnett	500	500	500	500	182	248	99	255	299	168	111	286
FR Total	**2188**	**2025**	**1847**	**2335**	**2350**	**2272**	**1122**	**1257**	**1313**	**1450**	**2182**	**1928**
SP trawl	140	279	166	196	231	206	101	125	116	108	192	258
SP Longline	101	109	285	163	146	112	78	101	170	146	97	83
SP Total	**241**	**388**	**451**	**359**	**377**	**318**	**179**	**226**	**286**	**254**	**289**	**341**

Tab.6- Hake catches 1998-2009

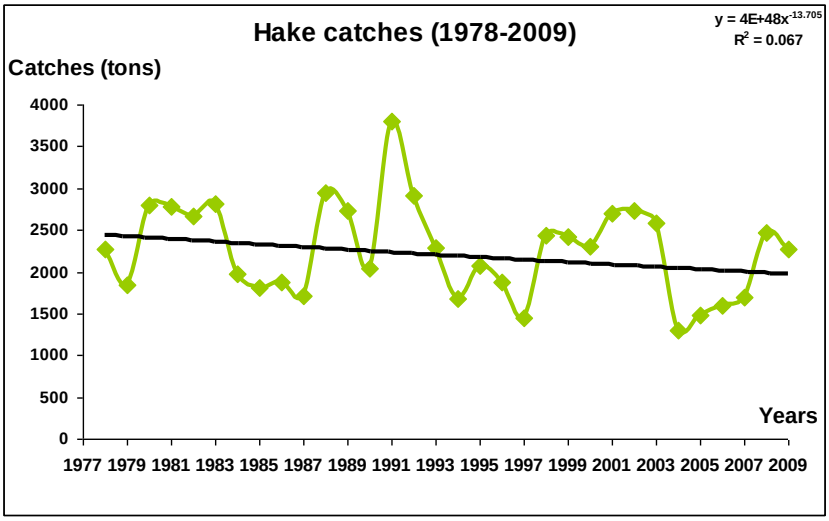


Fig.12- Hake catches 1998-2009

Small pelagic species *(68)* **:**

Before 1960, the landings of small pelagic species by the French fleet were of the order of 2000 tons / year. This production which consisted in 90 % of sardines (fished almost at night with “lampara” nets) increased then quickly up to around 20000 and remained at this level during about twenty years, with some interannual fluctuations.

From 1973 took place a progressive replacement of the lampara purse seiners by trawlers using big vertical opening nets. From 1987 the production of anchovy increased regularly during ten years; indeed the cumulated French-Spanish fishing effort practically doubled during this period as a result of the arrival in the Gulf of Lions of a group of 80 Spanish boats from Catalonia, from the province of Murcia, Andalusia and the region of Valencia. This fleet left the area after some years and since 1997 the production of anchovy and sardine of the Gulf of Lions followed a decreasing trend (tab. 7) as a result of the size of the fleet and the biomasses of the stocks.

Anchovy	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Catch	10000	8000	5000	6000	4769	6941	7073	4497	2249	2125	4133	4003

Sardine	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Catch Trawl	8590	8050	7850	9650	10337	7036	6106	6825	7435	8301	11000	5740
Catch Purse seine	2410	1950	2150	2350	1611	727	1005	668	2037	2083	2340	1000
Total Catch	**13000**	**10000**	**10000**	**12000**	**11948**	**7763**	**7111**	**7493**	**9472**	**10384**	**13340**	**6740**

Tab.7- Production of sardine and anchovy for the period 1997-2008

6. Discards and Waste Accumulation

There is no reliable quantitative information on the nature and quantities of discarded animals by the trawlers operating in the Gulf of Lions. However some field observations are on progress in the frame of the achievement of the data collection framework of the EU the scientists participating to this sampling on board the professional fishing boats indicate that the discards of non commercial species or undersized fishes by the trawlers are very low in the area. The artisanal fishery does not produce significant discards due to the higher selectivity of their gears.

The discharge of offshore waste can have more important ecological consequences: mortality of plants or animals by constrictions or drowning captures in the lost nets ("ghost fishing"), physical damage by ingestion, liberation of associated chemicals and alteration of certain benthic communities.
The distribution and abundance of large marine debris have been investigated on the continental slope and bathyal plain of the northwestern Mediterranean Sea during 3 oceanographic cruises undertaken in June 1994, July 1995 and April 1996 (55, 55b). Different types of debris were enumerated, particularly pieces of plastic, plastic and glass bottles, metallic objects, glass and diverse materials including fishing gear. The results showed considerable geographical variation, with concentrations ranging from 0 to 78 pieces of debris ha^{-1}. In most stations sampled, plastic bags accounted for a very high percentage (more than 70%) of total debris. In the Gulf of Lions, only small amounts of debris were collected on the continental shelf. Most of the debris was found in canyons descending from the continental slope and in the bathyal plain, with high amounts occurring to a depth of more than 500 m. An additional cruise was undertaken using the manned submersible Cyana

(provided by IFREMER). Sixteen dives where conducted in canyons off Marseille and Nice (France) ranging from 40 to 1448 m in depth.
For a total continental shelf area of 12000 km2 (from 0 to 200 m in depth), the data collected allowed an estimation of 1.188 million pieces of debris, 77% of which were plastics, including 92.8% bags. For 1995, the estimated amount of debris for the Gulf of Lions was 1.334×10^6. The 1994 and 1995 cruises yielded estimated total amounts of 26.84 t (1994) and 30.16 t (1995) of plastics on the continental shelf of the entire gulf. In comparison with the total quantity collected in the entire continental shelf from the northwestern Mediterranean Sea (Galgani et al.1995), these amounts were very low. However, these results concern only those areas in which trawling operations could be carried out (Figure 13, 14).
The average abundance of the waste in the Gulf of Lions can be compared with the values of abundance for certain demersal species: these quantities of waste exceed the biomass of certain species (107). On the other hand the evolution of the quantities of waste in time (Figure14) in the Gulf of Lions shows a significant decreasing trend.

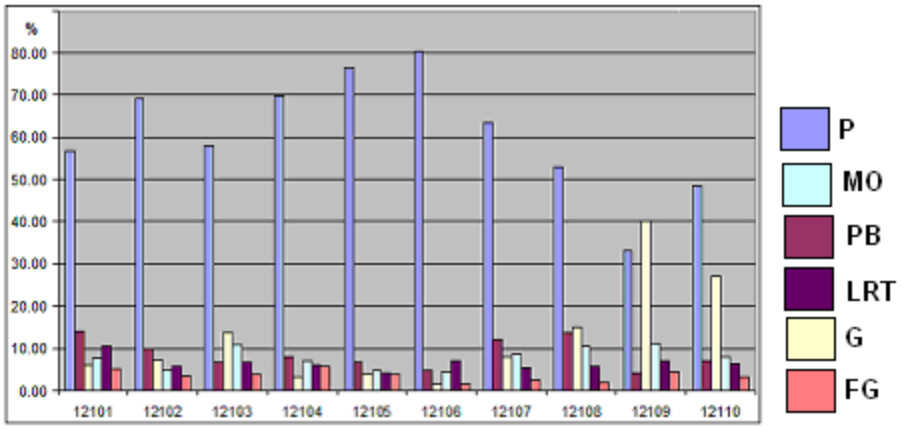
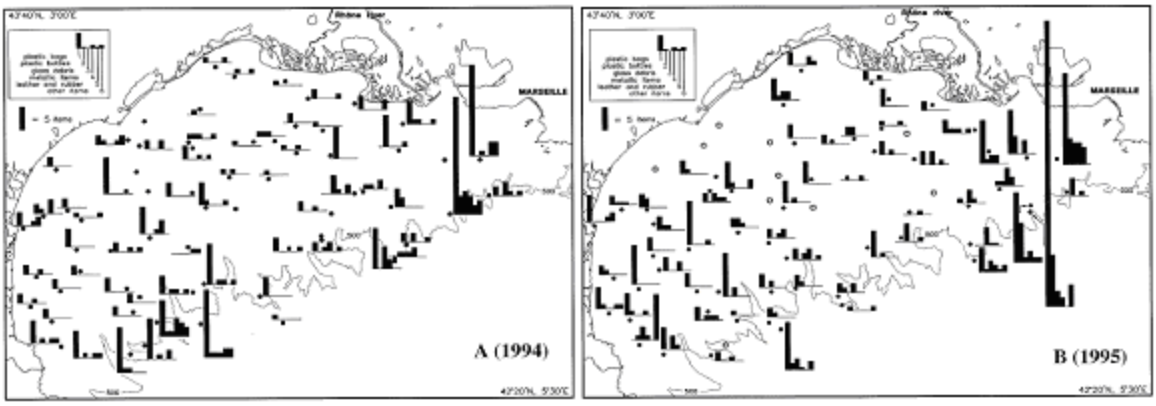


Fig. 13 Typology of the waste of the continental shelf and the continental slope of the Gulf of Lions. Analysis by stratum. Given in percentages (P: Plastics; PB: plastic bottles; G: Glass; MO: metallic objects; LLT: leathers, rubber, tissues; FG: fishing gear



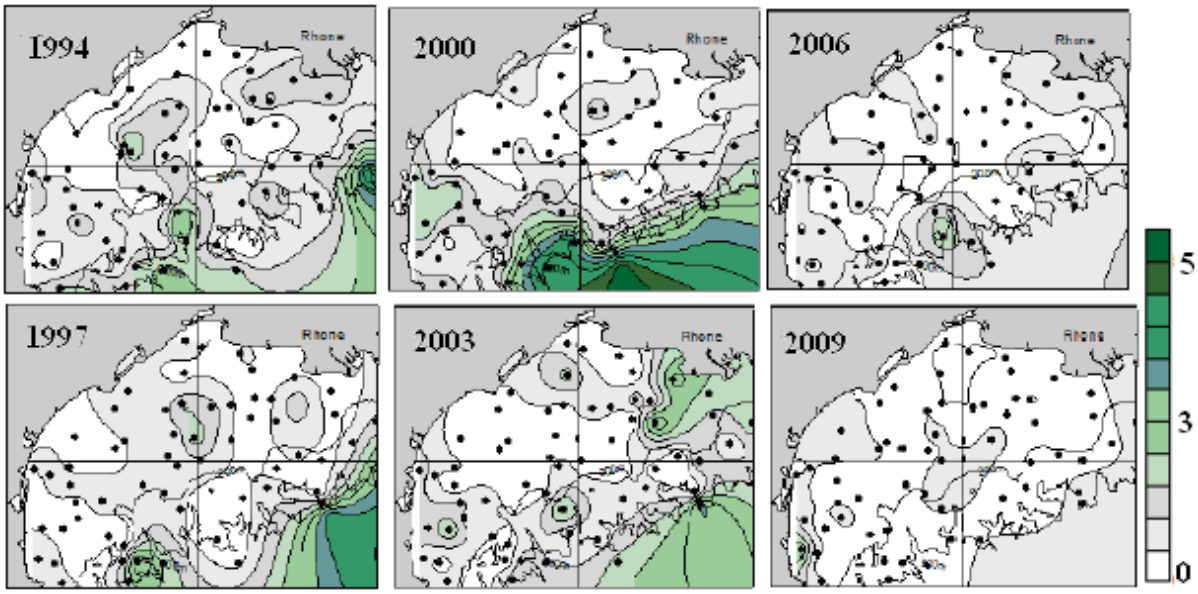


Fig. 14 Evolution of the densities of total waste in the Gulf of Lions between 1994 and 2009. Density by hectare. Surveys IFREMER / MEDITS

7. Regulations, Management

The Mediterranean French and Spanish fisheries are managed through licensing systems and they are subordinated to a large number of specific technical measures: characteristics and conditions of use of the fishing gears, minimum legal sizes of the species, fishing seasons and sectors. These regulations are more or less respected. Besides, the European Union adopted recently a regulation concerning the harmonization of the technical measures applicable to all the EU Mediterranean fleets.

French Management measures for trawlers and purse seiners *(9, 40)*

To control the fishing effort the French Administration established in 1988 the "Permis de Mise en Exploitation" (PME). It is delivered by the Direction des Pêches Maritimes et de l'Aquaculture (DPMA) for the ships of more than 25 meters and by the Direction Inter Départementale des Affaires Maritimes for those of less than 25 meters.

The licensing system limit the number of ships authorized to fish.
For the trawlers these licenses are managed at the national level by the DPMA. The same license allows practising the pelagic trawling and the demersal trawling. For the purse seiners targeting the small pelagics the licenses of the ships of more than 24m are managed at the national level by the DPMA. The licenses for the smaller purse seiners are managed at the regional Fisheries Committees level.

Technical measures:
Trawl net with 4 panels: netting with 20mm rhombohedric mesh size. Operate beyond the 3 nautical miles coastal area, between surface and bottom and target mainly the sardine and

the anchovy, with secondary catches of other pelagic and demersal species (mackerels, hake etc.).

Bottom trawl net: two panels of opening. Netting with 50 mm rhombohedric mesh size. Target the demersal species and capture additionally small pelagics. Trawling is prohibited at less than 3 nautical miles from the coastline.

Trawling operated by two boats dragging one single net ("chalutage en boeuf") prohibited.

Duration of the fishing restricted to the period from 3 am to 7 pm. Fishing operation prohibited on Saturdays and Sundays (except for the lampara purse seiners that have a very short fishing season). No fishing during some particular holidays.
Number of fishing days limited at 250 days/year
Technical measures: engine power of the trawlers limited to 316kw, overall boat length limited to 25m.

Trawling prohibited at depth greater than 1000m

Purse seine for small pelagics: night fishing with attracting lights ("lamapara"), or fishing during the day using echo sounders. 500 to 800 m nets with 14mm meshsize. Target mainly the sardine.

Also: Minimum legal sizes for the main commercial species.

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108 Stein A. , 1984. - Contribution à l'actualisation de l'étude statistique de la pêche à la sardine dans le golfe du Lion : applications des modèles globaux de SCHAEFFER ET FOX. Univ. Tech. Languedoc, DEA écologie, option écologie aquatique. 41 p

109 Sylla G., 2001.-Variabilité saisonnière dans les pratiques de pêche des chalutiers du port de Sète. Faculté des sciences et techniques, Université de Corse : 32p. + annexes

110 Tito De Morais, Bodiou J.Y. et Labat J.P., 1986.- Nurseries de Pleuronectiformes du golfe du Lion, répartition, capacité trophique. ATP "Déterminisme du recrutement".- CNRS, sect. TOAE, section 19.

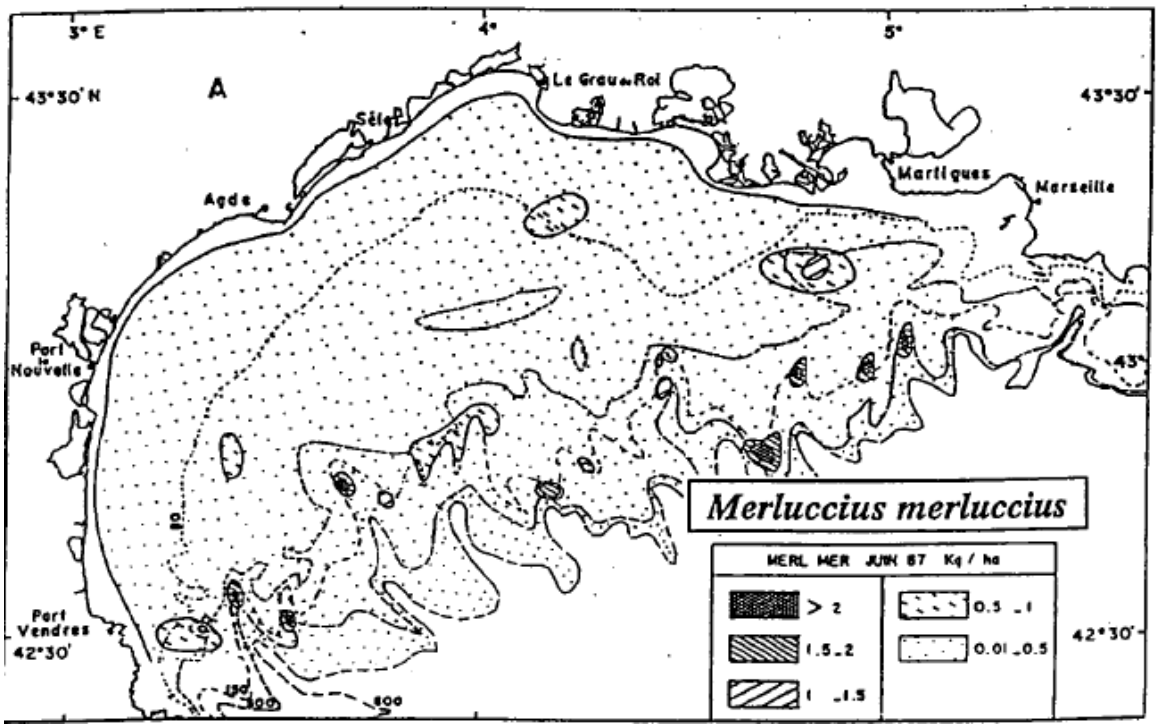
111 Tournier H. , 1975. - Etude statistique de la pêche de la sardine dans le golfe du Lion. Inst. Pêches marit., rapport int.,16 p

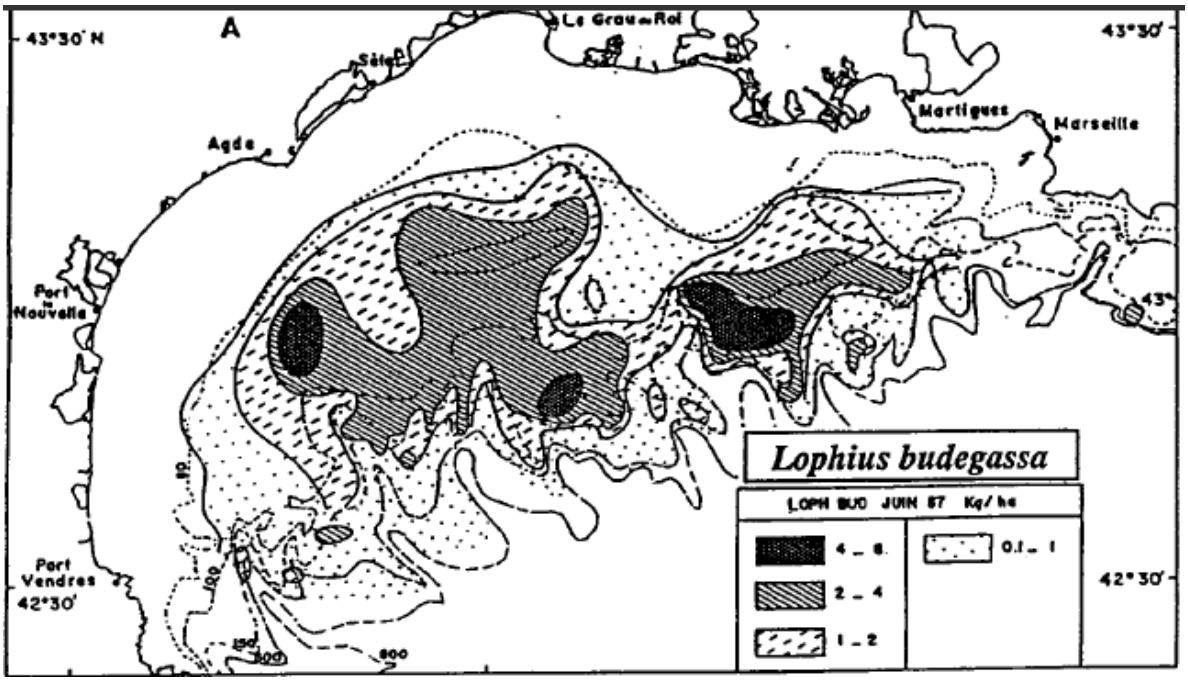
112 Tournier H. et H. Farrugio, 1981. - Modèles de production globaux pour le stock de sardines du golfe du Lion. Inst. Pêches marit., doc; int., 9 p

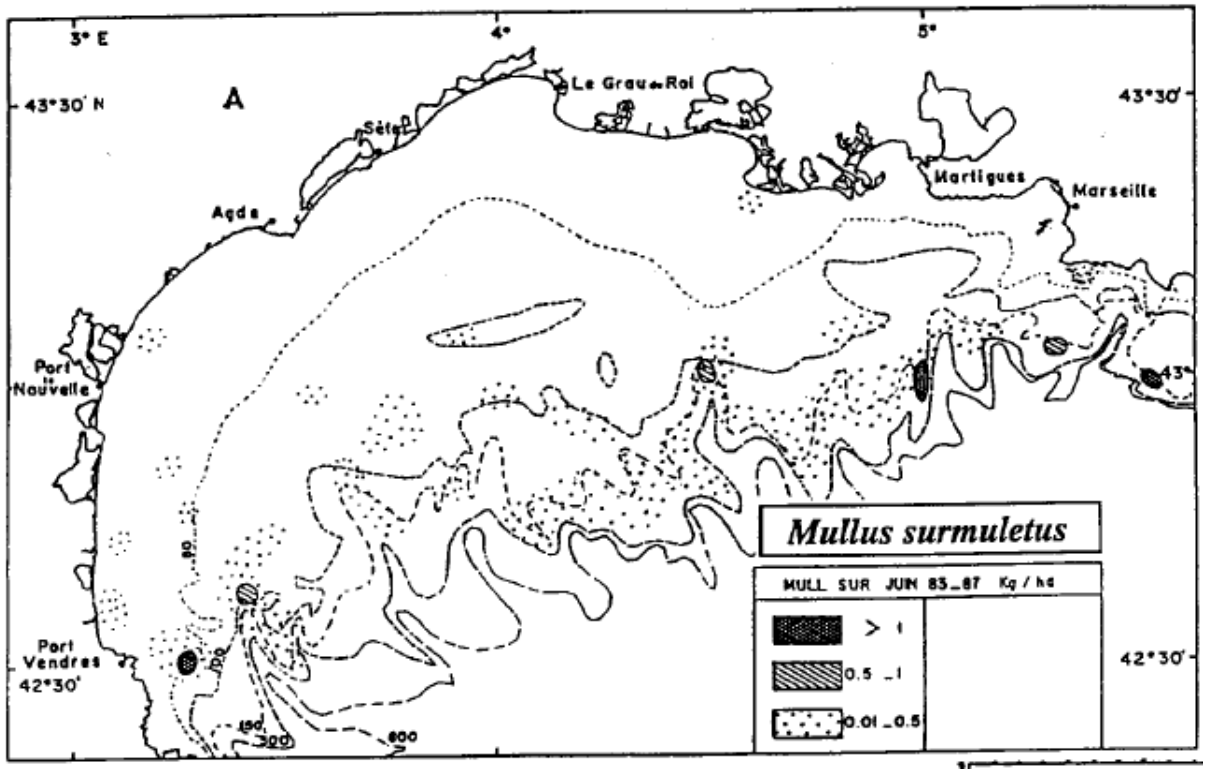
ANNEX 1

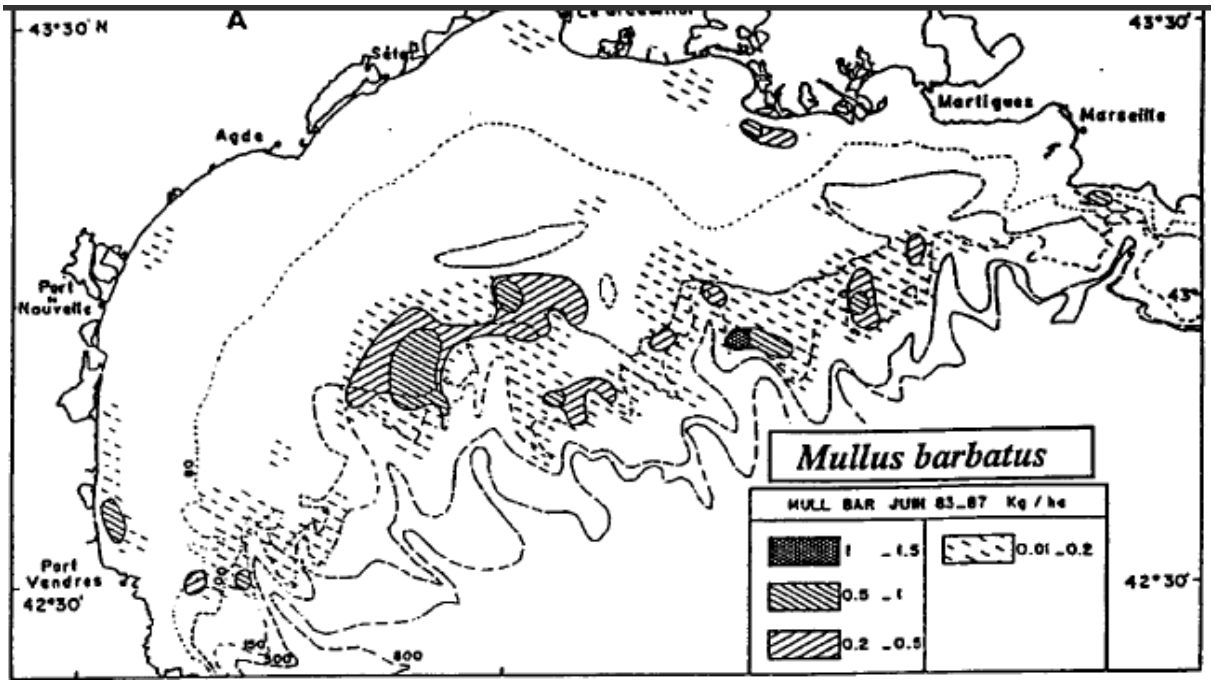
Geographical distribution of some main species

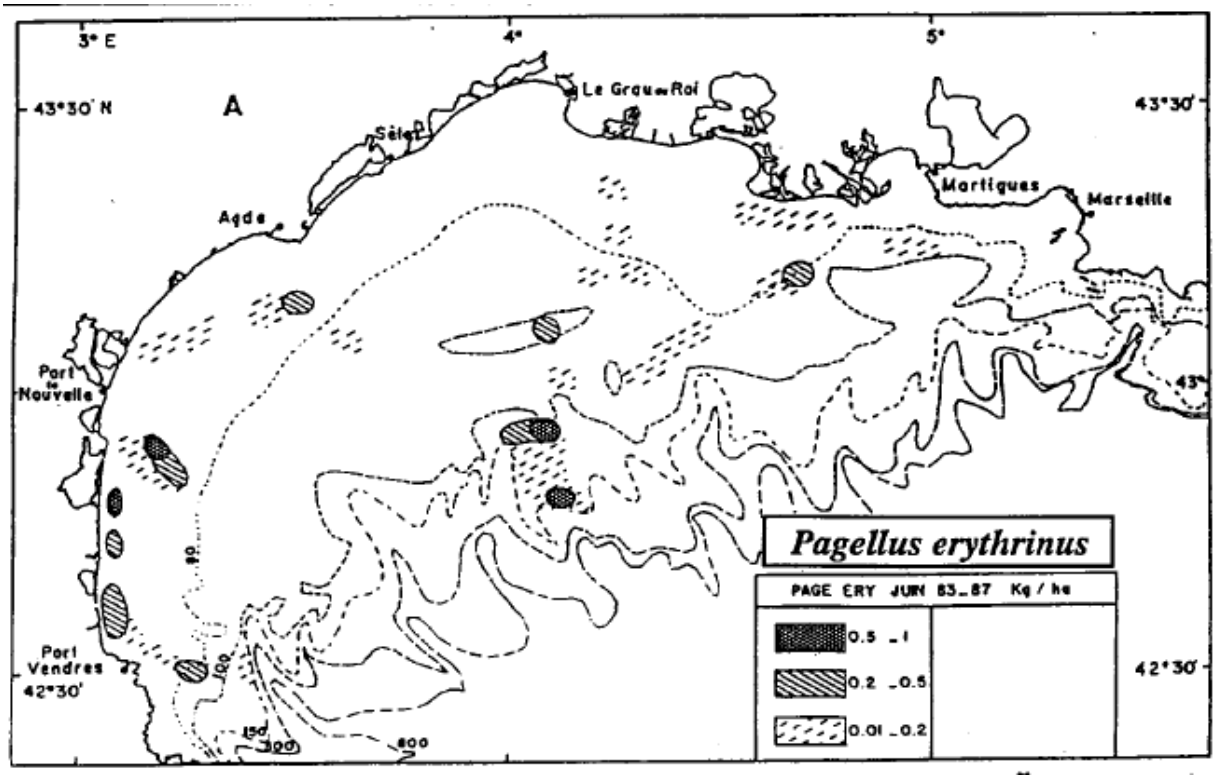
Source : Campillo A, Aldebert (Y.), Bigot (J.L.) et Liorzou (B.)., Capelle J., Carries C., Dremière P.Y., Duclerc J., Farrugio H., Le Corre G., 1989.- Données sur la distribution des principales espèces commerciales du golfe du Lion.- Rapp. IFREMER/DRV 89.041/RH Sète, 175 p.

