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Research on deep-water species off the Portuguese continental coast

by

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ABSTRACT

The tendency of fishing fleets to extend to deeper areas implies an increasing capture of deep-water species, not yet fully utilised. Following this trend an effort has recently been put on species and their ecosystems study. Deep-water species from the Portuguese continental slope have been routinely studied under an IPIMAR project since 1994 and later integrated into an EU - FAIR Project. This paper focuses on some aspects of Deep-water species: analysis of landing data, fisheries description and presentation of research surveys results. Landing data are available from an independent Portuguese Administrative office. Most representative landed species (either in total weight or price) were selected. Despite teleosteans and selachians present the highest landing weight, crustaceans are, by far, the most valuable. At Portugal Mainland there are three fisheries targeting deep-water species: a crustacean trawl that develops on grounds off South and Southwest coasts and two with longline, one directed to Black scabbardfish off the West Coast and the other directed to sharks off the West Galician coast. Research surveys aim the study of biology, distribution and biomass estimates of deep-water species. Most frequently captured species have different distribution patterns. Some present an extended distribution area, which includes nearly the whole surveyed area; others, such as Bluemouth and Red and Scarlet shrimps, have a more restrictive distribution, living usually close to deep-canyons. Species community structure, alternative statistical approaches to species abundance estimation and biological parameters crucial for population dynamics are now being further analysed, meanwhile some results have already been published.

Key-words: Deep-water species, Fisheries, Landings, Portugal Mainland, Surveys.

1. Introduction

In recent years there is a global tendency of fishing fleets to extend their fishing areas more deeply, mainly due to the overexploited status of the majority of traditionally exploited resources. As a consequence several new species became frequent in the catches. This recent input of new food proteins are not completely profited, since consumers are not yet aware of them and some time lag is expected to occur just before a routine consumption. In Portugal Mainland, Black scabbardfish (*Aphanopus carbo*) is a good example of this, despite exploratory surveys have indicated its occurrence off the Portuguese continental slope near Sesimbra port, in the year of 1980, it took almost three years for the species to enter into the consumer market (Martins, pers. comm.).

Catches in deeper and far from the coast areas are, therefore, associated with an undesirable and uncontrolled throw away of marine resources from ecosystems, by all recognised, as very fragile and quite different from the more coastal ones (Gordon et al, 1995). As a consequence most of European countries are now developing research studies on deep-water species, i.e., species dwelling deeper than 400 m, according to the definition adopted by the ICES Study Group on the Biology and Assessment of Deep-sea fisheries resources.

In Portugal Mainland several deep-water species have already some economic importance, as a matter of fact, in 1996 their landings represented almost 10 % of the total landings in weight, which corresponded to nearly 15 % of