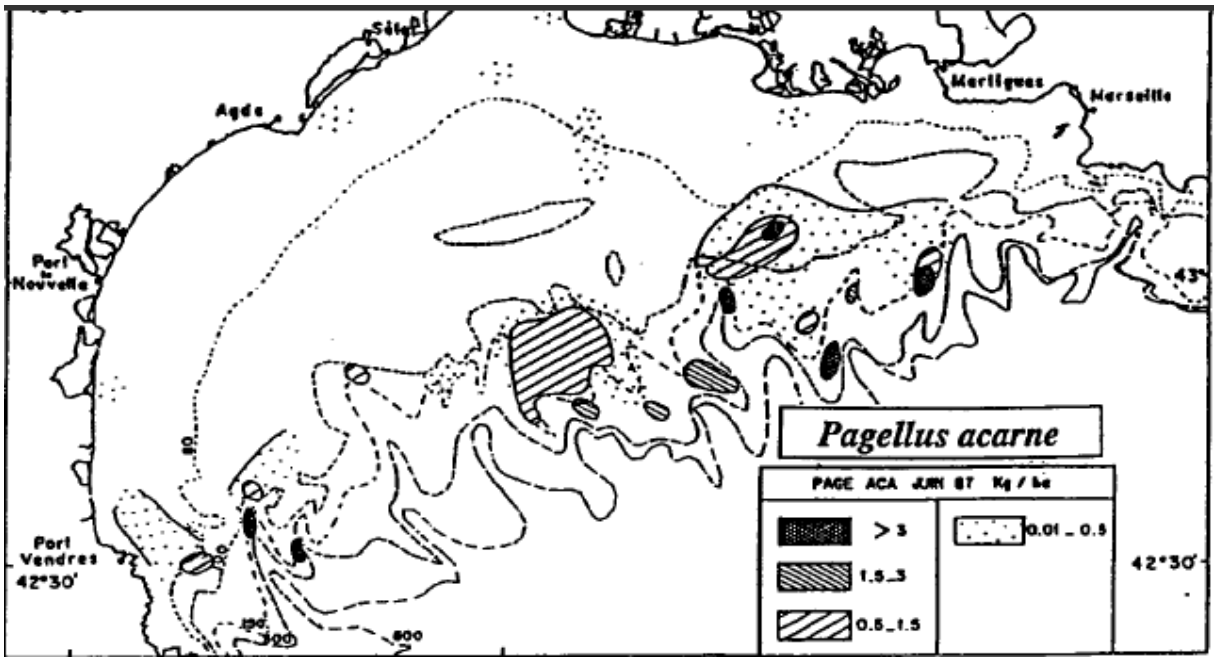


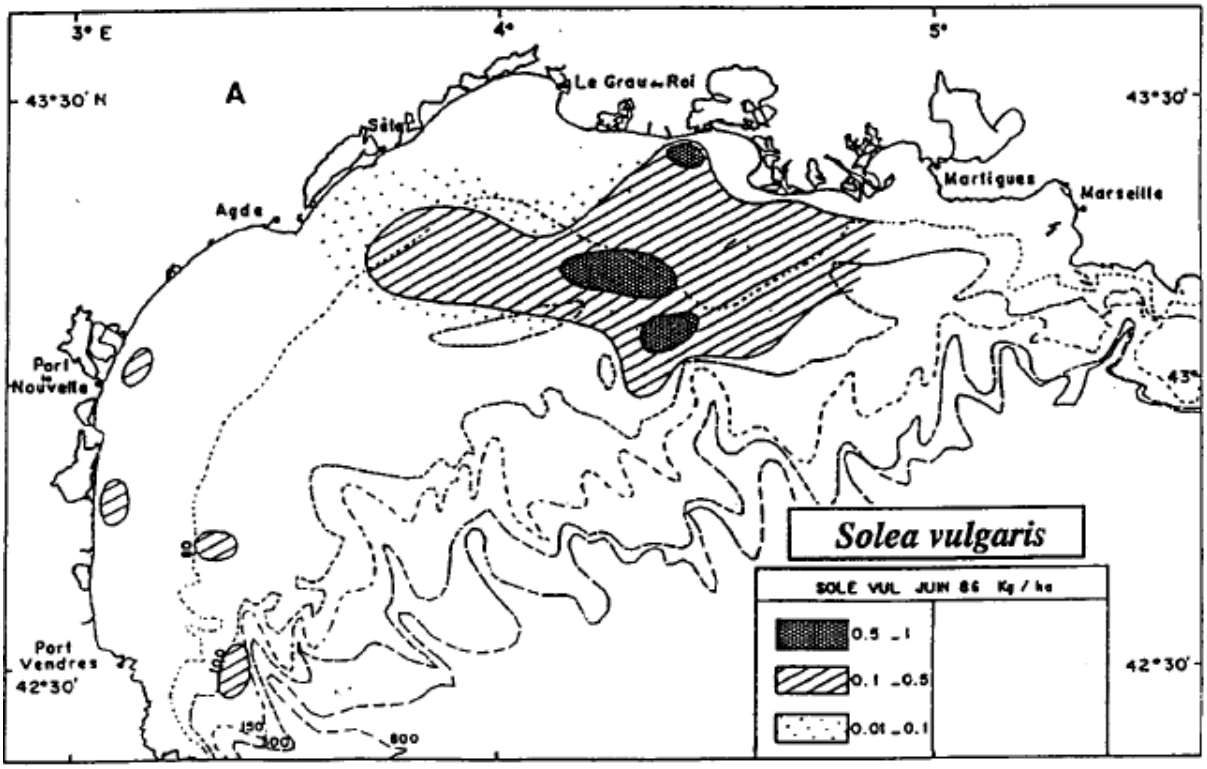

A
43°30' N
43°30'
Le Grau-du-Roi
Sète
Agde
Martigues
Marseille
Port la Nouvelle
Port Vendres
42°30'
Lophius budegassa
LOPH BUD JUIN 87 Kg/ha
4 _ 8
2 _ 4
1 _ 2
0.1 _ 1

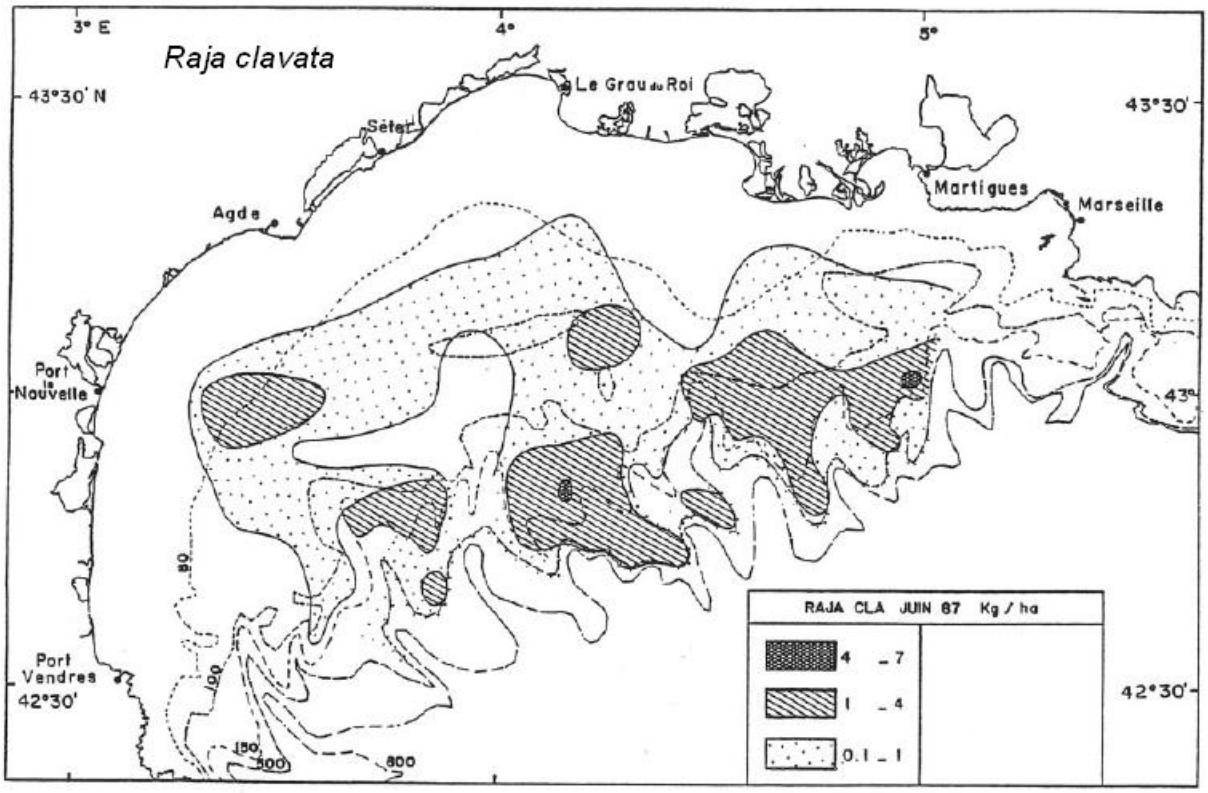

3° E
4°
5°
A
43°30' N
43°30'
Le Grau-du-Roi
Sète
Agde
Martigues
Marseille
Port la Nouvelle
Port Vendres
42°30'
Mullus surmuletus
MULL SUR JUIN 85_87 Kg / ha
> 1
0.5 _ 1
0.01 _ 0.5

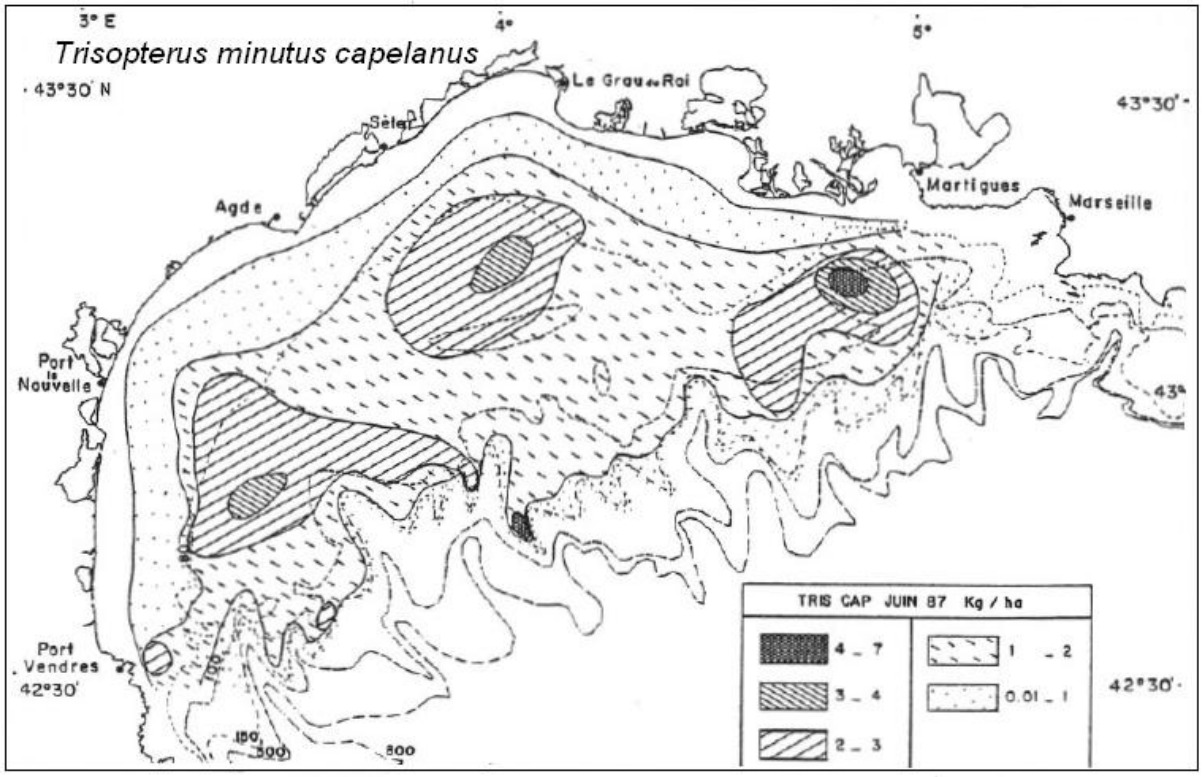

43°30' N
A
43°30'
Sète
Agde
Martigues
Marseille
Port la Nouvelle
Port Vendres
42°30'
43°
80
100
150
300
600
Mullus barbatus
MULL BAR JUN 83_87 Kg / ha
1 _1.5
0.5 _1
0.2 _0.5
0.01 _0.2

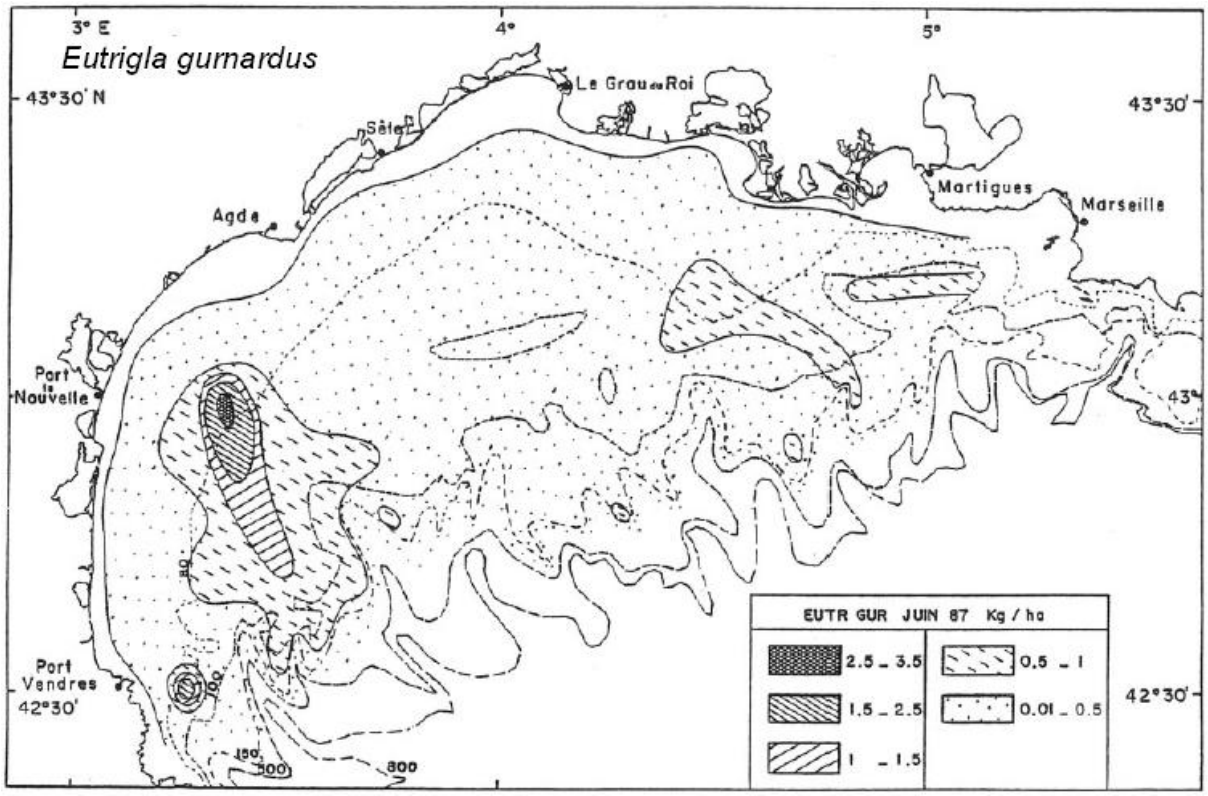

3° E
4°
5°
43°30' N
A
Le Grau du Roi
43°30'
Sète
Agde
Martigues
Marseille
Port la Nouvelle
Port Vendres
42°30'
43°
80
100
150
300
600
Pagellus erythrinus
PAGE ERY JUN 83_87 Kg / ha
0.5 _1
0.2 _0.5
0.01 _0.2

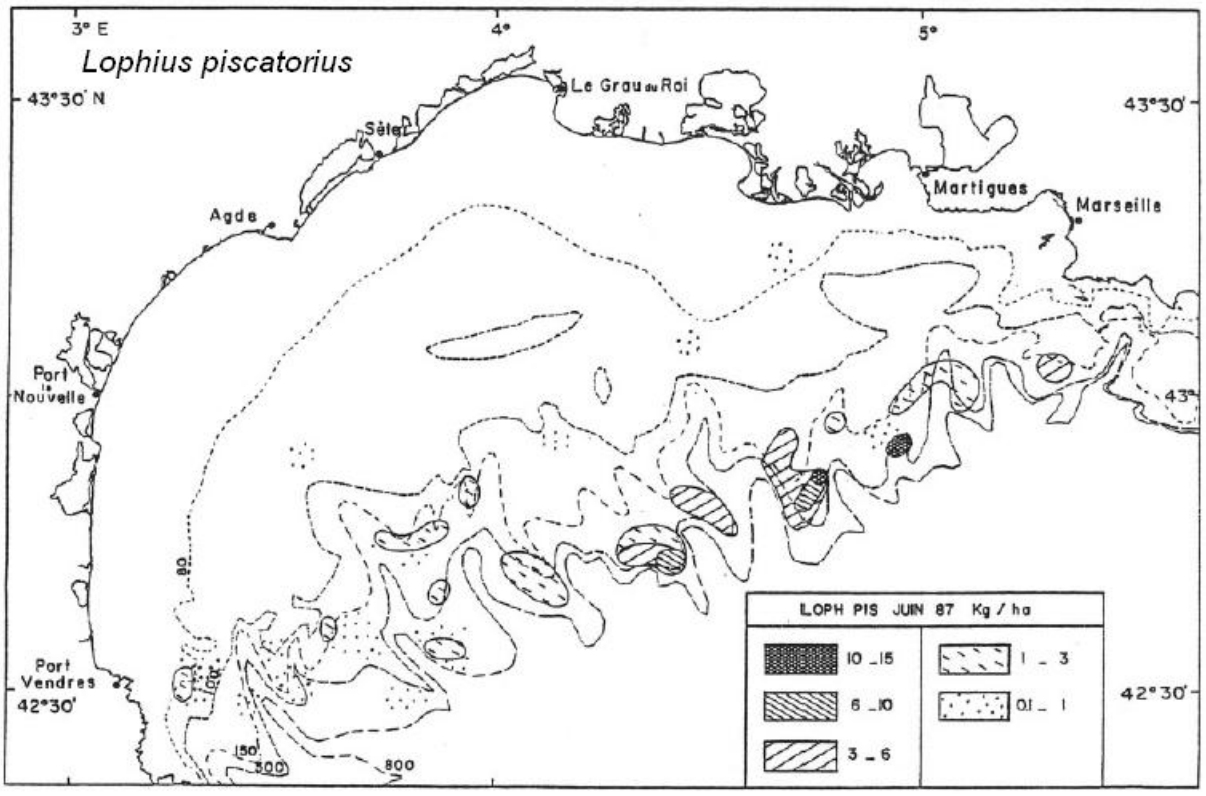

Sète
Agde
Martigues
Marseille
Port la Nouvelle
Port Vendres
42°30'
43°
Pagellus acarne
PAGE ACA JUIN 87 Kg / ha
> 3
1.5_3
0.5_1.5
0.01_0.5
42°30'
50
100
200
800

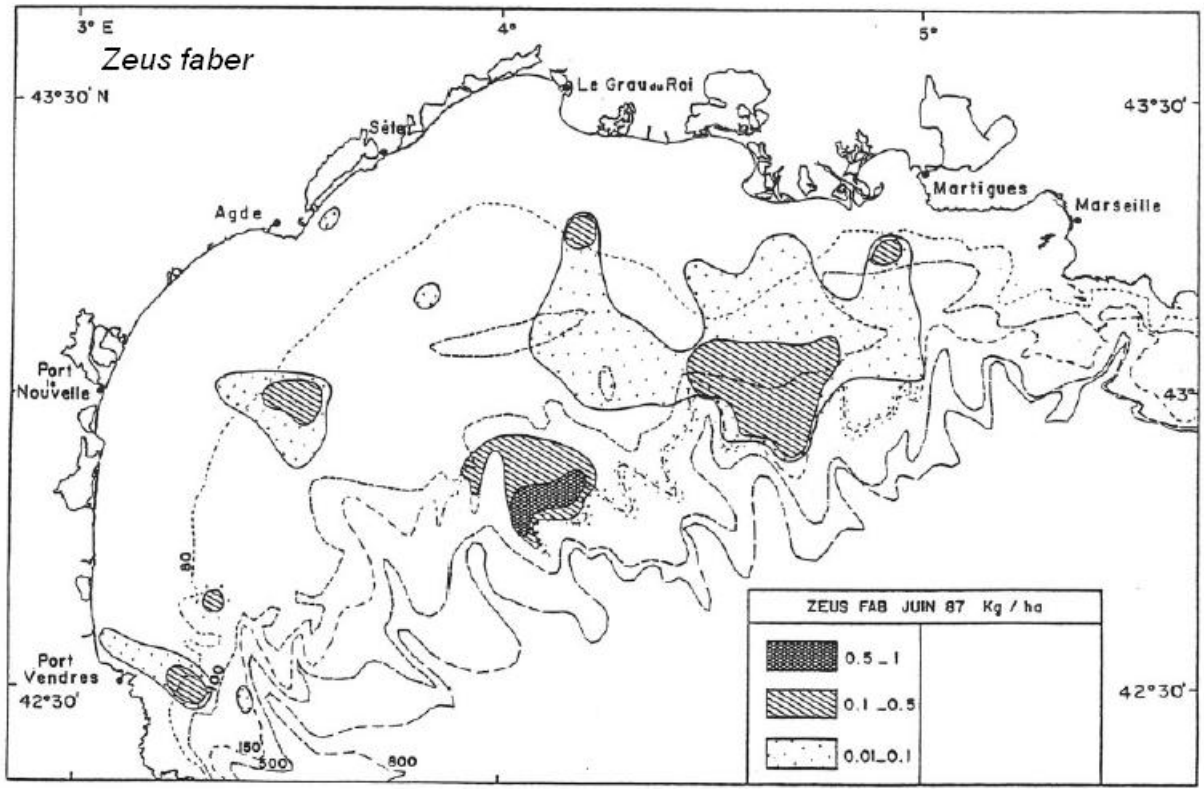

3° E
4°
5°
43°30' N
A
Le Grau-du-Roi
Sète
Agde
Martigues
Marseille
43°30'
Port la Nouvelle
Port Vendres
42°30'
43°
Solea vulgaris
SOLE VUL JUIN 86 Kg / ha
0.5 _1
0.1 _0.5
0.01_0.1
42°30'
50
100
150
200
800

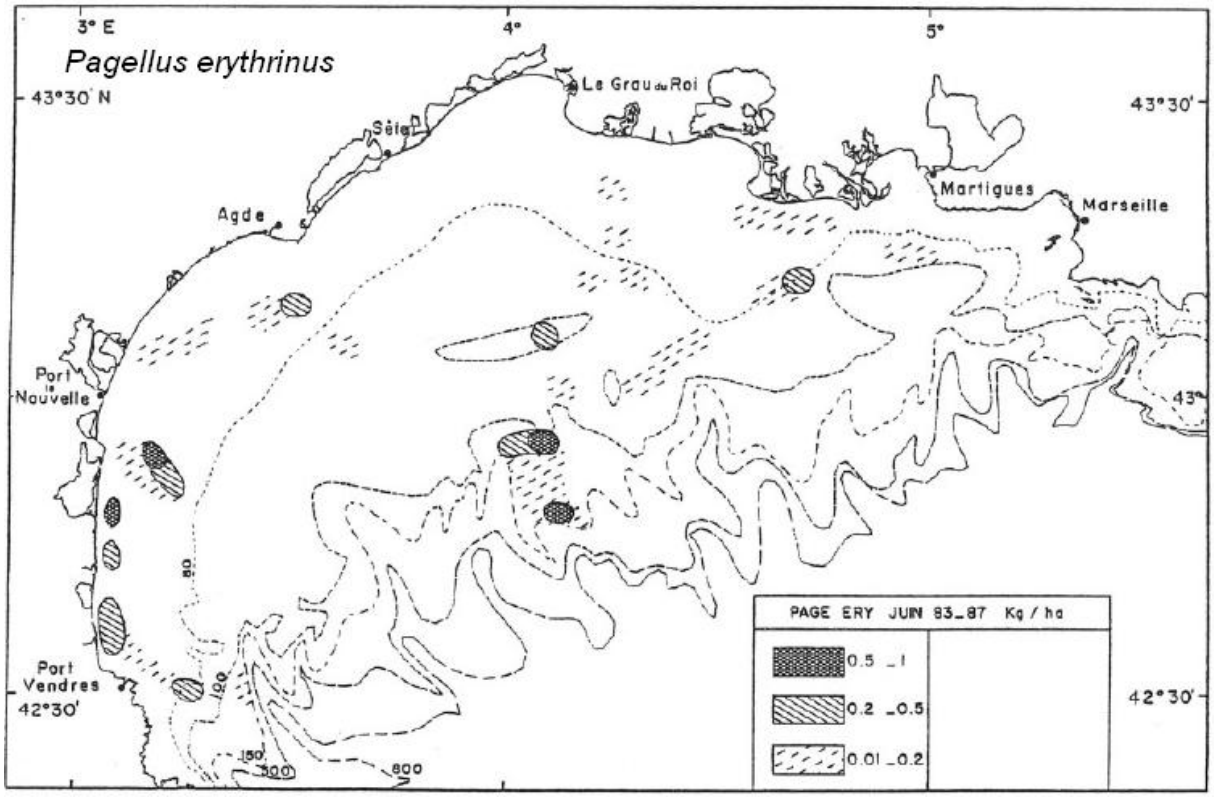

Raja clavata
3° E
4°
5°
43°30' N
43°30'
Le Grau du Roi
Sète
Agde
Martigues
Marseille
Port la Nouvelle
Port Vendres
42°30'
43°
80
90
150
300
800
RAJA CLA JUIN 87 Kg / ha
4 _ 7
1 _ 4
0.1 _ 1

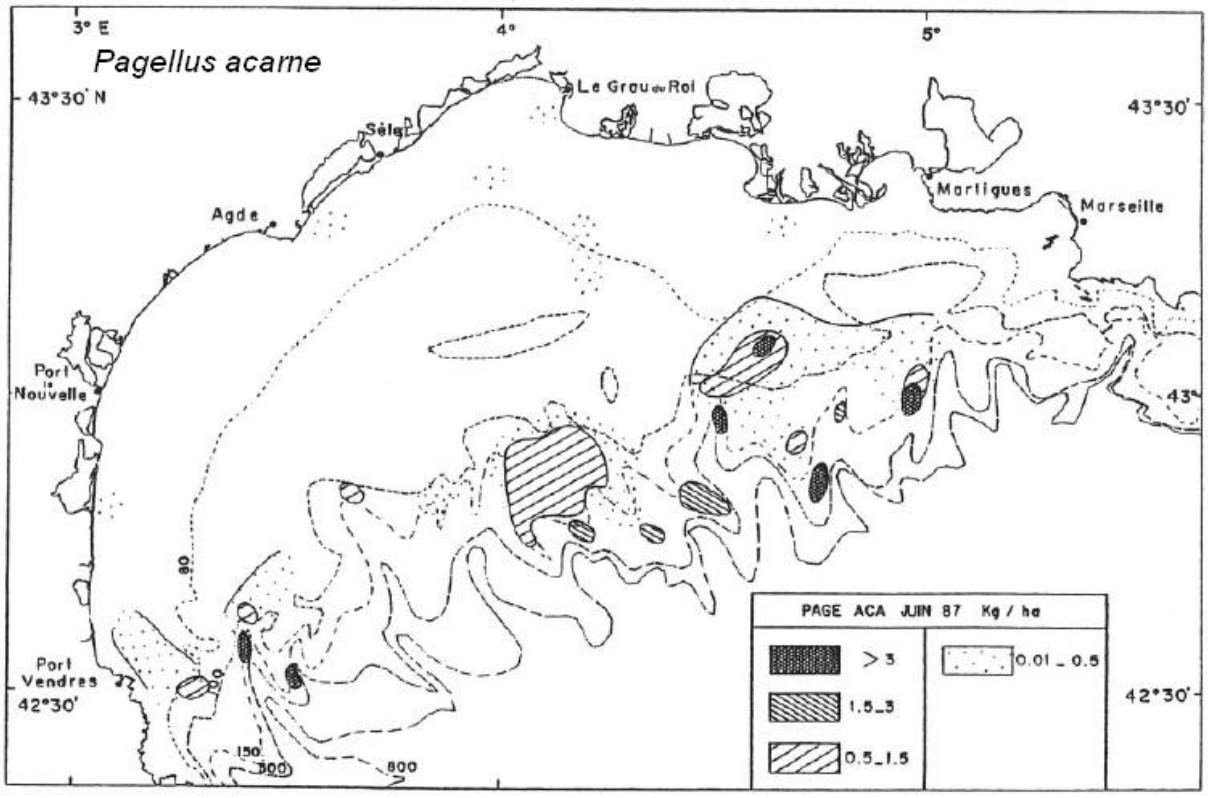

Trisopterus minutus capelanus
3° E
4°
5°
43°30' N
43°30'
Le Grau du Roi
Sète
Agde
Martigues
Marseille
Port la Nouvelle
Port Vendres
42°30'
43°
80
90
150
300
800
TRIS CAP JUIN 87 Kg / ha
4 _ 7
3 _ 4
2 _ 3
1 _ 2
0.01 _ 1


Eutrigla gurnardus
3° E
4°
5°
43°30' N
43°30'
Le Grau du Roi
Sète
Agde
Martigues
Marseille
Port la Nouvelle
Port Vendres
42°30'
43°
80
100
150
300
800
EUTR GUR JUIN 87 Kg / ha
2.5 _ 3.5
1.5 _ 2.5
1 _ 1.5
0.5 _ 1
0.01 _ 0.5


Lophius piscatorius
3° E
4°
5°
43°30' N
43°30'
Le Grau du Roi
Sète
Agde
Martigues
Marseille
Port la Nouvelle
Port Vendres
42°30'
43°
80
100
150
300
800
LOPH PIS JUIN 87 Kg / ha
10 _ 15
6 _ 10
3 _ 6
1 _ 3
0.1 _ 1


3° E
4°
5°
Zeus faber
43°30' N
43°30'
Le Grau du Roi
Sète
Agde
Martigues
Marseille
Port la Nouvelle
43°
80
100
150
300
800
Port Vendres
42°30'
42°30'
ZEUS FAB JUIN 87 Kg / ha
0.5 _ 1
0.1 _0.5
0.01_0.1

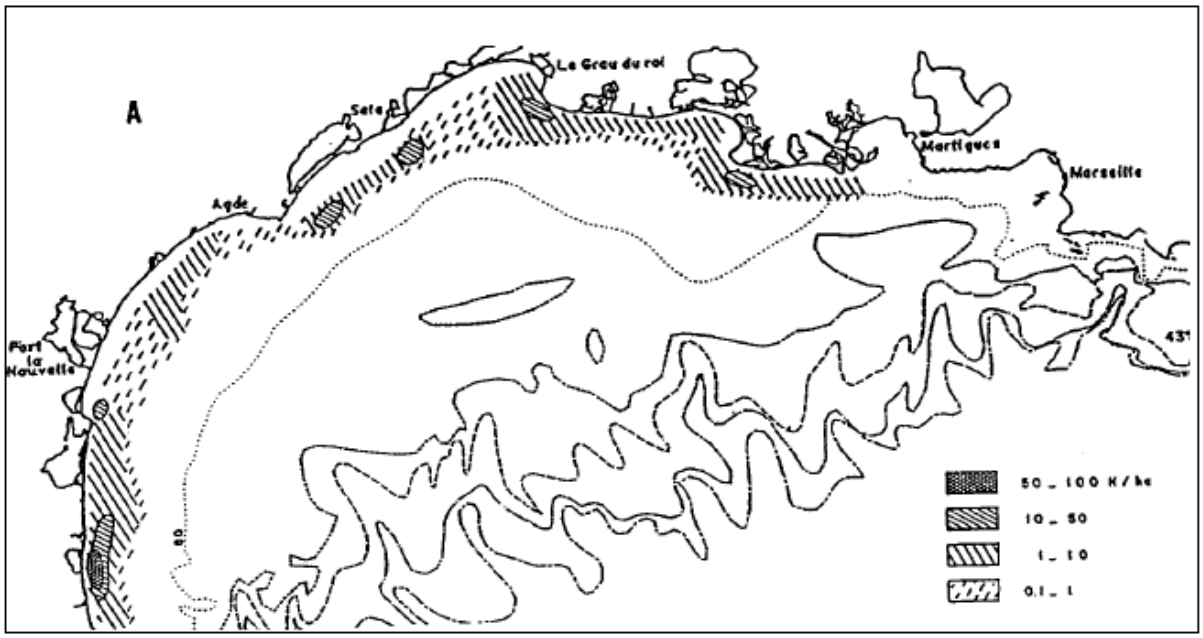

3° E
4°
5°
Pagellus erythrinus
43°30' N
43°30'
Le Grau du Roi
Sète
Agde
Martigues
Marseille
Port la Nouvelle
43°
80
100
150
300
800
Port Vendres
42°30'
42°30'
PAGE ERY JUIN 83_87 Kg / ha
0.5 _ 1
0.2 _0.5
0.01 _0.2

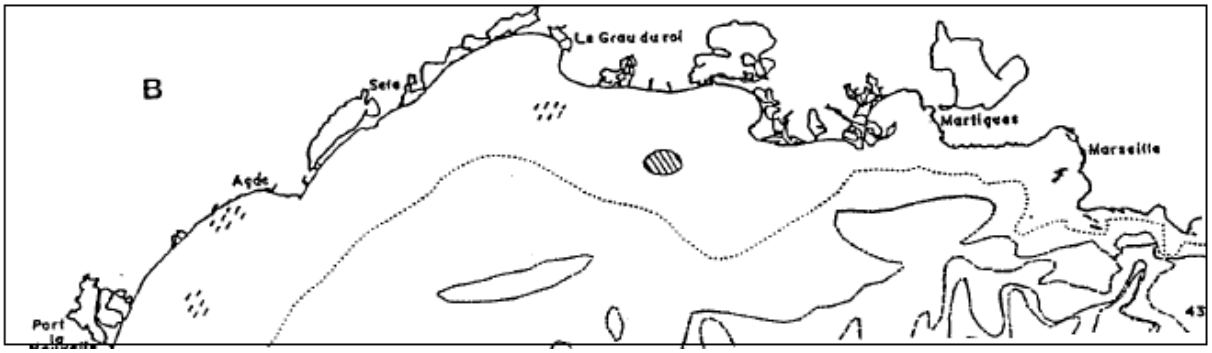

Pagellus acarne
3° E
4°
5°
43°30' N
43°30'
Le Grau du Roi
Sète
Agde
Martigues
Marseille
Port la Nouvelle
Port Vendres
42°30'
80
150
300
800
PAGE ACA JUIN 87 Kg / ha
> 3
1.5_3
0.5_1.5
0.01 _ 0.5

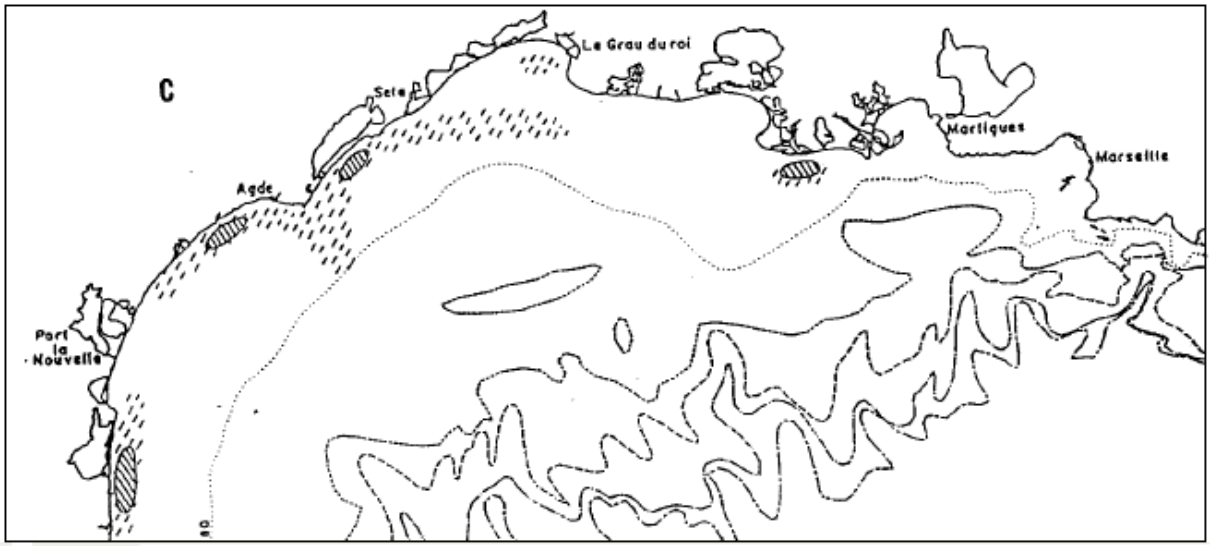
ANNEX 2

Spatial distribution of the juveniles of commercial species

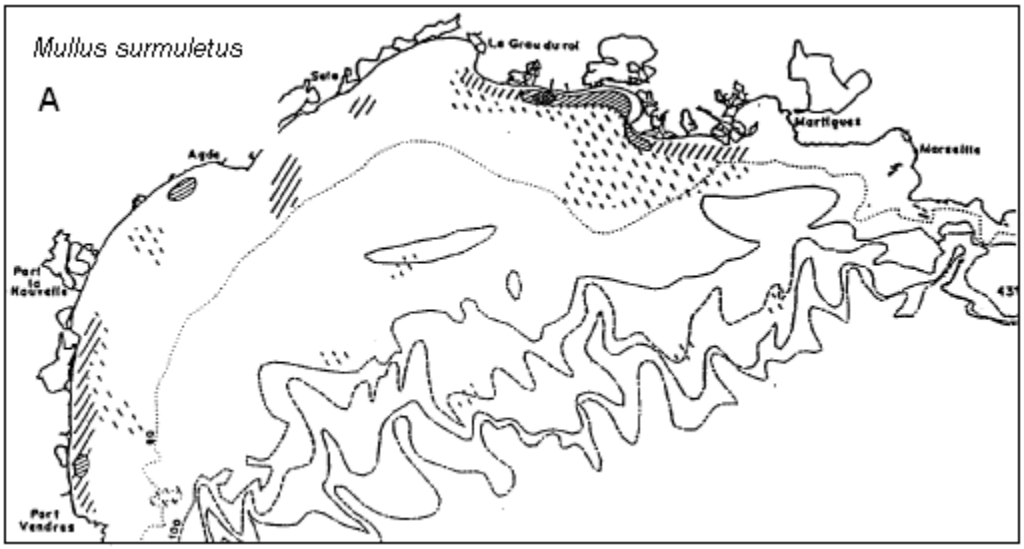
Source: GFCM, Subcommittee for Stock Assessment - Sète, France, 21-23 mars 2000 . Distribution and abundance of the juveniles of demersal fish species in the gulf of Lions. Laboratoire « Ressources Halieutiques» IFREMER, Sète

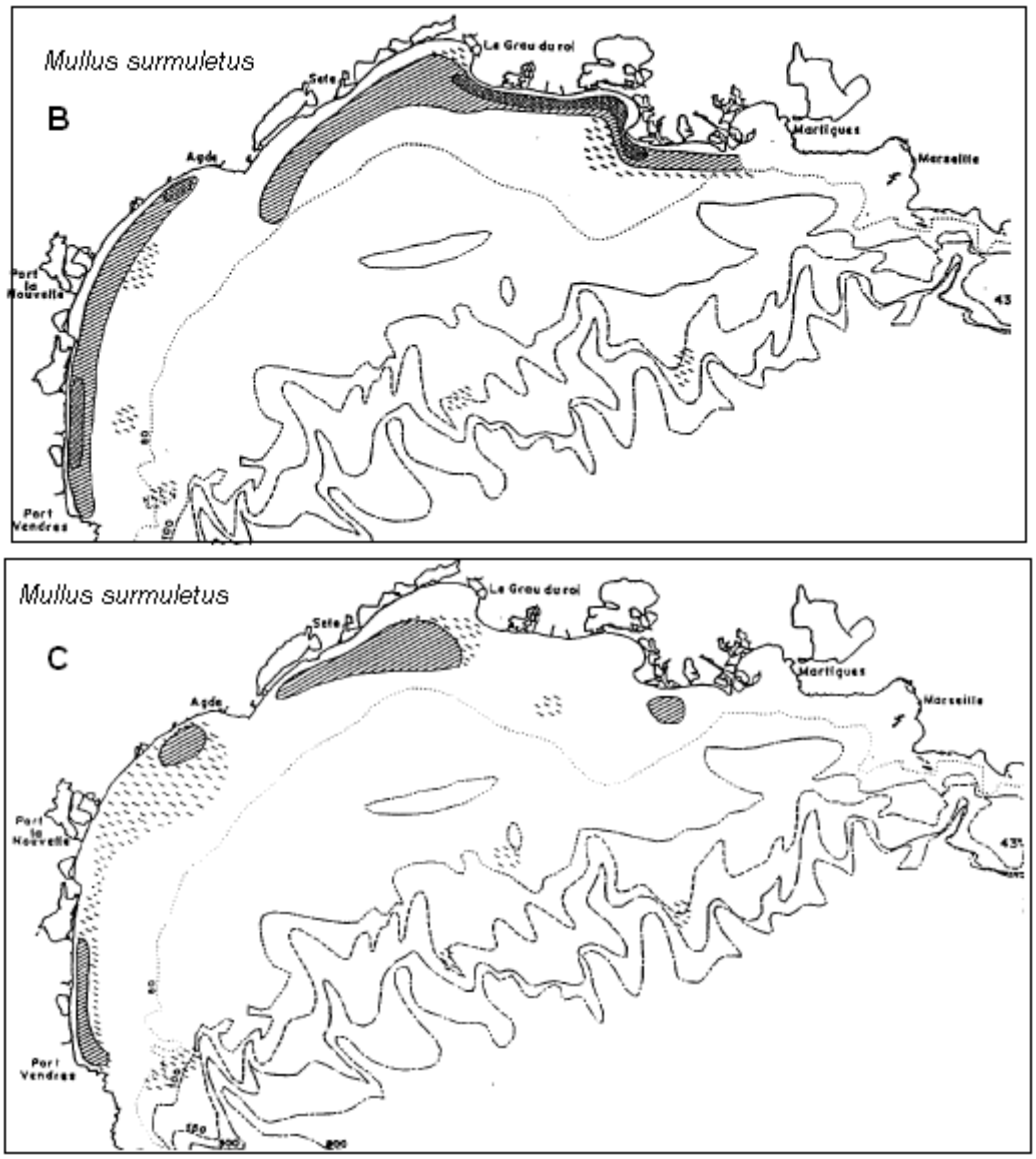




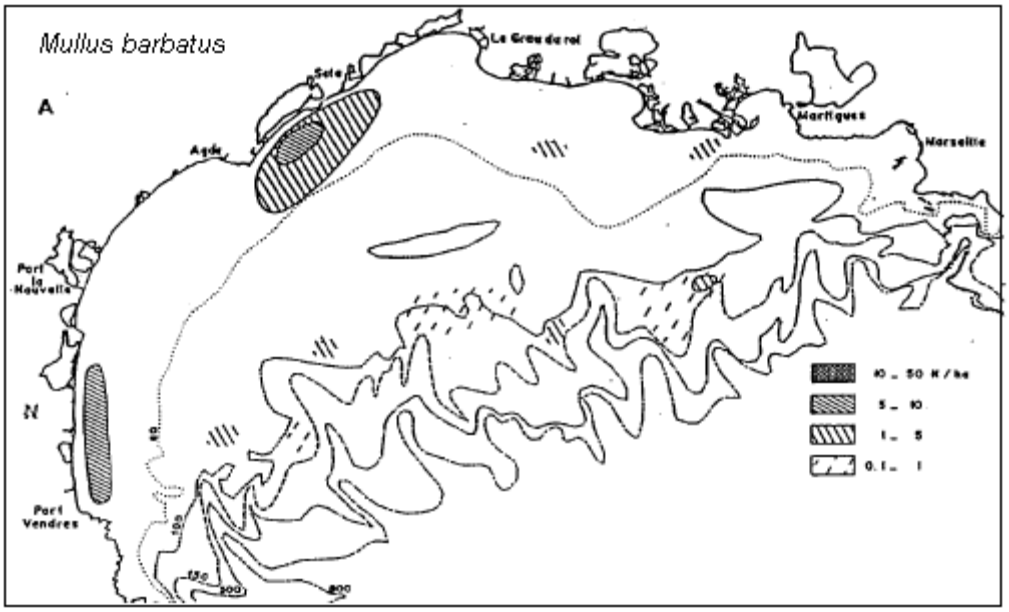


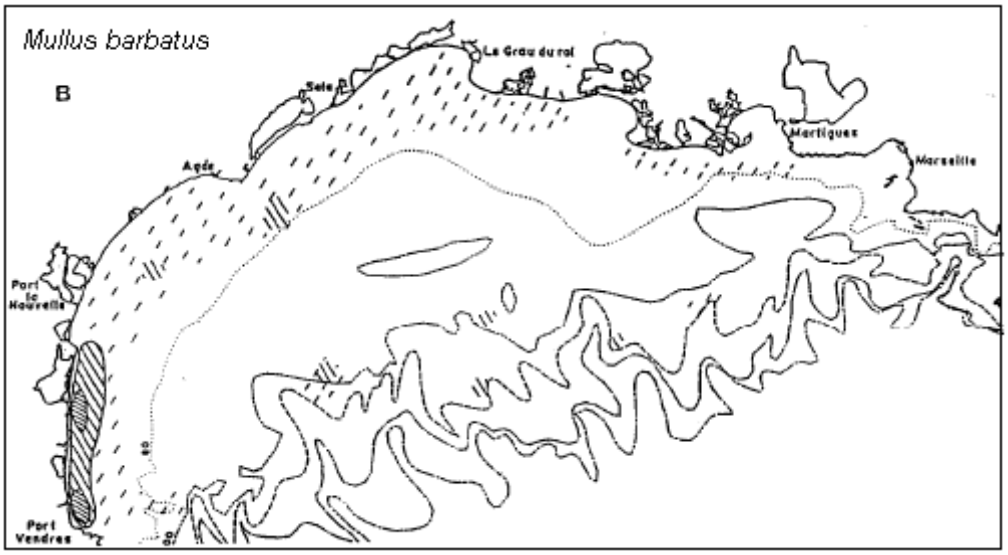
Distribution of *Pagellus erythrinus*, 0 group (A : nov 1988) and group 1 (B:nov 88, C: feb.89)

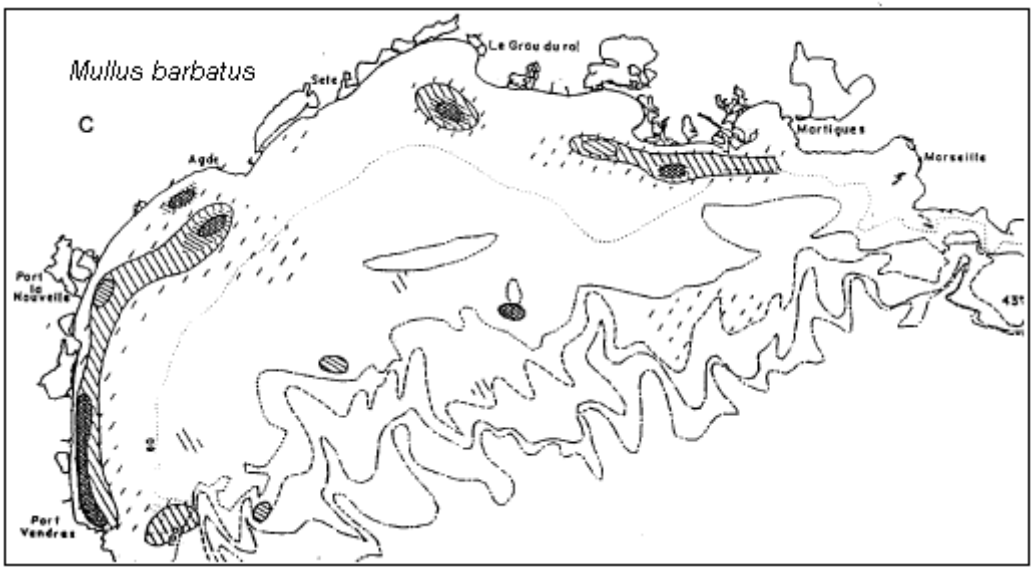




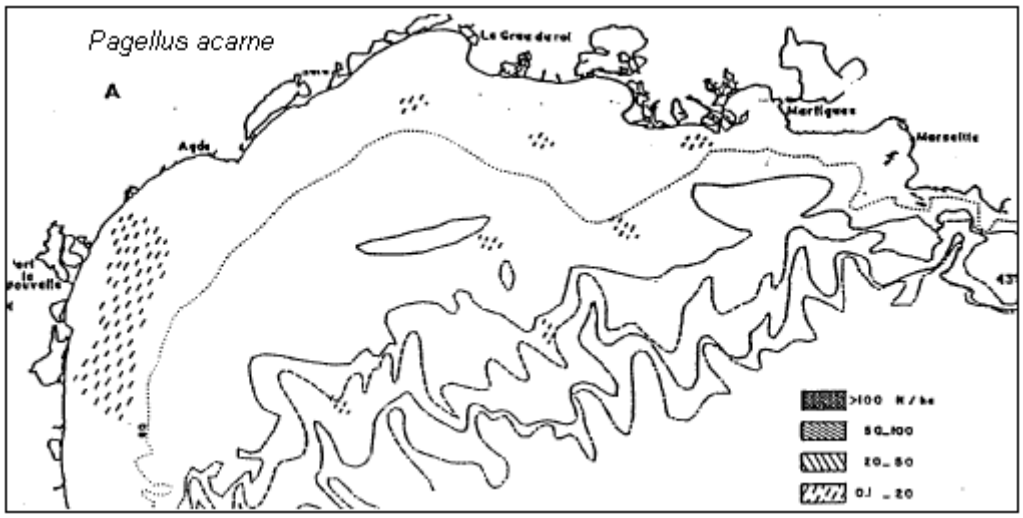
Distribution of *Mullus surmuletus*, 0 group (A : nov 1988) and group 1 (B:nov 88, C: feb.89)

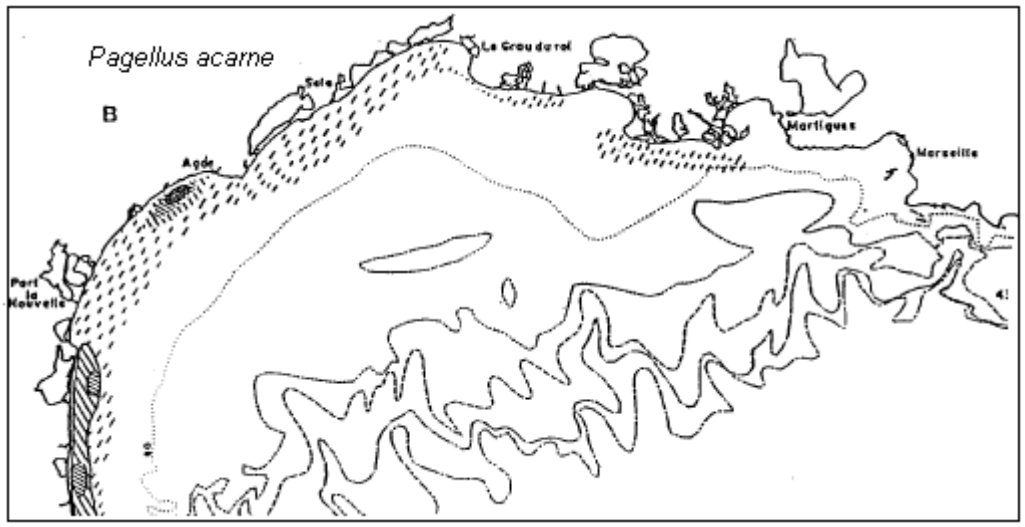


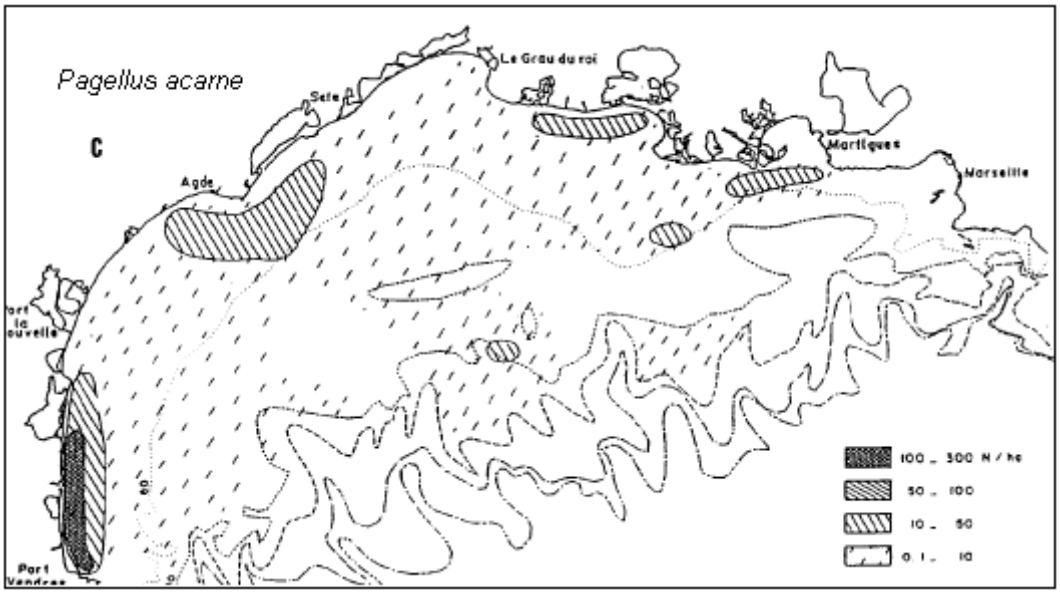




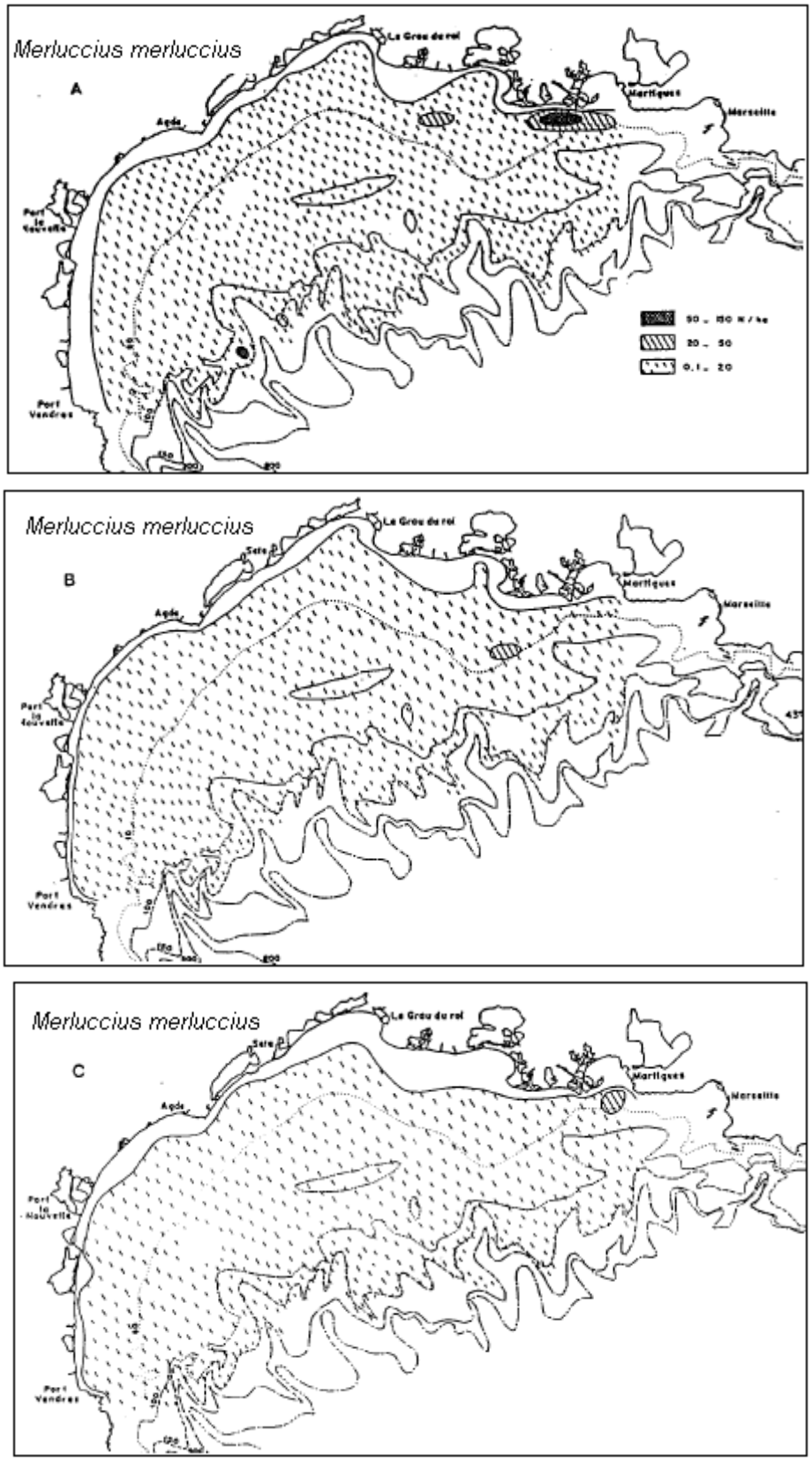
Distribution of *Mullus barbatus*, group 1 (A : june 1988, B:nov 88, C: feb.89)



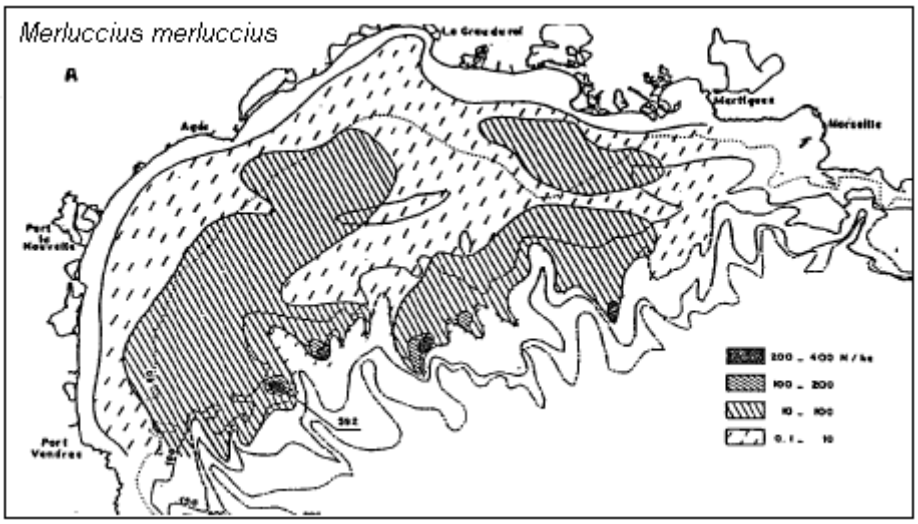


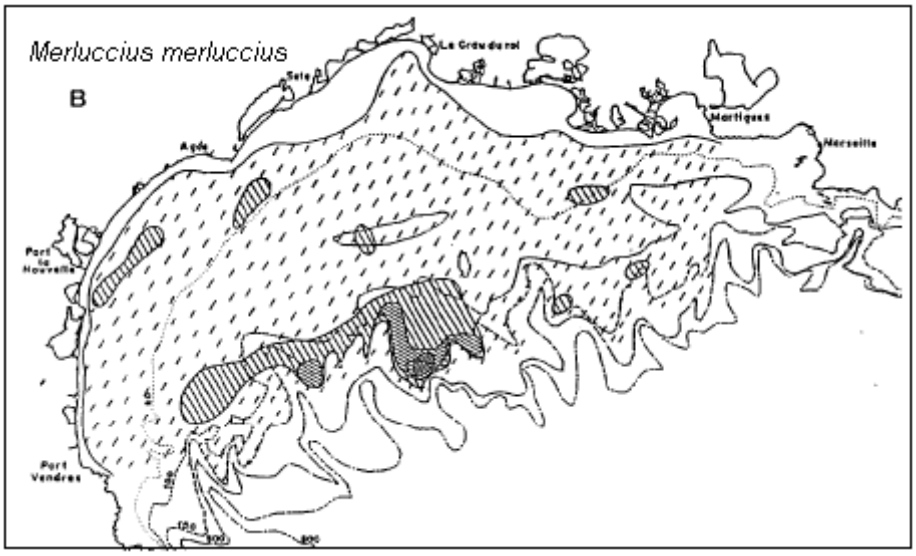


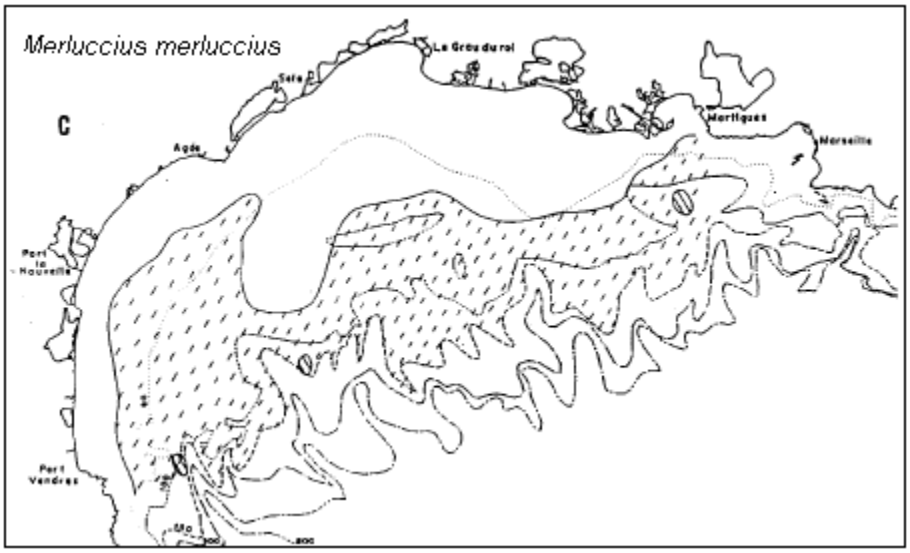
Distribution of *Pagellus acarne*, 0 group (A : nov 1988) and group 1 (B:nov 88, C: feb.89)



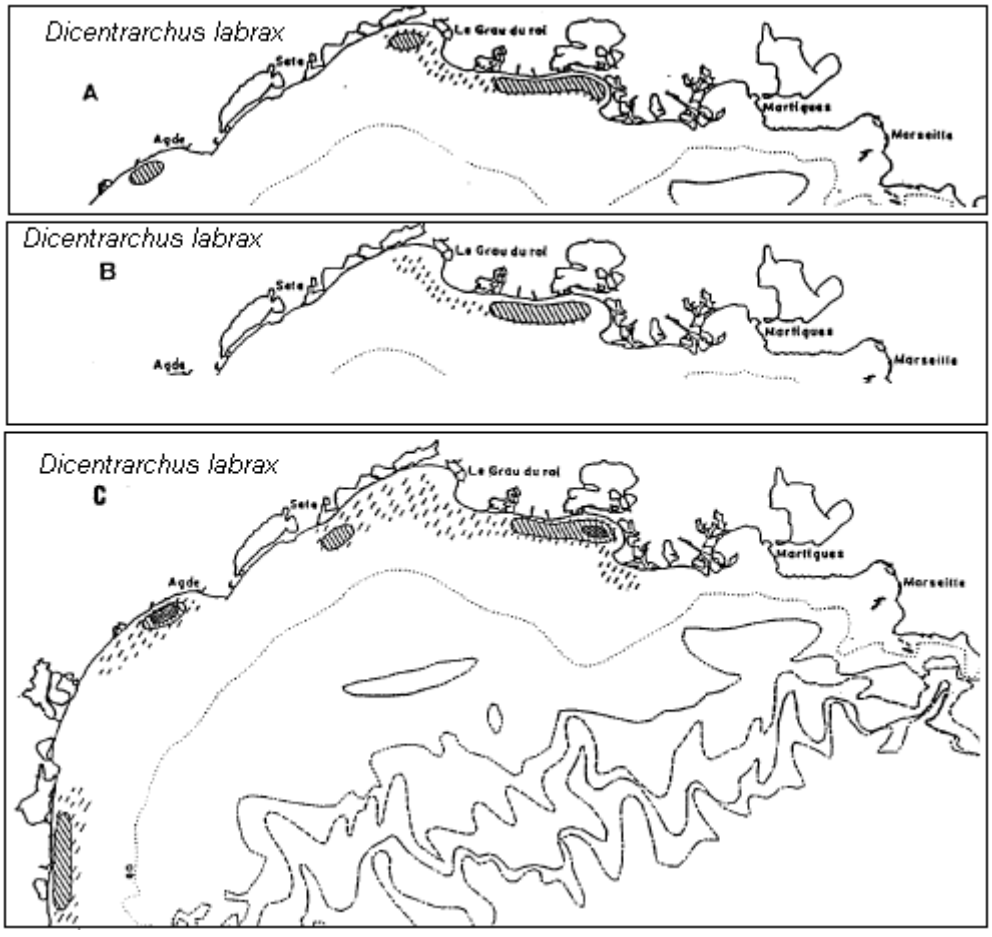
Distribution of *Merluccius merluccius*, group 1(A : nov 1988) & group1 (B:nov 88, C: feb.89)

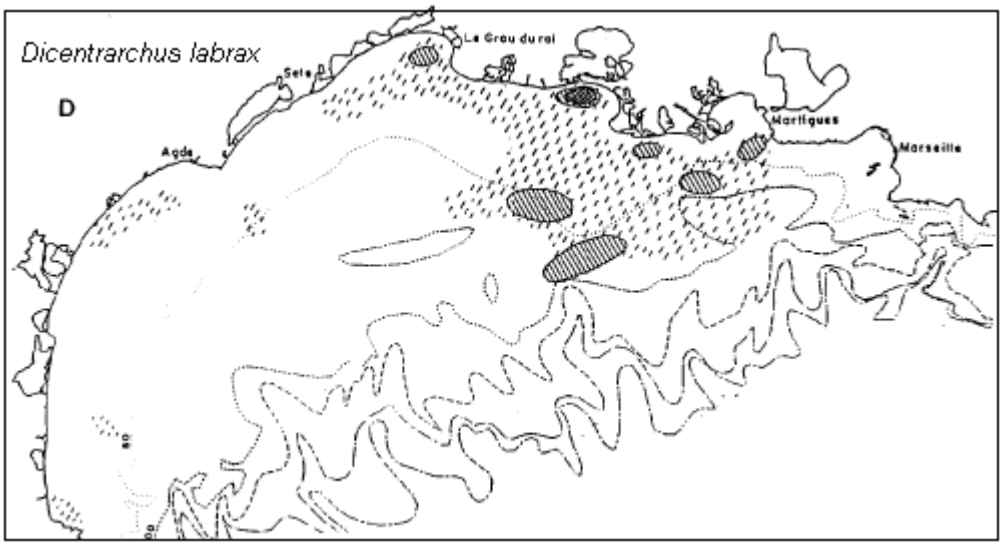




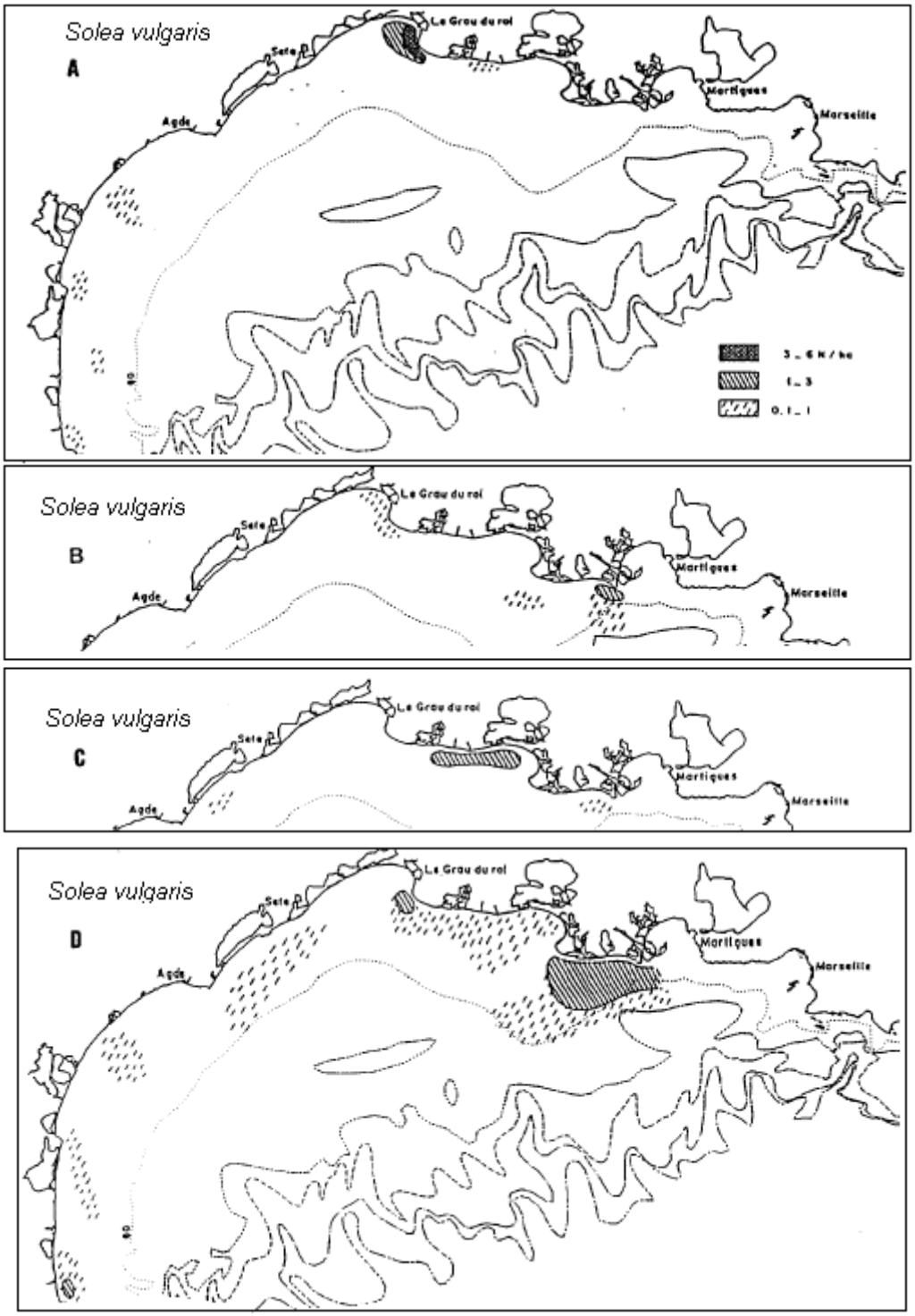


Distribution of *Merluccius merluccius*, 0 group(A : nov 1988) & group1 (B:nov 88, C: feb.89)


Dicentrarchus labrax
A
Le Grau du roi
Sete
Agde
Martigues
Marseille
Dicentrarchus labrax
B
Le Grau du roi
Sete
Agde
Martigues
Marseille
Dicentrarchus labrax
C
Le Grau du roi
Sete
Agde
Martigues
Marseille



Distribution of *Dicentrarchus labrax*, group 1(A : nov 1988) & group2 (B:june 88, C: nov.88 D: feb.89)



Distribution of *Solea vulgaris*, group0 (A : nov 1988) & group1 (B:june 88, C: nov.88 D: feb.89)

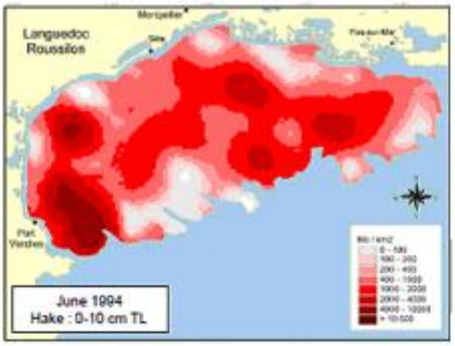
ANNEX 3

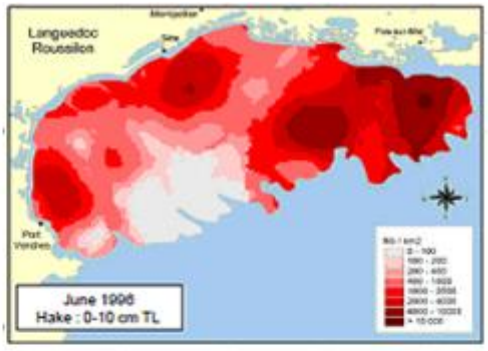
Spatial distribution of hake size classes in the gulf of Lions

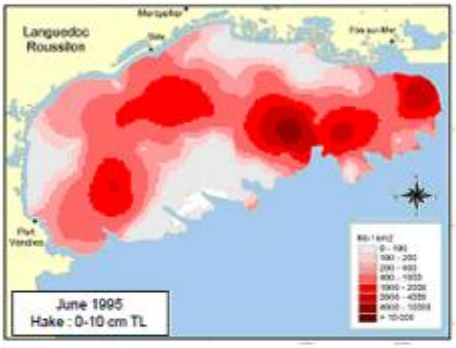
1994-1999

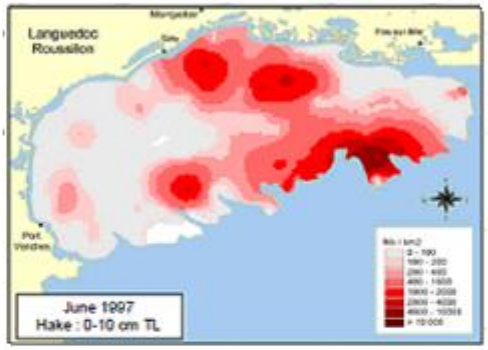
Source: Impact of fishery and environment on hake recruitment in Northwestern Mediterranean, LLUCET, funded by the Eurpoean programme FAIR, contract CT97-3522. (project leader: Jordi Lleonart).

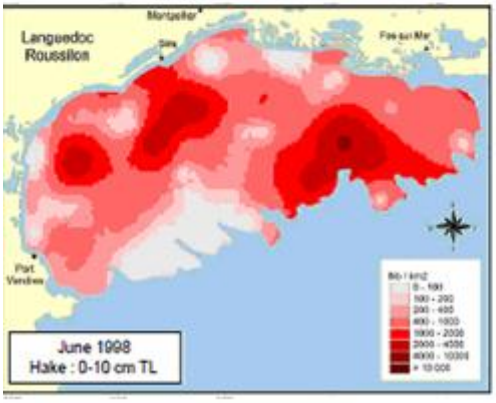
Spatial distribution of hake size class **0-10 cm**

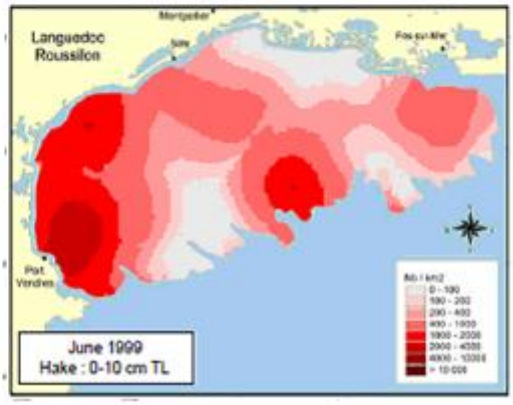




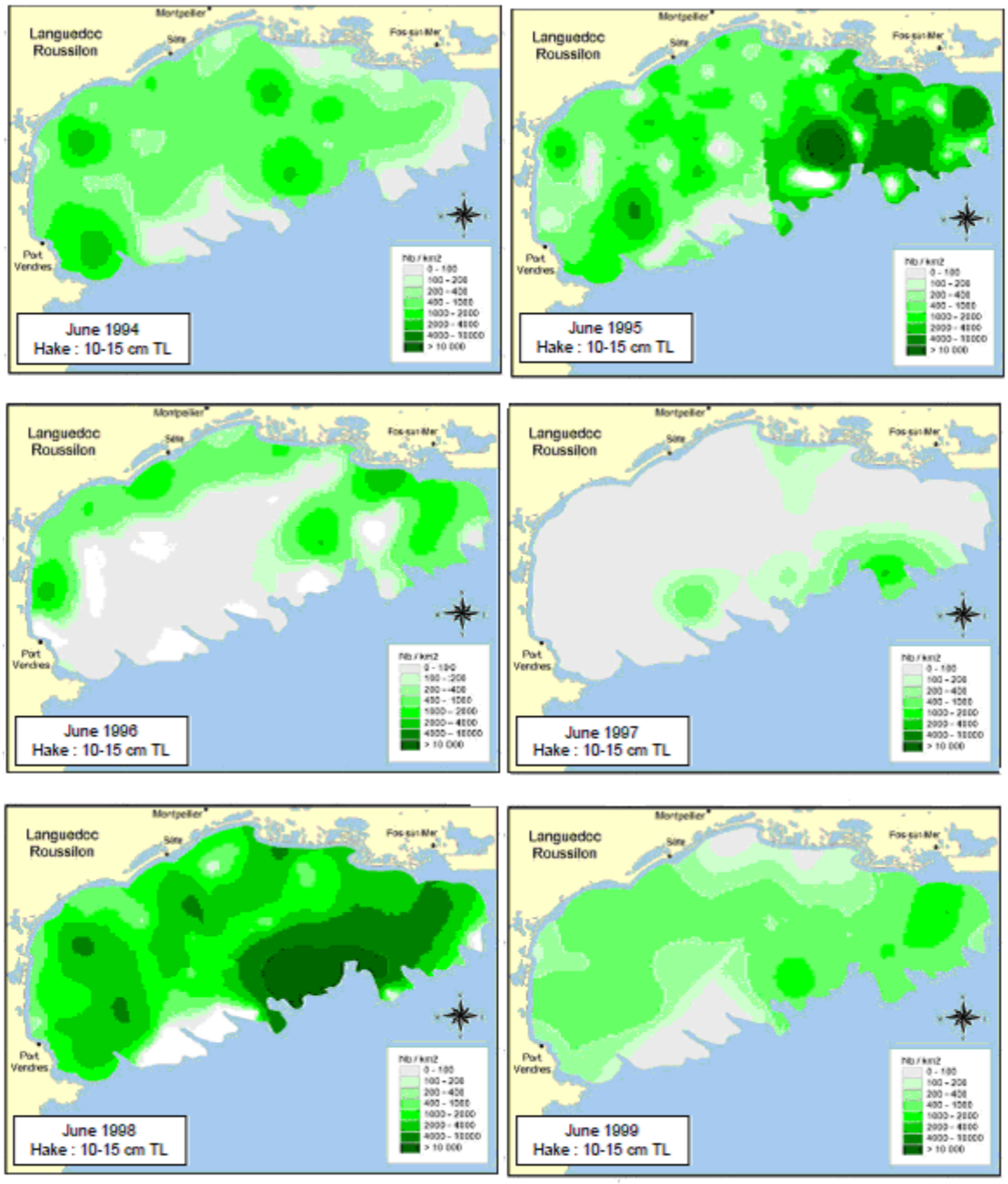




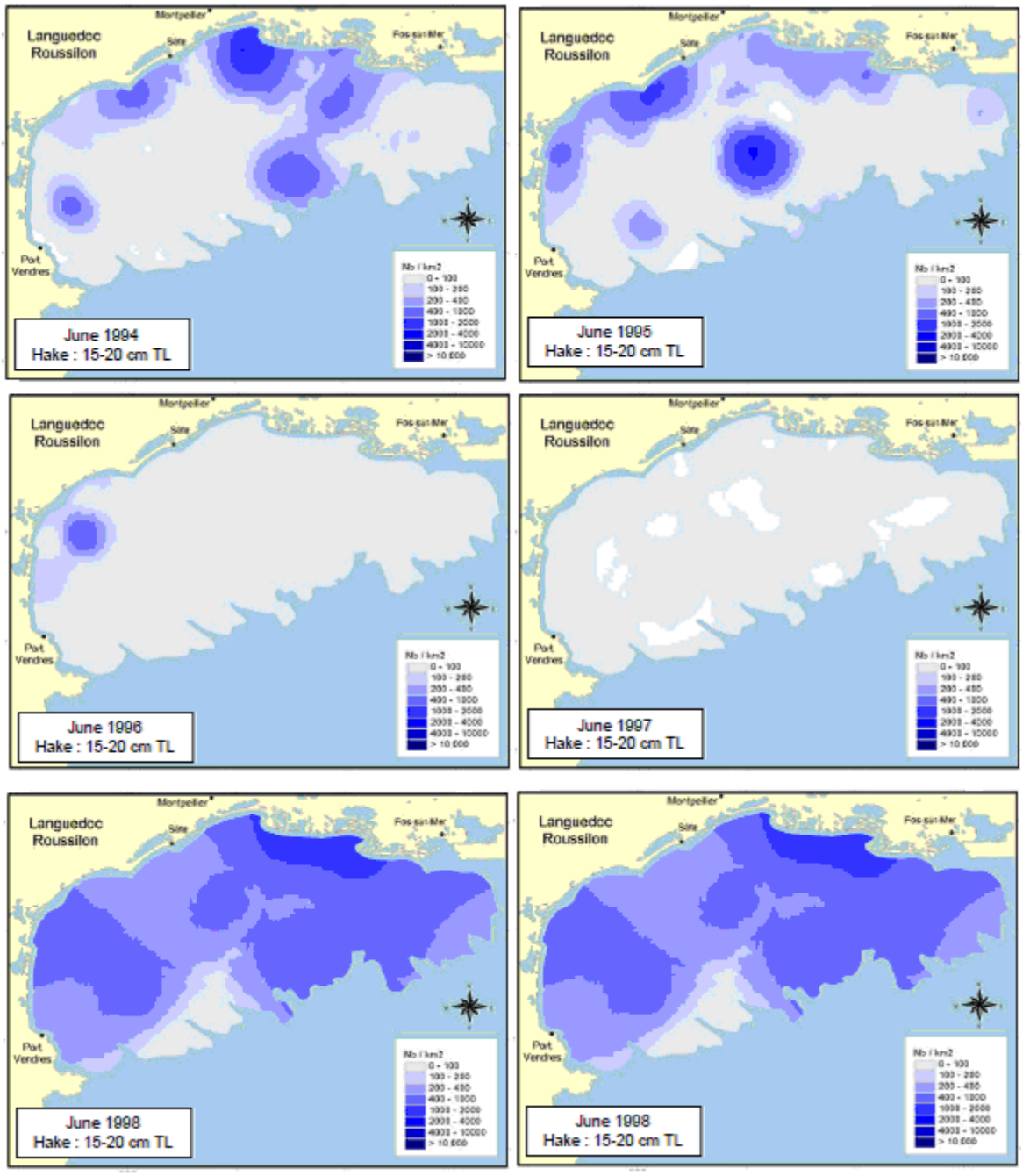




Spatial distribution of hake size class **10-15 cm**



Spatial distribution of hake size class **15-20 cm**

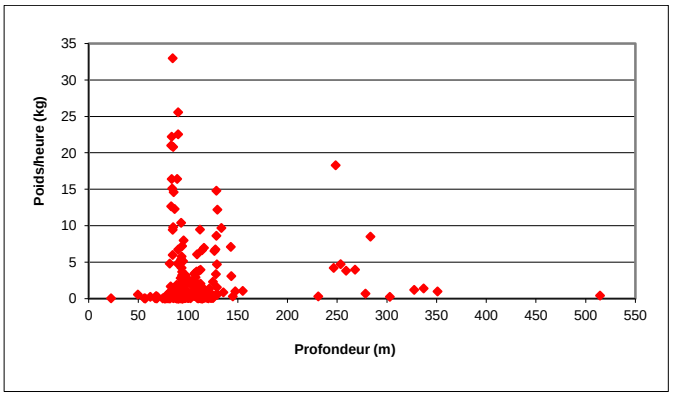


ANNEX 4

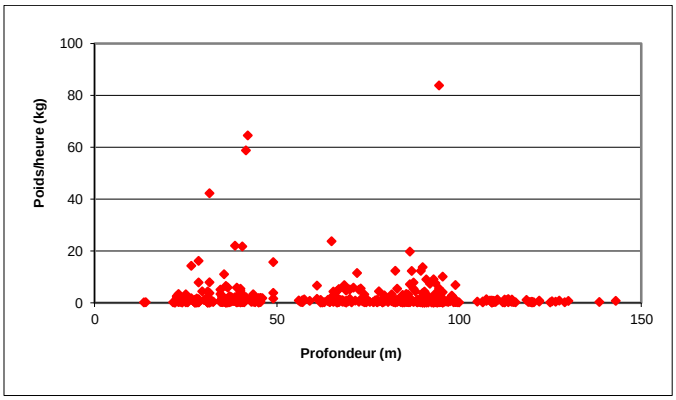
Ref : A.Souplet, 2010 - Les stocks démersaux de la Méditerranée française. Résultats des campagnes MEDITS de 1994 à 2009 . Rapport IFREMER DHMTLaboratoire : HMT – Sète Juillet 2010 - Référence : HMT 2010/01

Bathymetric distribution of the species

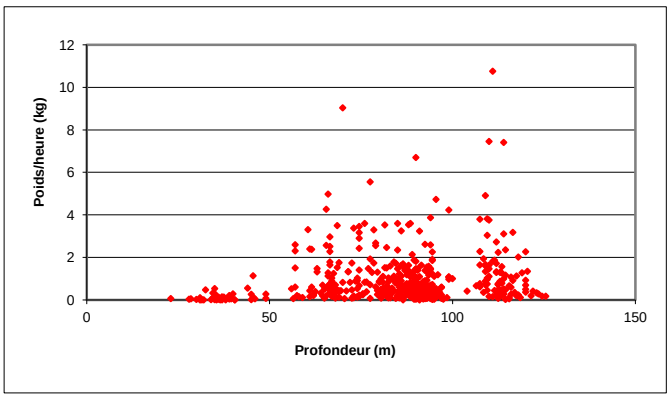
Aspitrigla cuculus



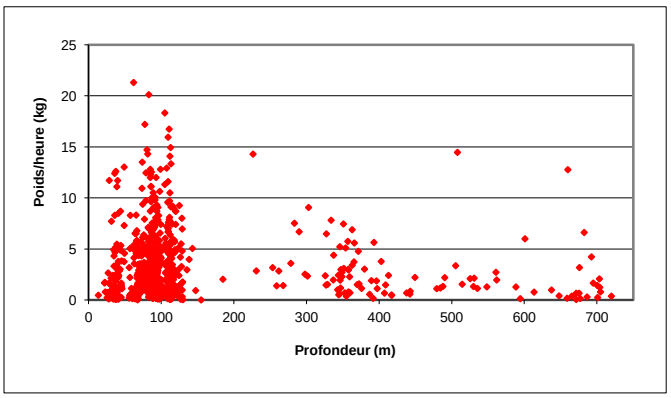
Boops boops



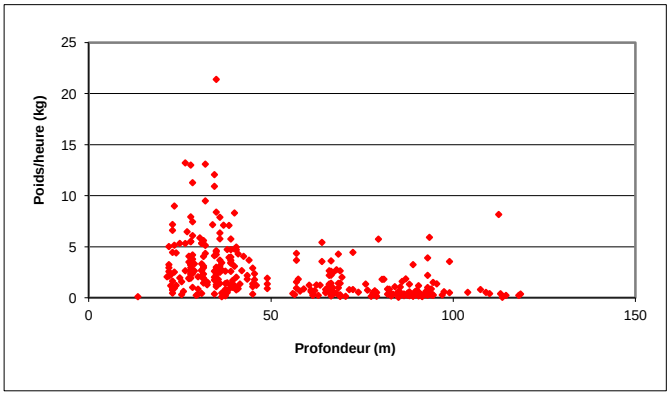
Citharus linguatula



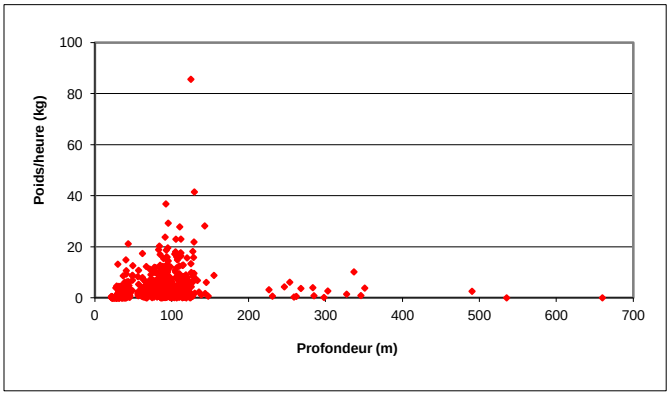
Eledone cirrhosa



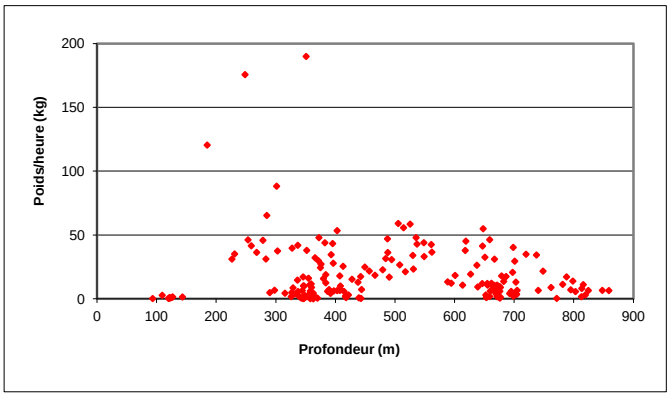
Eledone moschata



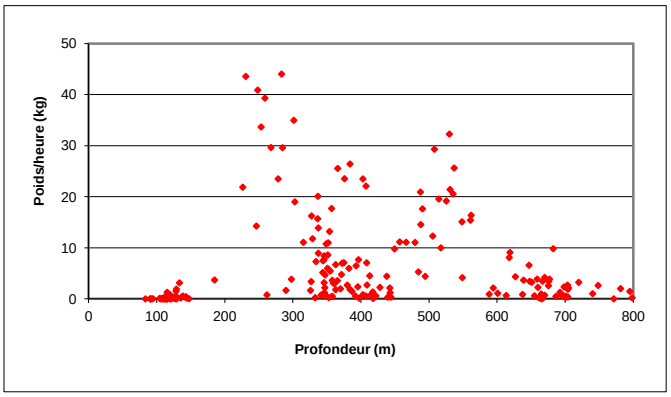
Eutrigla gurnardus



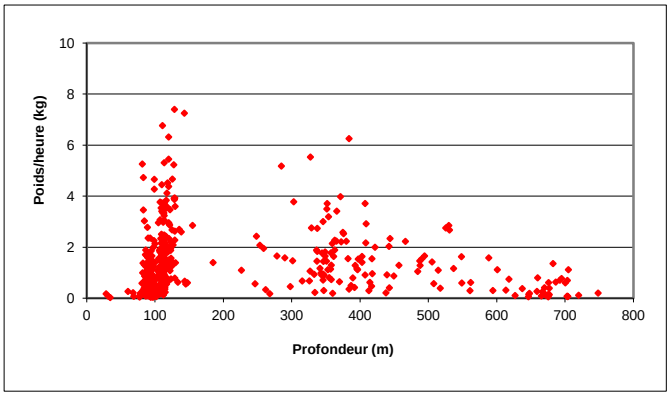
Galeus melastomus



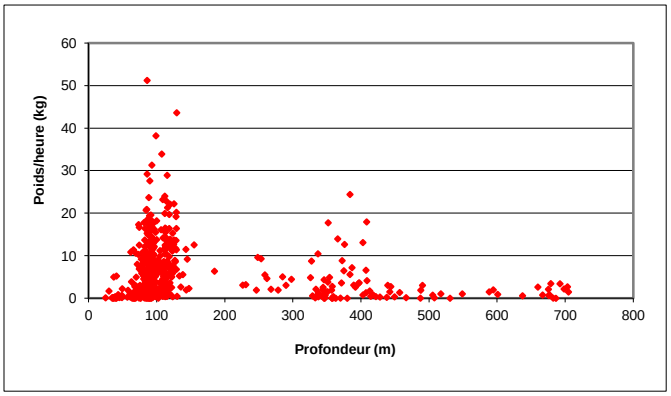
Helicolenus dactylopterus



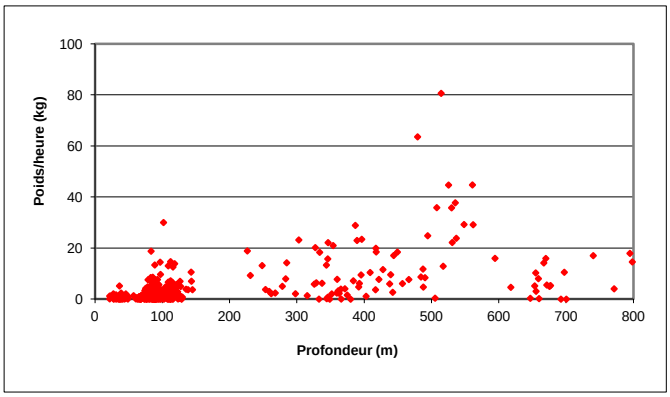
Lepidorhombus boscii



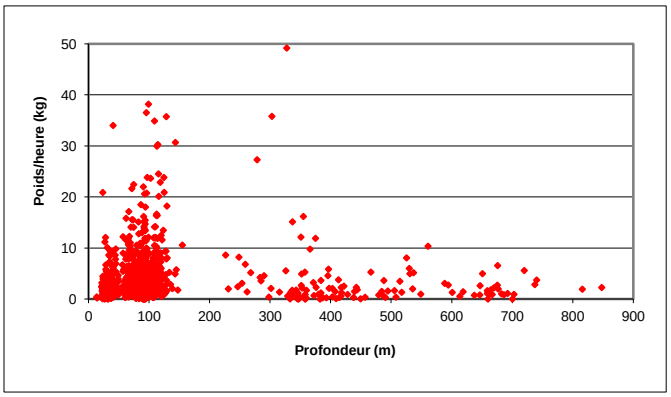
Lophius budegassa



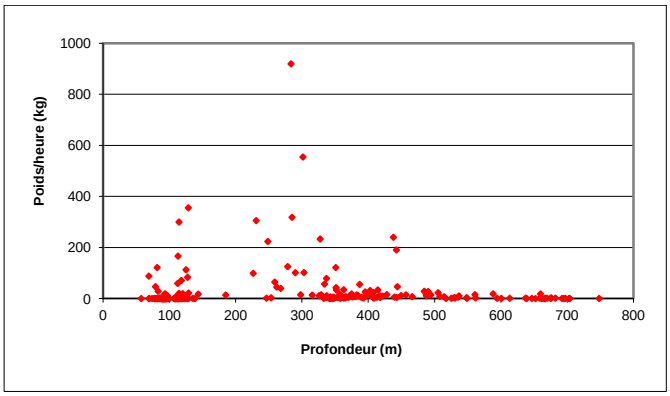
Lophius piscatorius



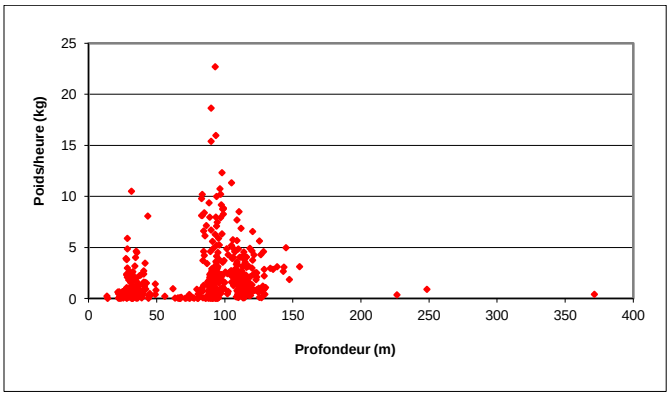
Merluccius merluccius



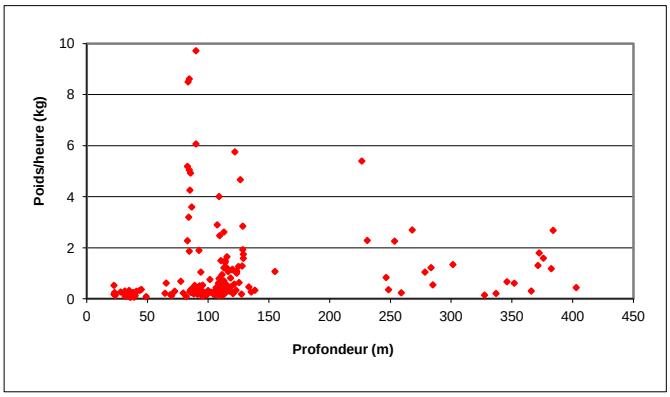
Micromesistius poutassou



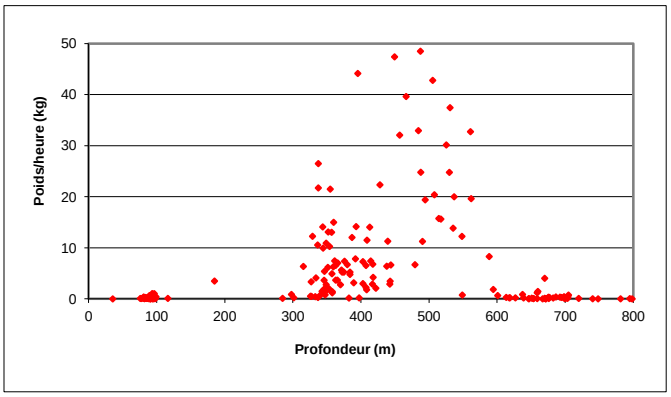
Mullus barbatus



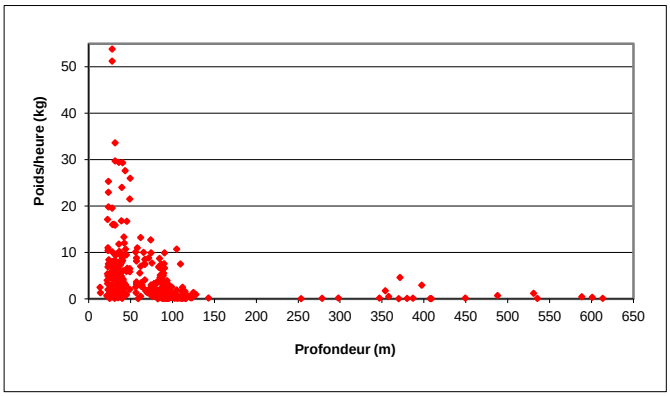
Mullus surmuletus



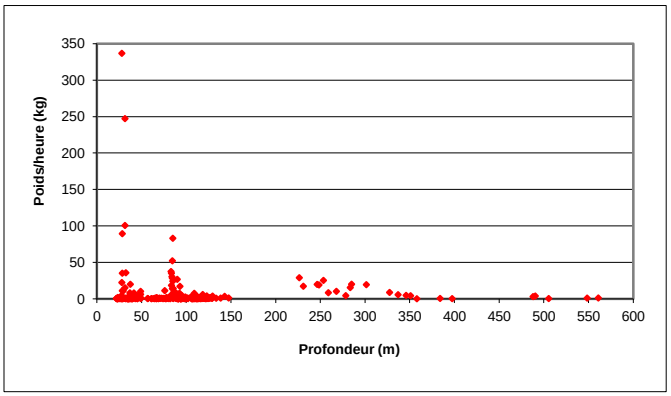
Nephrops norvegicus



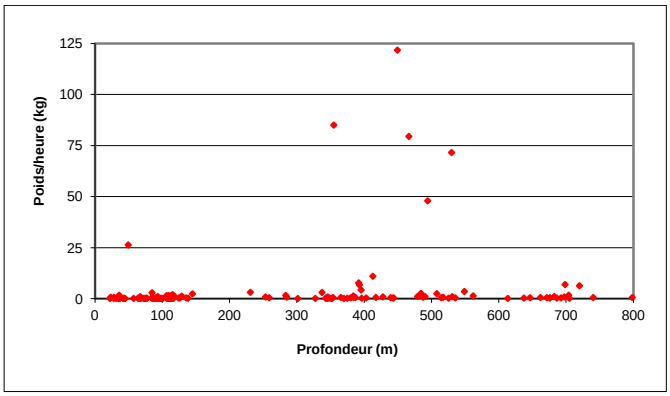
Octopus vulgaris



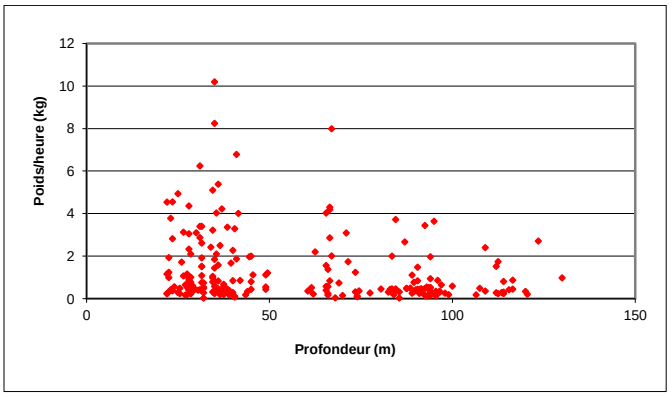
Pagellus acarne



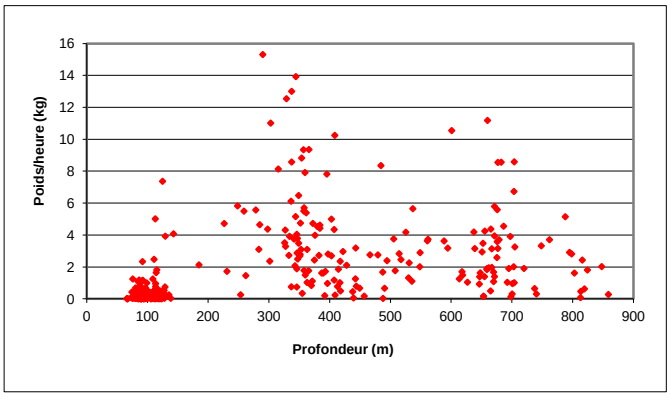
Pagellus bogaraveo



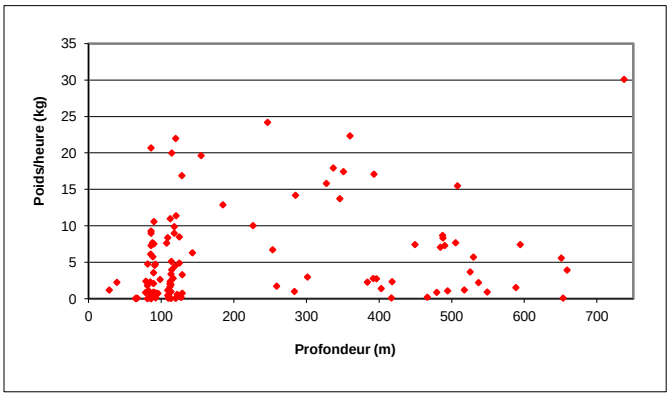
Pagellus erythrinus



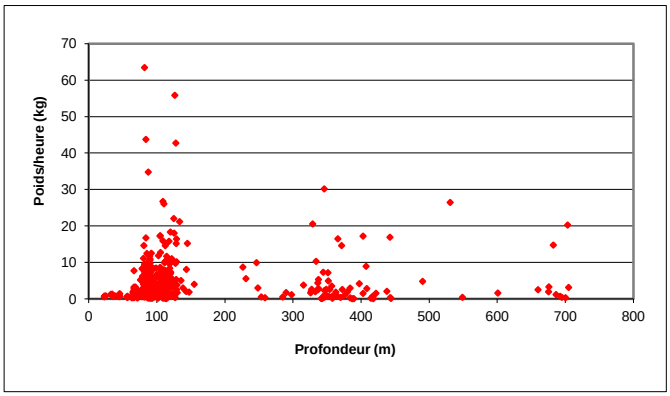
Phycis blennoides



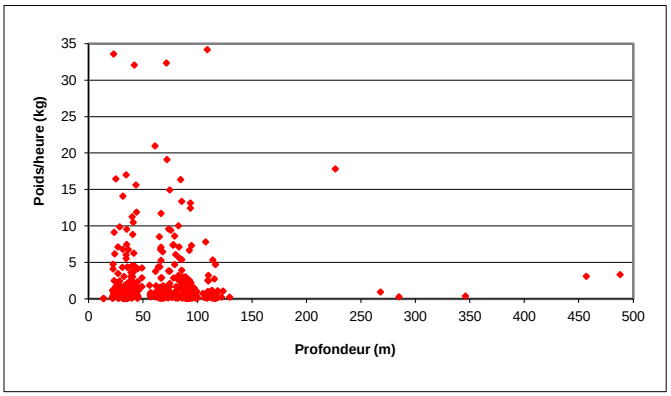
Raja clavata



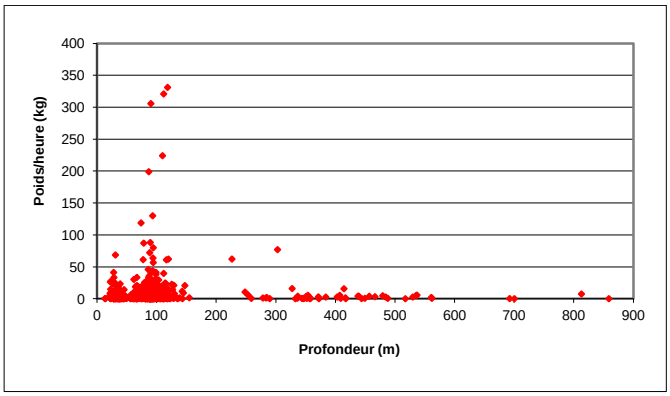
Scyliorhinus canicula



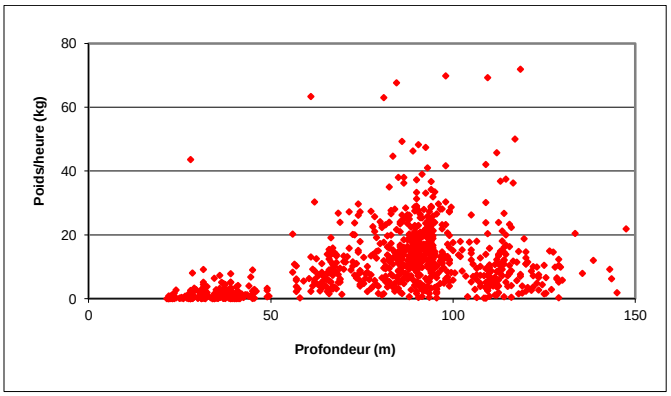
Trachurus mediterraneus



Trachurus trachurus

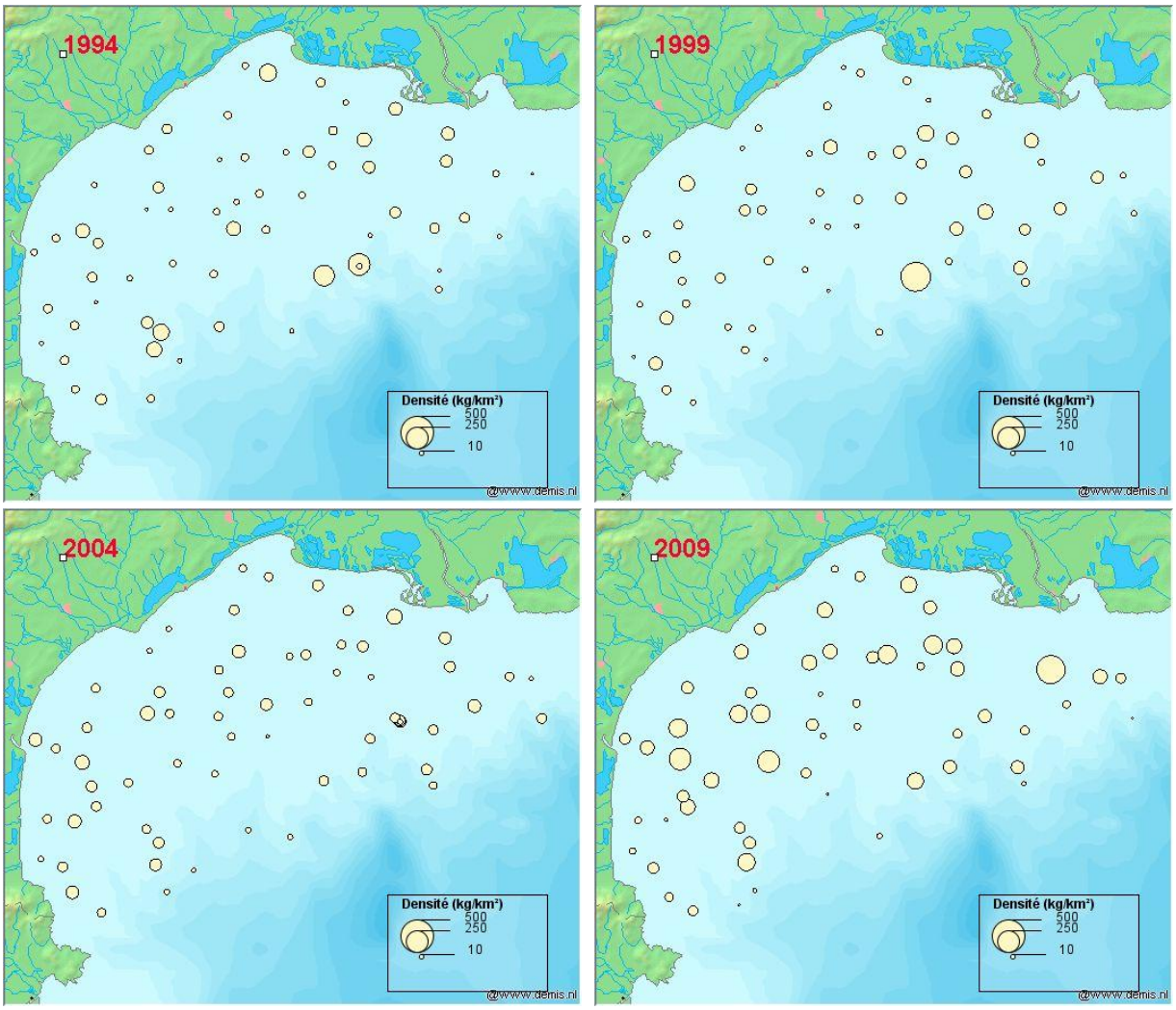


Trispoterus minutus

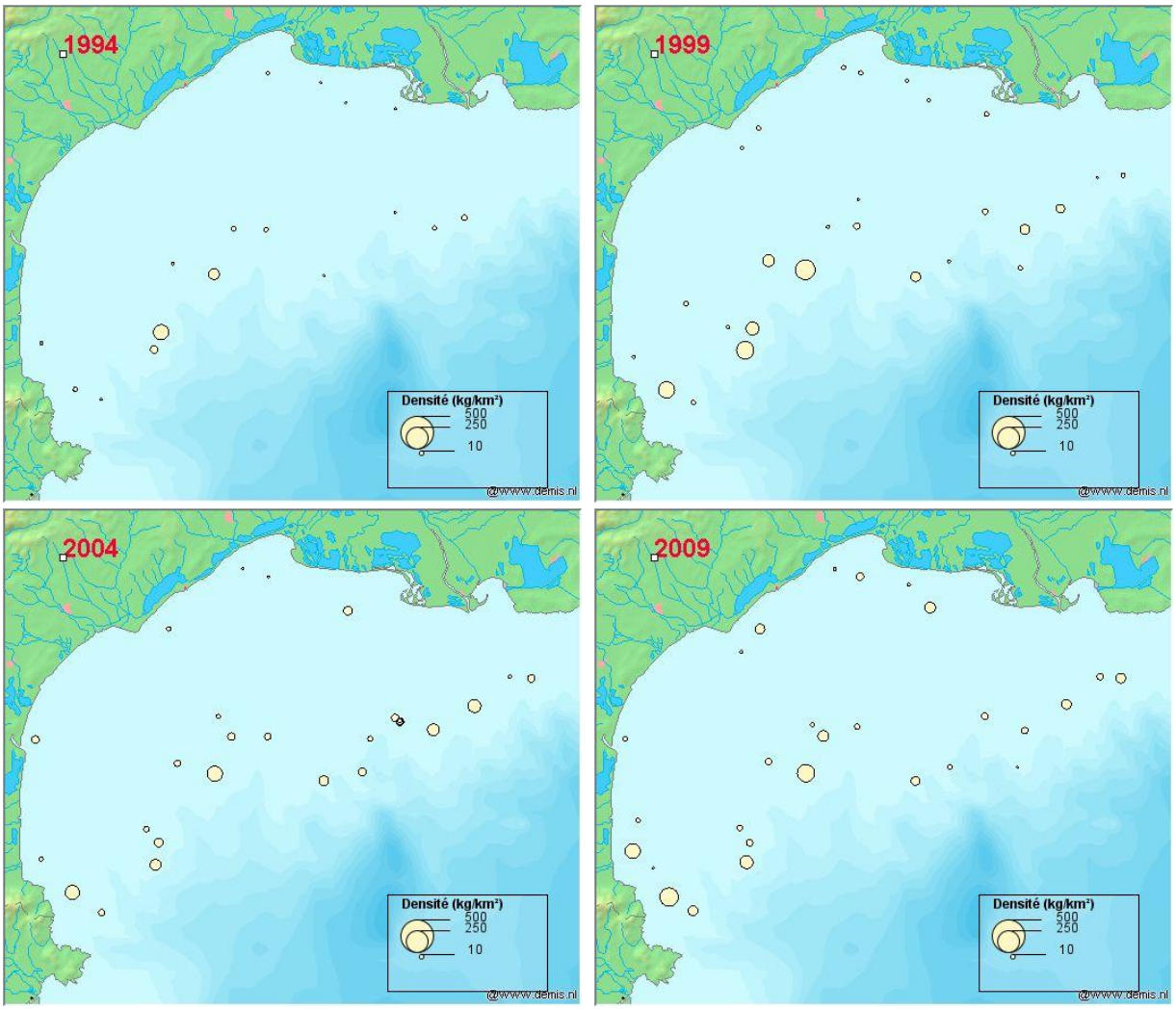


Spatial distribution and density of the main species

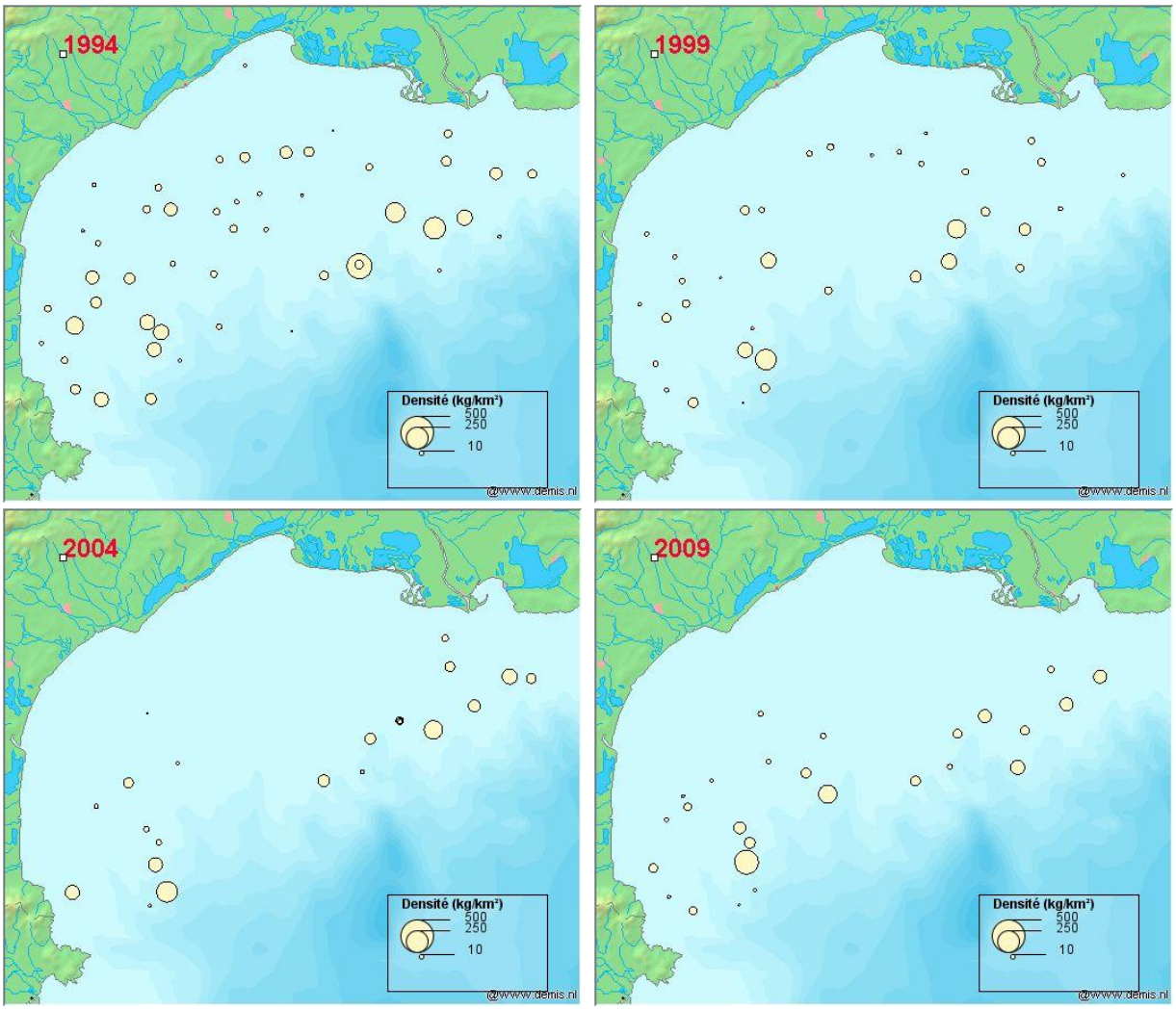
Merluccicus merluccius



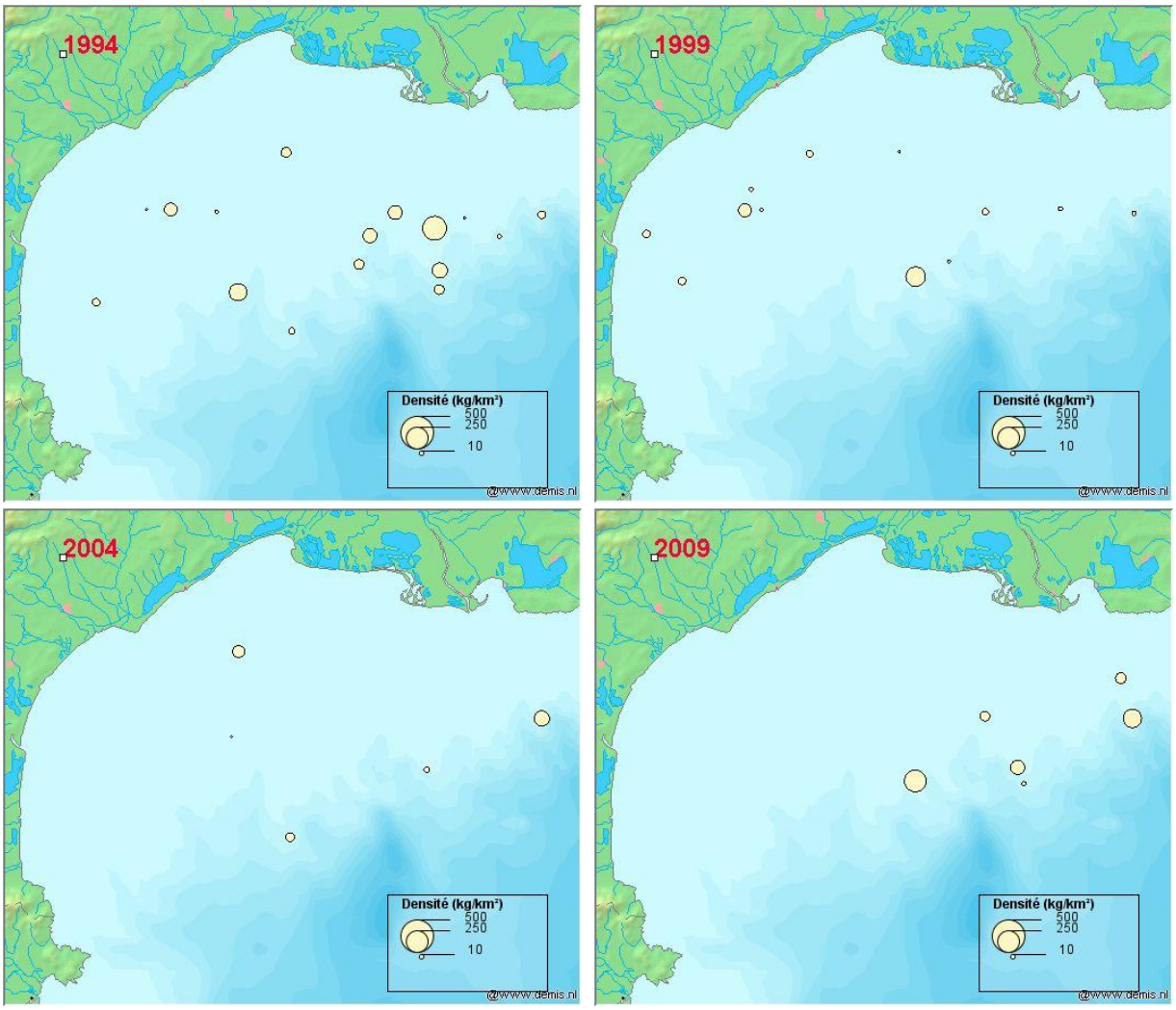
Mullus barbatus



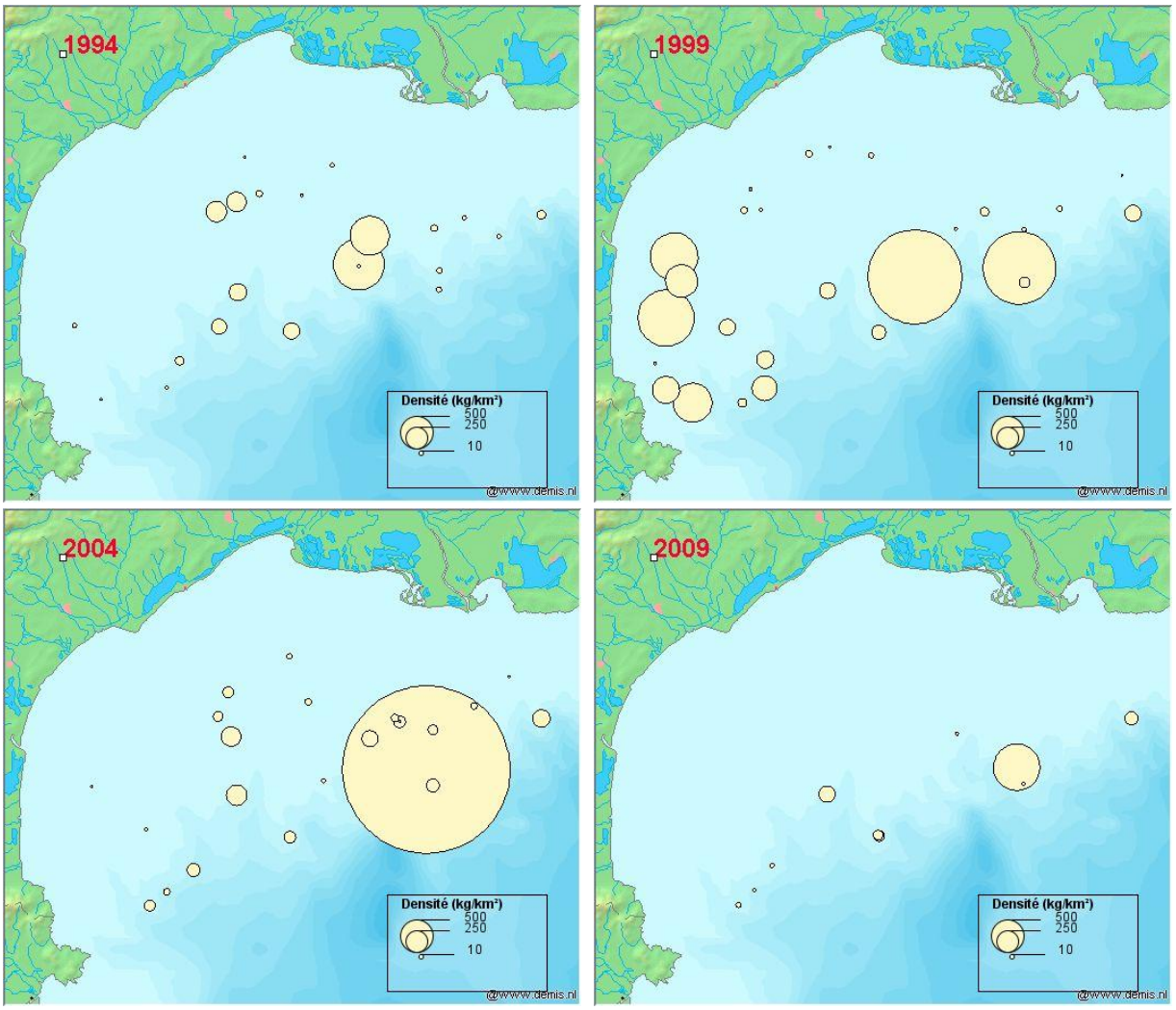
Scyliorhinus canicula



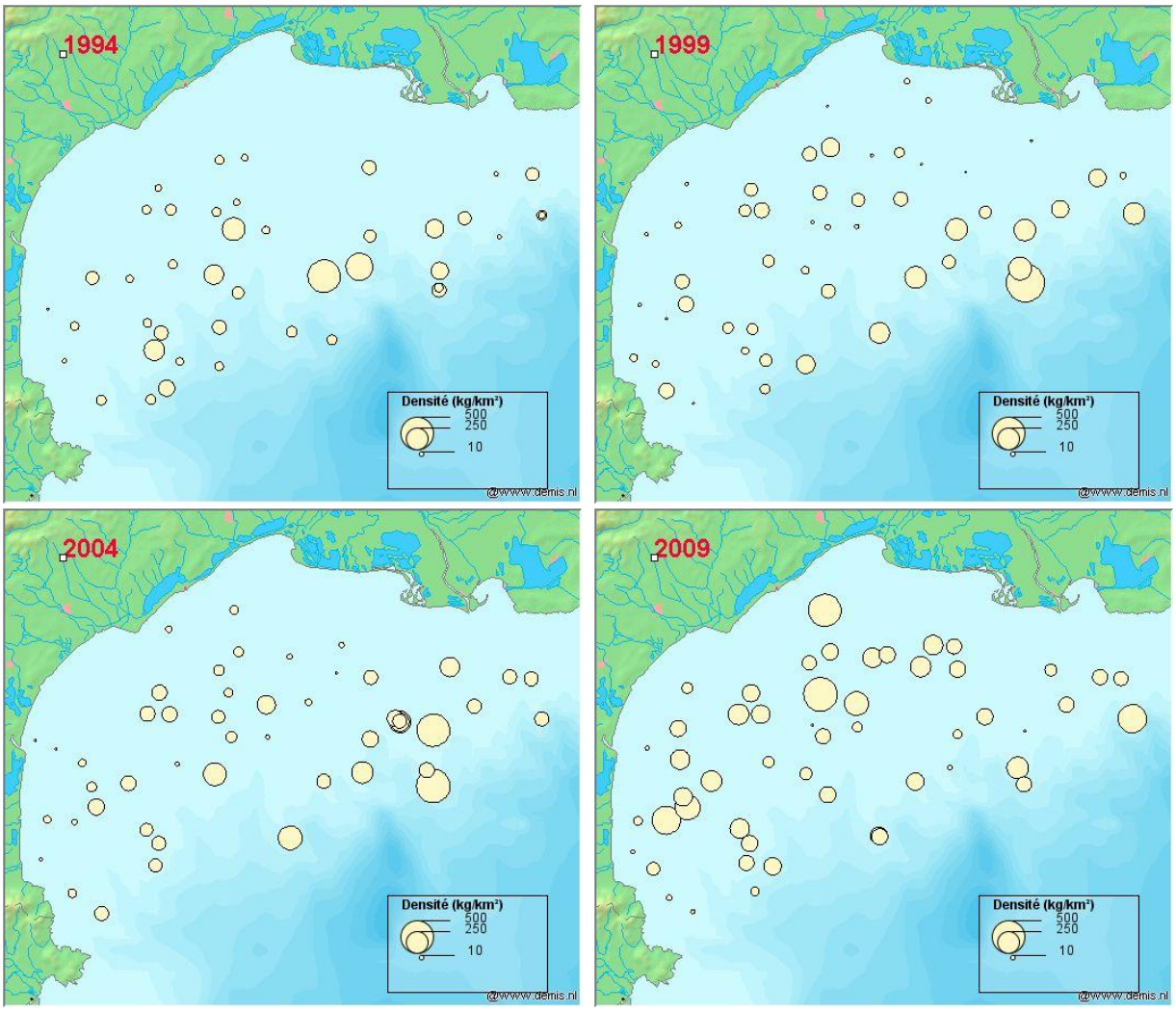
Raja clavata



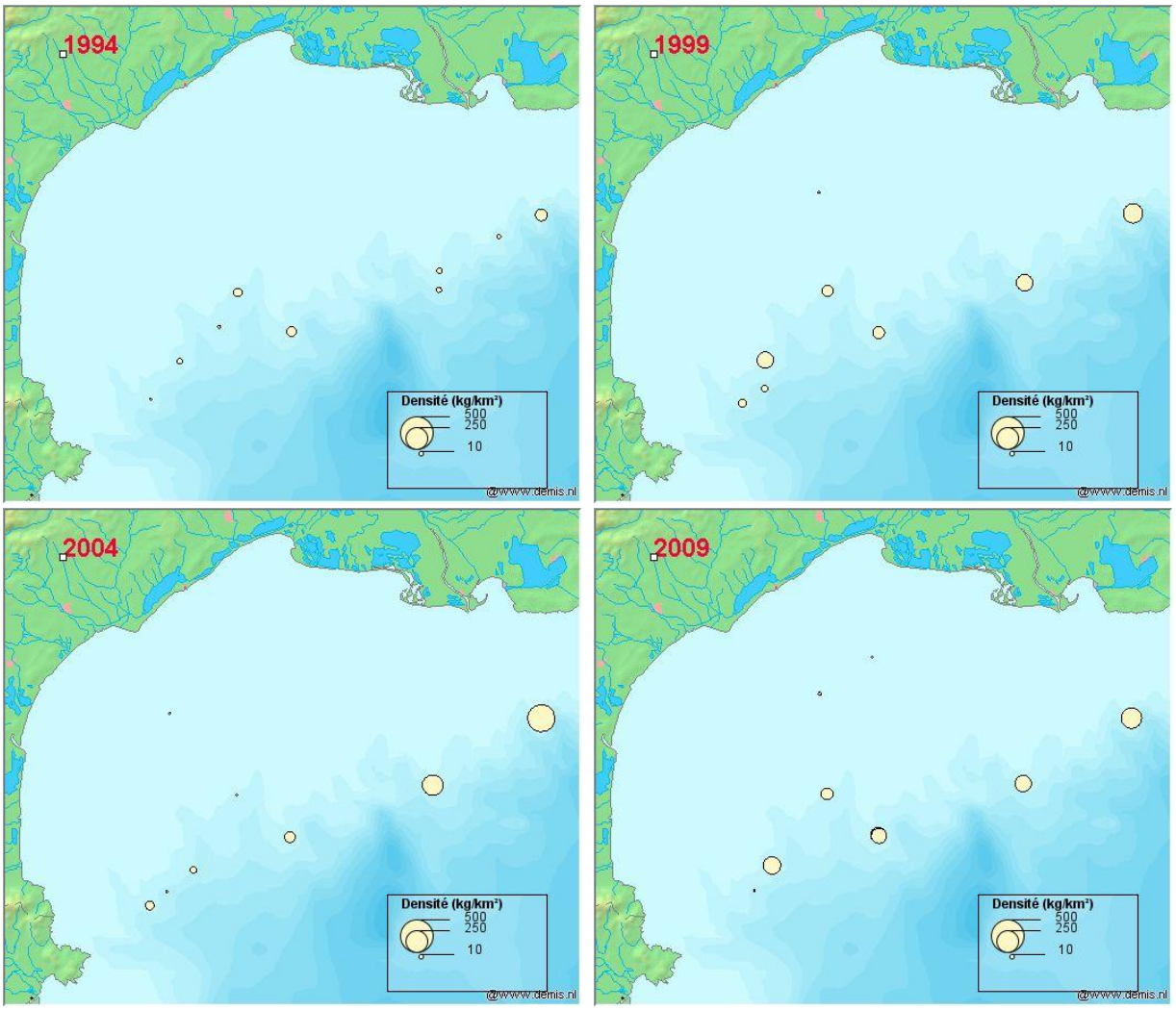
Micromesistius poutassou



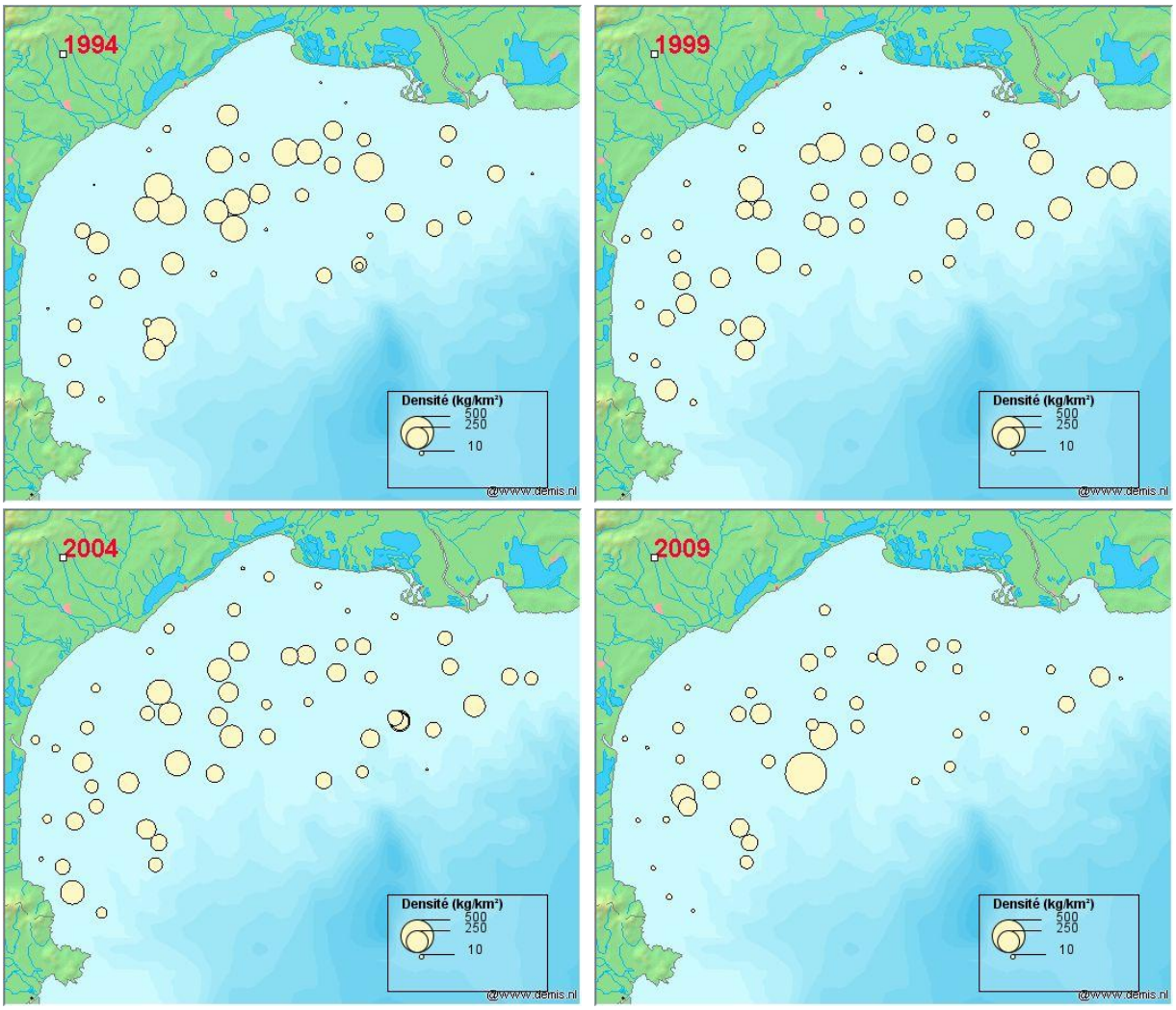
Lophius spp


1994
Densité (kg/km²)
500
250
10
@www.demis.nl
1999
Densité (kg/km²)
500
250
10
@www.demis.nl
2004
Densité (kg/km²)
500
250
10
@www.demis.nl
2009
Densité (kg/km²)
500
250
10
@www.demis.nl

Nephrops norvegicus



Trisopterus minutus



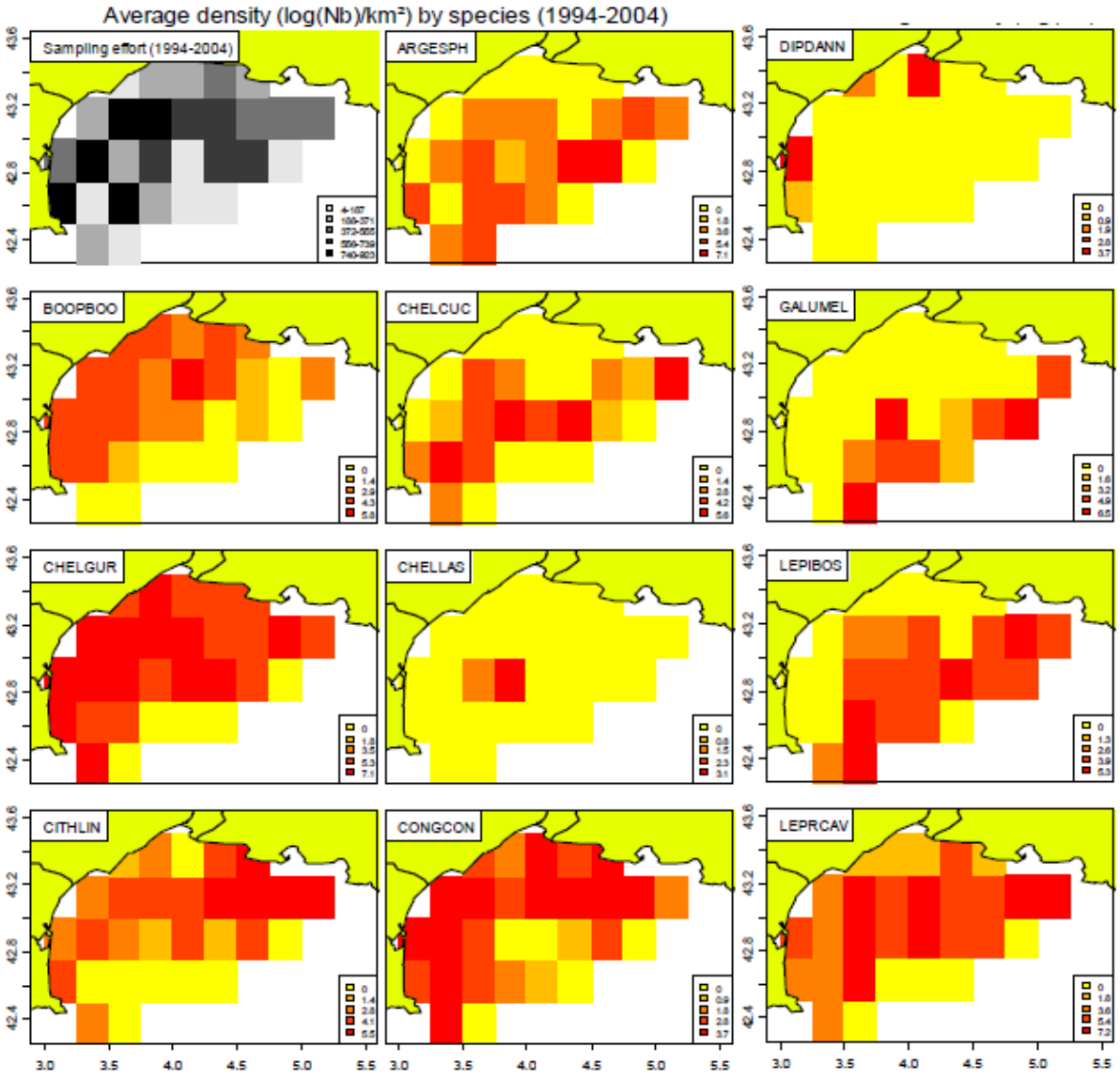
ANNEX 5

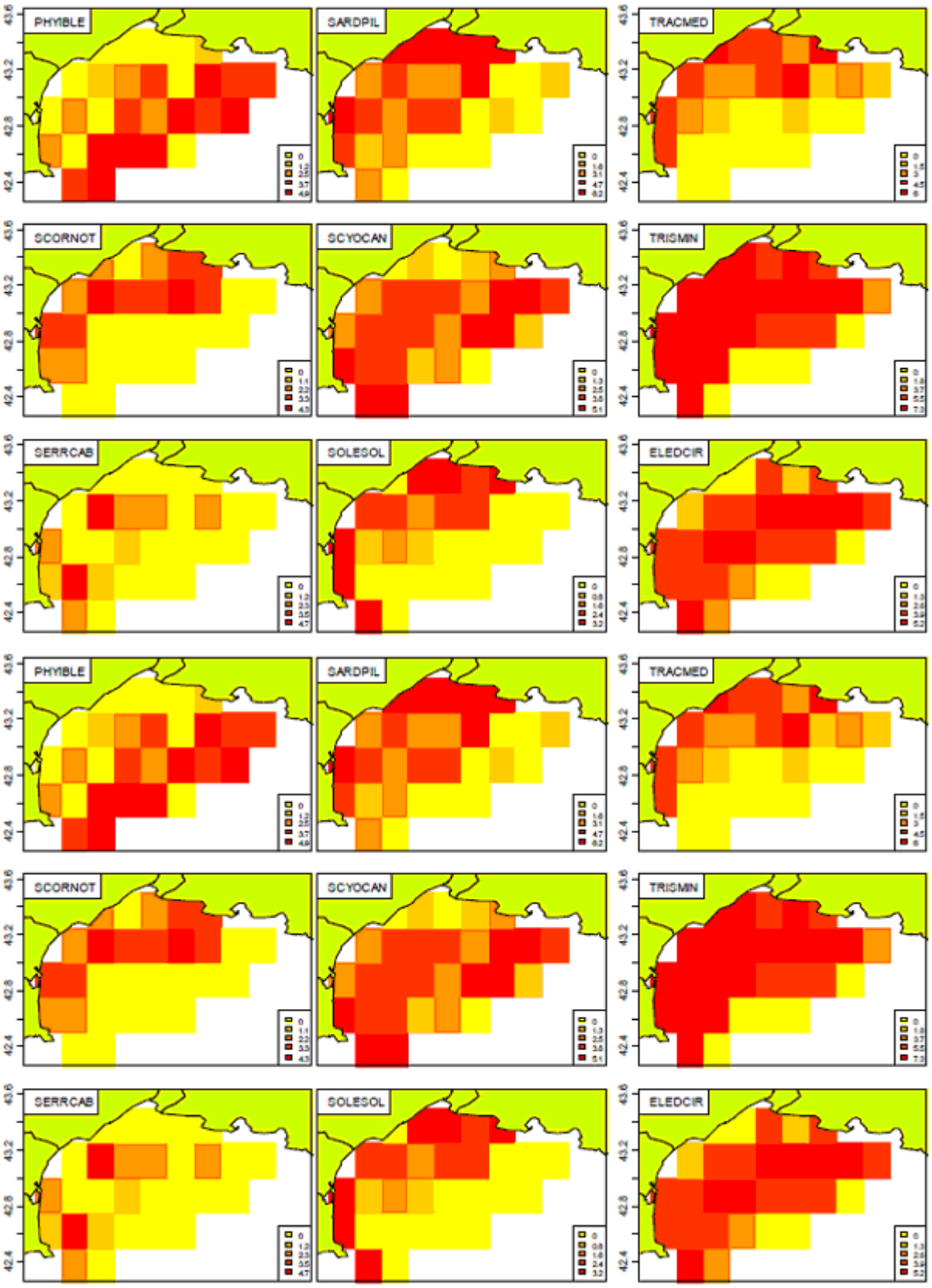
Average density (1994-2004) for 44 species

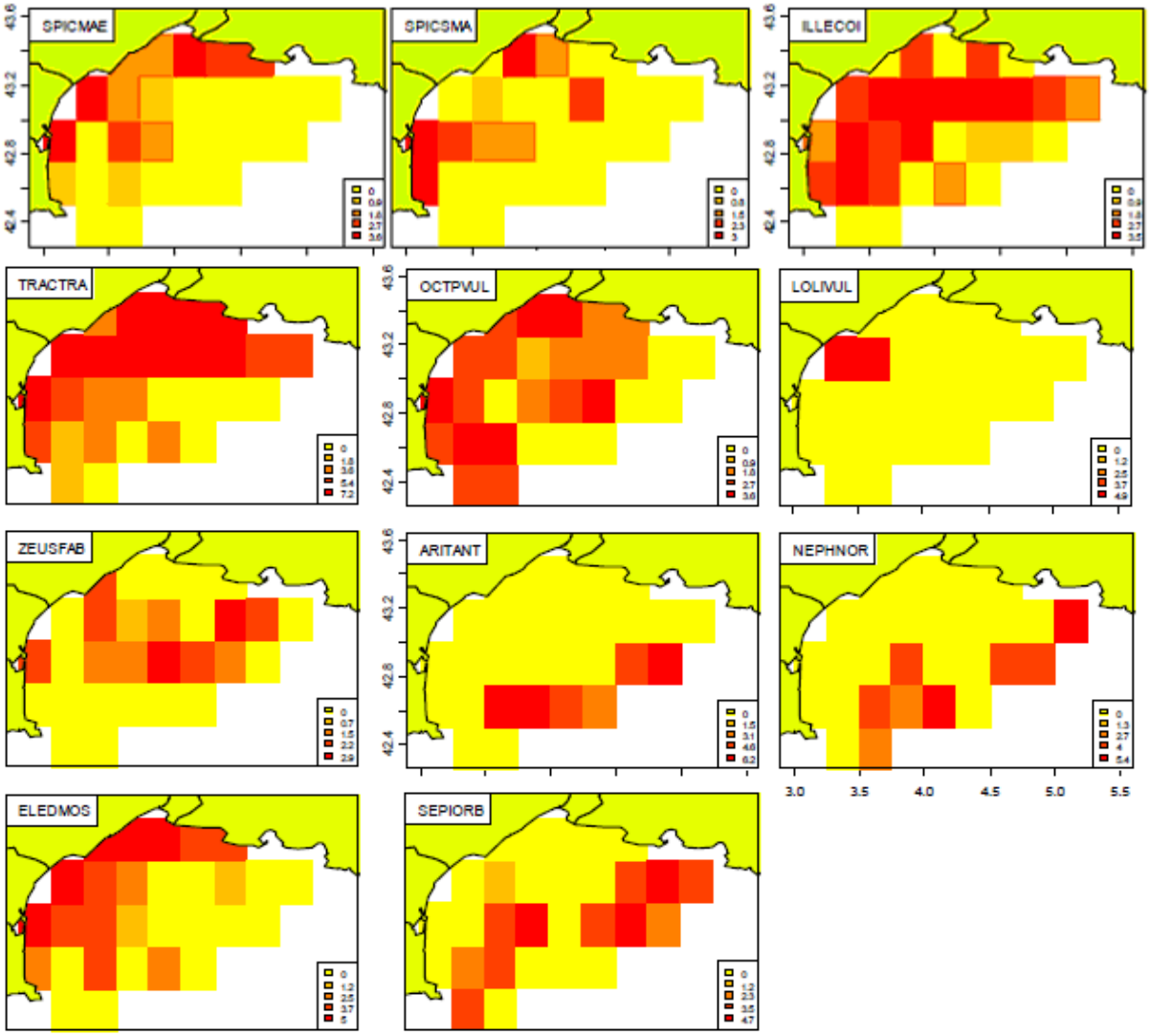
Source : Morin J., Bertrand J., Cochard M.L., Coppin F., Léauté J.P., Lobry J., Mahé J.C., Poulard J.C., Rochet M.J., Schlaich I., Souplet A., Trenkel V., Vaz S., Vérin Y., 2009. L'état des communautés exploitées au large des côtes de France. Application d'indicateurs à l'évaluation de l'impact de la pêche. Bilan 2004 – Edition 2009. Ifremer, HMMN, 43 pages + 749 p.annexes.

Species	code
Argentina sphyraena	ARGESPH
Boops boops	BOOPBOO
Chelidonichthys cuculus	CHELCUC
Chelidonichthys gurnardus	CHELGUR
Chelidonichthys lastoviza	CHELLAS
Citharus linguatula	CITHLIN
Conger conger	CONGCON
Diplodus annularis	DIPDANN
Engraulis encrasicolus	ENGRENC
Galeus melastomus	GALUMEL
Helicolenus dactylopterus	HELIDAC
Lepidorhombus boscii	LEPIBOS
Lepidopus caudatus	LEPPCAU
Lepidotrigla cavillone	LEPRCAV
Lophius budegassa	LOPHBUD
Lophius piscatorius	LOPHPIS
Merluccius merluccius	MERLMER
Micromesistius poutassou	MICMPOU
Mullus barbatus	MULLBAR
Mullus surmuletus	MULLSUR
Pagellus acarne	PAGEACA
Pagellus bogaraveo	PAGEBOG

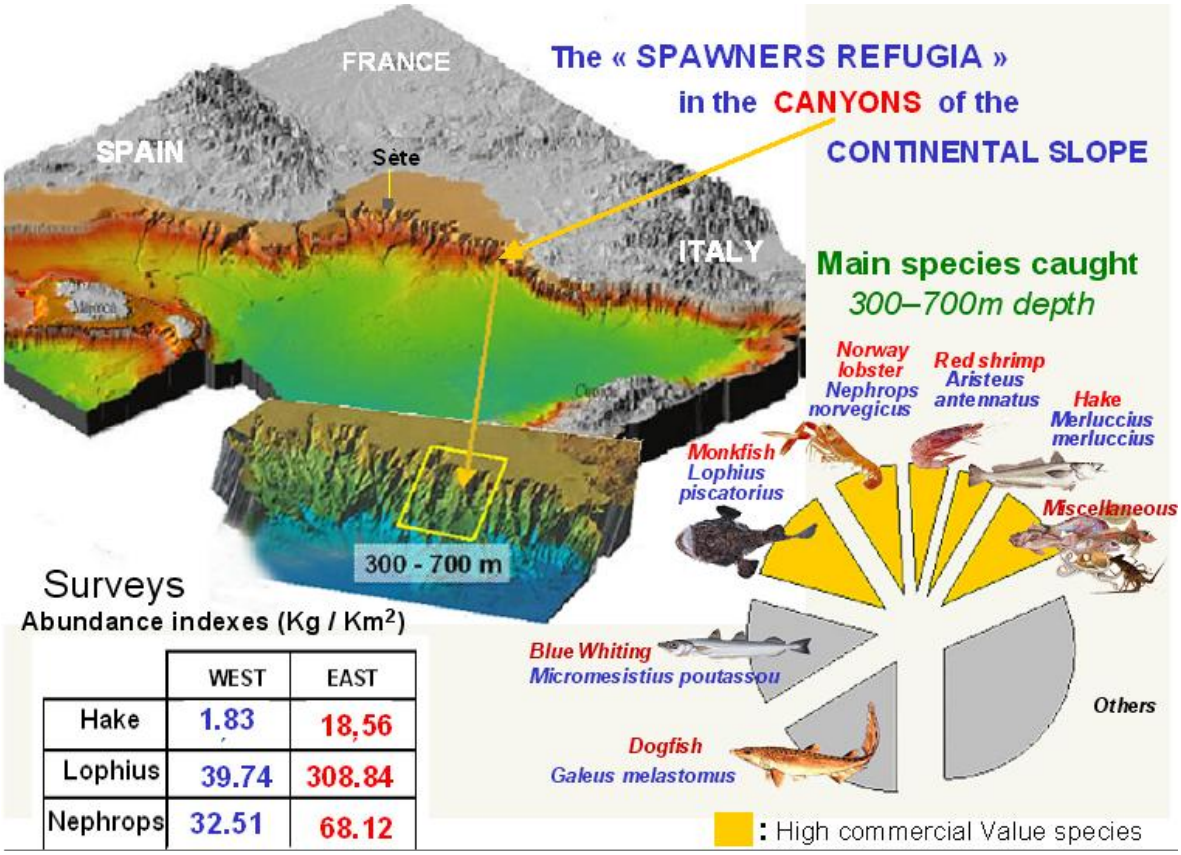
Species	code
Pagellus erythrinus	PAGEERY
Phycis blennoides	PHYIBLE
Sardina pilchardus	SARDPIL
Scorpaena notata	SCORNOT
Scyliorhinus canicula	SCYOCAN
Serranus cabrilla	SERRCAB
Solea solea	SOLESOL
Spicara maena	SPICMAE
Spicara smaris	SPICSMA
Trachurus mediterraneus	TRACMED
Trachurus trachurus	TRACTRA
Trisopterus minutus	TRISMIN
Zeus faber	ZEUSFAB
Eledone cirrhosa	ELEDCIR
Eledone moschata	ELEDMOS
Illex coindetii	ILLECOI
Loligo vulgaris	LOLIVUL
Octopus vulgaris	OCTPVUL
Sepia orbignyana	SEPIORB
Aristeus antennatus	ARITANT
Nephrops norvegicus	NEPHNOR


Average density (log(Nb)/km²) by species (1994-2004)
Sampling effort (1994-2004)
ARGESPH
DIPDANN
BOOPBOO
CHELCUC
GALUMEL
CHELGUR
CHELLAS
LEPIBOS
CITHLIN
CONGCON
LEPRCAV


PHYBLE
SARDPIL
TRACMED
SCORNOT
SCYOCAN
TRISMIN
SERRCAB
SOLESOL
ELEDCIR
PHYBLE
SARDPIL
TRACMED
SCORNOT
SCYOCAN
TRISMIN
SERRCAB
SOLESOL
ELEDCIR

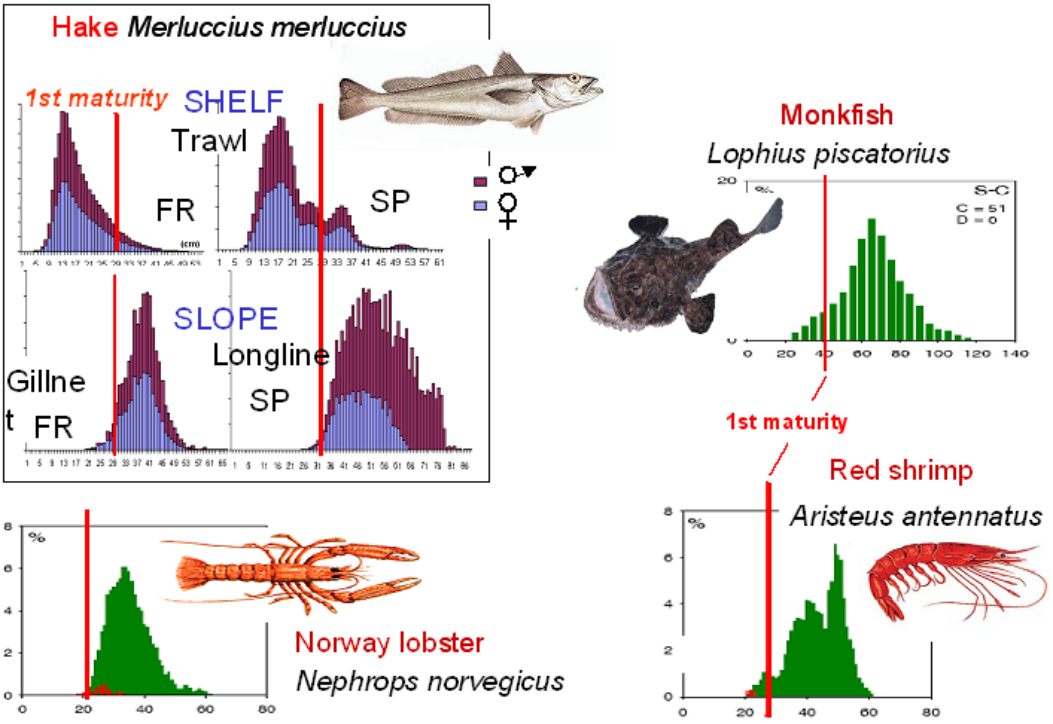

SPICMAE
SPICSMA
ILLECOI
TRACTRA
OCTPVUL
LOLIVUL
ZEUSFAB
ARITANT
NEPHNOR
ELEDMOS
SEPIORB
43.6
43.2
42.8
42.4
3.0
3.5
4.0
4.5
5.0
5.5

ANNEX 6



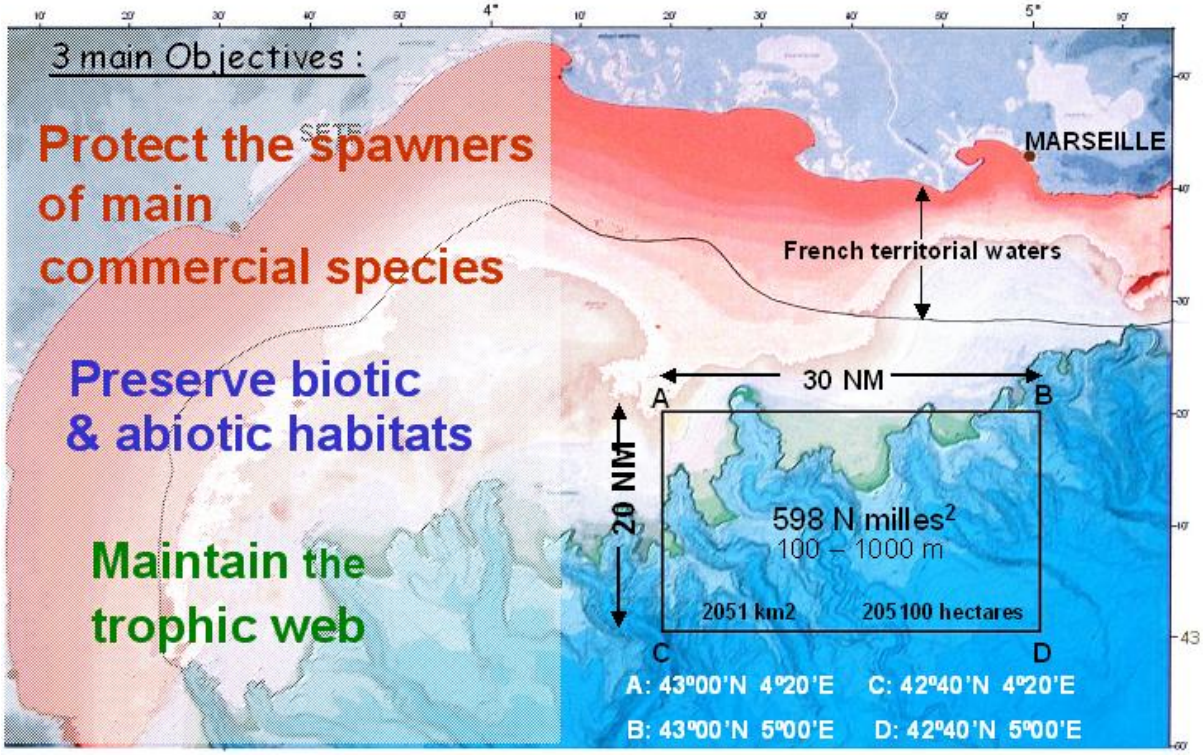
	WEST	EAST
Hake	1.83	18,56
Lophius	39.74	308.84
Nephrops	32.51	68.12

sizes of the catches in the eastern canyons



The Fishery Restricted Area

Adopted by the GFCM member countries in March 2009



RECOMMENDATION GFCM/33/2009/1
ON THE ESTABLISHMENT OF A FISHERIES RESTRICTED AREA IN THE GULF OF LIONS TO PROTECT SPAWNING AGGREGATIONS AND DEEP SEA SENSITIVE HABITATS

The General Fisheries Commission for the Mediterranean (GFCM),*RECALLING* that the objective of the Agreement establishing the General Fisheries Commission for the Mediterranean is to promote the development, conservation, rational management and best utilization of living marine resources;

RECALLING Recommendation GFCM/29/2005/1 on the management of certain fisheries exploiting demersal and deepwater species and, notably, Article 1 therein; *CONSIDERING* that the Scientific Advisory Committee (SAC) assesses that several stocks are overexploited, some with a high risk of collapse, and that sustainable management requires that measures aimed at limiting the capture of juveniles are implemented;

REAFFIRMING its commitment to further improving the gear selectivity of demersal trawl fisheries beyond what can be achieved by a minimum 40 mm square mesh size with a view to ensure better protection of juveniles of several species as well as to reduce discarding practices in a multispecies context;

CONSIDERING that selectivity of some fishing gears cannot go beyond certain level in Mediterranean mixed fisheries and that, in addition to the overall control and limitation of the fishing effort and fleet capacity, it is fundamental to limit the fishing effort in areas in which adults of important stocks aggregate in order to allow these stocks to deliver the necessary recruitment, thus allowing for their sustainable exploitation;

NOTING that the SAC advises to ban the use of towed and fixed gears and longlines for demersal resources in an area on the continental shelf and slope of the Eastern Gulf of Lions;

CONSIDERING that more scientific information is needed with a view to understand the relevance of her adjacent areas on the continental shelf and slope for the protection of spawners and sensitive habitats as well as to better known the level and spatial distribution of the fishing effort exerted

PENDING the delivery of this additional information by the SAC.

ADOPTS in conformity with the provision of paragraph 1 (b) and (h) of Article III and Article V of GFCM Agreement that:

1. The fishing effort for demersal stocks of vessels using towed nets, bottom and mid-water longlines, bottom-set nets shall not exceed the level of fishing effort applied in 2008 in the fisheries restricted area of the eastern Gulf of Lions as bounded by lines joining the following geographic coordinates:

42°40'N, 4°20' E;
42°40'N, 5°00' E;
43°00'N, 4°20' E;
43°00'N, 5°00' E;

2. Members and cooperating non-Members of GFCM shall communicate to the GFCM Executive Secretary not later than June 2009 the list of vessels that have used towed nets, bottom and midwater longlines, bottom-set nets in the area referred to in paragraph 1 in the year 2008.

3. The list shall contain the following information for each vessel:

_ Name of vessel
_ Register number
_ GFCM unique identifier (country ISO 3-alpha code + 9 digits, e.g. xx000000001)
_ Previous name (if any)
_ Previous flag (if any)
_ Previous details of deletion from other registries (if any)
_ International radio call sign **(**if any)
_ Type of vessel, length overall and gross tonnage (GT) and/or gros registered tonnage (GRT)
_ Name and address of owner(s) and operator(s)
_ Main gear(s) used to fish in the fishery restricted area
_ Seasonal period authorized for fishing in the fishery restricted area
_ Number of fishing days exerted by each vessel in the year 2008 and number of fishing days exerted in the fishery restricted area

4. Members and cooperating non-Members of GFCM shall establish a register of the fishing vessels authorized to fish in the area which ensure that the vessels not having records of fishing in the area prior 31 December 2008 are not authorized to start fishing therein.

5. Members and cooperating non-Members of GFCM shall communicate to the GFCM Executive Secretary not later than September 2009 the legal conditions, as in force at 31 December 2008, as for the maximum time of daily fishing activity, the maximum number of days a vessel can stay at sea as well as the compulsory timing between the exit and return to the registered port of their fishing vessels.

6. Members and cooperating non-Members of GFCM shall ensure that fishing vessels operating in the area respect their obligation as in force at 31 December 2008 as for the maximum time of daily fishing activity, the maximum number of days a vessel can stay at sea as well as the legally compulsory timing to exit and return to the registered port.

7. For the fisheries restricted area referred to in paragraph 1 , Members and Cooperating non-Members of GFCM shall call the attention of the appropriate national and international authorities in order to protect this area from the impact of any other human activity jeoopardizing the conservation of the features that characterize this particular habitat as an area of spawners' aggregation.

8. Boundaries of the area and conditions to fish therein as referred to in previous paragraphs may change on the basis of SAC advice.

ANNEX 7

PROPOSAL OF FISHERIES RESTRICTED AREAS (FRA)

CONCERNING THE CAP CREUS CANYON

Submitted by:
World Wide Fund for Nature – WWF
Institute of Marine Sciences (ICM-CSIC), Barcelona (Spain).

Submitted to the GFCM Scientific Advisory Committee

10th SessionNicosia, Cyprus, 22-26 October 2007- Ref: GFCM:SAC10/2007/Inf.19

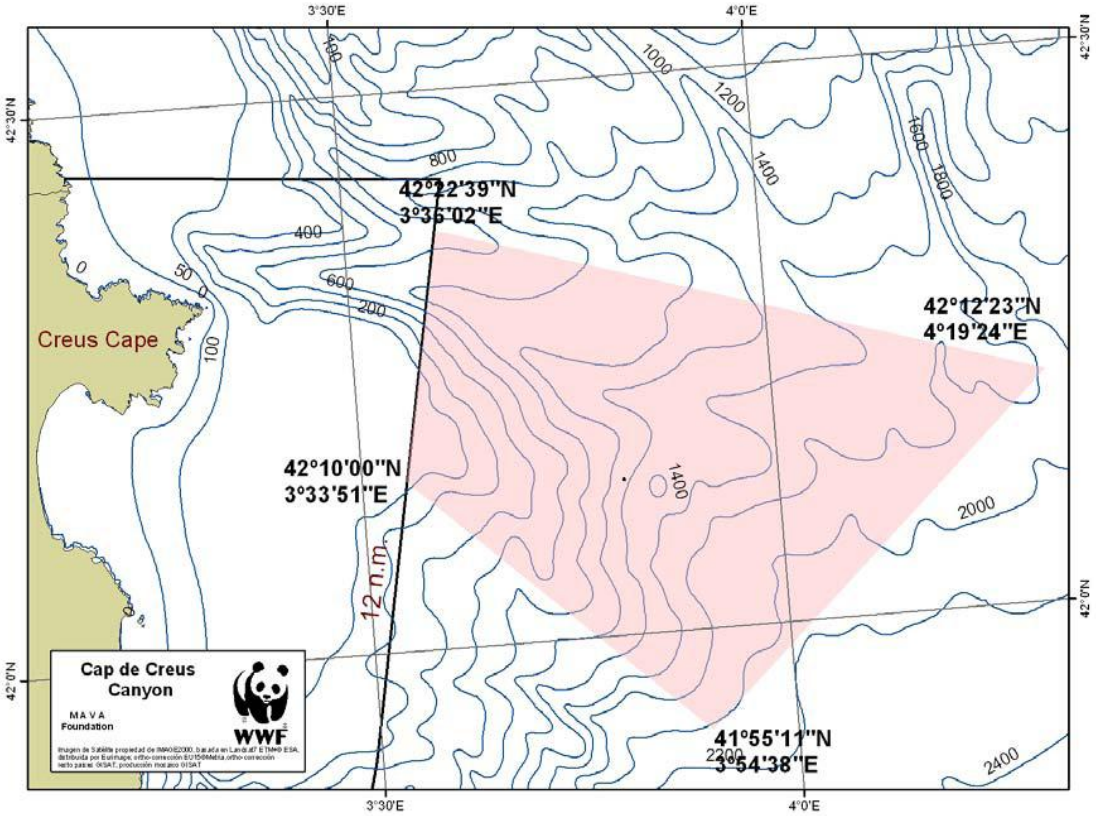
The Cap de Creus Canyon is the most western one in the submarine Canyons system of the Gulf of Lions, a bathymetrically complex region with significant sediment input from the Rhone river and many other small rivers. The preferential direction of the coastal currents, the narrowing of the shelf and the coastal topographic constrain causes that most of the sediment transport occur through the Cap de Creus Canyon, where observed sediment fluxes are much higher than in the eastern and central submarine Canyons. Additionally, the Cap de Creus Canyon is more frequently affected by periodical arrivals of dense, cold and particle rich shelf water cascades, which makes it a unique habitat in the northwestern Mediterranean. It presents deep zones very close to the coast with a still much unknown faunistic composition. The abundant supply of organic matter trough the whole Canyon is thought to be essential for the maintenance of its associated deep sea ecosystems and high biodiversity, including its threatened deep sea coral species. The three-dimensional communities, dominated by *Madrepora oculata*, observed in different locations of the Cap de Creus, constitute therefuge and nursery of numerous benthic mobile species, as well as fish larvae and decapods, in some cases of commercial interest, like hake and red shrimp. The presence of numerous remnants of ropes and fishing gears found in the areas prospected attests the impact of industrial fishing activities in the Canyon. It is known that many of these deep sea coral communities were destroyed probably due to the intense activity of trawlers and bottom long-liners in the areas of the shelf and slope. The living coral communities of the Cap of Creus have survived due to the inaccessibility of some of these deep zones. Current levels of fisheries exploitation (targeting crustaceans and demersal fish) are resulting in an important biodiversity loss, destroying valuable sessile communities and preventing their use as shelterand food by numerous marine organisms. Benthic communities found until now in the Canyon, show a patchy distribution. Patche spresent different sizes being some of them quite large (up to several 100 m2). These benthic communities are dominated by the cold water coral *Madrepora oculata* which mixed in several places with *Lophelia pertusa*. The size of the patches should be enough to consider them as a core area that will permit the start of a mid and long term recovery of the vanished populations in the slope and end of the continental shelf. Nowadays there are more evidences of the interconnection among all the communities of the Canyon, from the continental shelf to the deep-sea waters. The terraces located in the head of the canyon are plenty of organic debris from coastal organisms (like mollusc shells and urchin skeletons) coming from the surrounding shelves. At the same time

mobile organisms, like lobsters and fish, have been observed in many places inside the canyon. These organisms temporarily visit or migrate to coastal zones. Due to this interconnection it is necessary an integral conservation plan of the core area together with shallower areas, that will include a strictly enforced fisheries restricted area.Cap de Creus Canyon is located at the Mediterranean Costa Brava (42o 18' 49.202 N – 003o34' 6.000 E). It starts in the continental shelf at approximately 90-100 m depth and is 5 km offshore of the coastal line. The Canyon is oriented northwest-southeast, constituting an axis of a V shape structure that gradually opens toward the open sea. The total length of theCanyon is around 40 km and its maximum depth 2000 m. The Cap de Creus Canyon has been identified as the main outlet of dense shelf waters from the Gulf of Lions.

Precise location of the proposed area:

Northernmost: 42º22'39''N – 3º36'02''E
Southernmost: 41º55'11''N – 3º54'38''E
Easternmost: 42º12'23''N – 4º19'24''E
Westernmost: 42º10'00''N – 3º33'51''E

Depth range : 200-2000 m**2.**
Surface: 1742 km2 – 174200 ha



Dominant marine habitats:

Benthic communities:

1. Soft bottom communities dominated by Pennatulaceans.
2. Soft bottom communities dominated by Ceriantharia. These communities are dominant insoft bottom shelf areas, but also inside the canyon.
3. Hard bottom communities dominated by Scleractinians. These communities dominated thehard substrate areas, mainly of the southern wall of the canyon. However the rockypromontories of the northern wall presented also cold coral communities. The dominantspecies in the identified communities until now was *Madrepora oculata,* which mixed with *Lophelia pertusa* and also with *Dendrophyllia cornigera*.The communities showed a considerable diversity of benthic sessile species, with presence ofseveral sponge species, octocorals, hydroids, bryozoans, brachiopods, ascidians etc., and also of mobile species as ophiuroids, sea urchins and several species of decapods. Moreover, a richzooplanktonic community live associated with this benthic communities finding there refugeand a nursery place.

Until now 12 fish taxa have been identified. Some of these species are commercially important in theMediterranean, specially hake (*Merluccius merluccius*).The upper wall of submarine canyons has been considered elsewhere as an important refuge habitat for several abundant zooplanktonic species such as the swarms of euphausiacea. But also the coral forests and other habitats inside the canyon constitute a refuge for numerous benthic mobile (e.g. ophiuroids, crabs) and sessile species (e.g. brachiopods,sponges), as well as a nursery for fish larvae and decapods, in some cases of highcommercial interest, like hake and red shrimp.

ANNEX 8

RECOMMENDATION GFCM/2005/1 ON THE MANAGEMENT OF CERTAIN FISHERIES EXPLOITING DEMERSAL AND DEEPWATER SPECIES

FAO General Fisheries Commission for the Mediterranean.Report of the twenty-ninth session. Rome, 21–25 February 2005.GFCM Report. No. 29. Rome, FAO. 2005. 50p

The General Fisheries Commission for the Mediterranean (GFCM),

RECALLING that the objectives of the Agreement establishing the General Fisheries Commission for the Mediterranean are to promote the development, conservation, rational management and proper utilization of living marine resources;

RECALLING the Declaration of the Ministerial Conference for the Sustainable Development of the Fisheries in the Mediterranean held in November 2003 in Venice and, in particular, paragraph 4, third indent;

RECALLING that effective management measures aim to curb the decline in stocks identified in the scientific advice, and to improve the exploitation pattern in the fisheries;

RE-AFFIRMING the principles of the FAO Code of Conduct for Responsible Fisheries and recalling the precautionary approach to fisheries management therein and, in particular, in relation to the development of new fisheries;

CONSIDERING that in the absence of any scientific information on the status of fisheries and of the exploited resources a more cautious approach is needed and that suitable information coming from adjacent areas could be used for proper and precautionary management of fisheries;

NOTING that the selectivity of codend mesh sizes currently in use in the various demersal trawl fisheries is not suitable to ensure adequate protection for juveniles of several species, as well as toreduce discarding practices;

CONSIDERING also that in the advice for 2001, 2002, 2003, and 2004 the Scientific AdvisoryCommittee (SAC) considered that certain stocks are overexploited, some with a high risk of collapse, and that sustainable management requires that measures aimed at limiting the capture of juveniles are implemented;

NOTING that the stock assessment conducted by the SAC only concern specific geographical subareas corresponding to the data supplied by certain Members and that the assessed stocks may beshared with adjacent GFCM geographical sub-areas (GSAs);

RECALLING Recommendation GFCM/2002/1 which urges the control of fishing effort and the improvement of the exploitation pattern of demersal fisheries, as well as limiting catches of juveniles of small pelagic species;

ADOPTS, in conformity with the provisions of paragraph 1 (b) and (h) of Article III and Article V ofGFCM Agreement that:

Demersal Fisheries

1. The Members of GFCM shall adopt measures aimed at increasing the selectivity of demersal trawlnets, notably by immediate implementation of at least a 40 mm mesh size opening for the whole demersal trawl codend. Members are invited to explore and implement additiona lmeasures in order to improve further the selectivity.

Deepwater Fisheries

2. The Members of the GFCM shall prohibit the use of towed dredges and trawlnets fisheries at depths beyond 1 000 m of depth.

General Aspects

3. The Members of GFCM shall notify the Executive Secretary, each year, one month prior tothe Plenary Session of the Commission, with a report on the implementation of the management measures adopted.

4. The Scientific Advisory Committee shall evaluate the impact of the implementation of themanagement measures and shall recommend, if necessary, to the GFCM either possible adjustments or new additional measures.

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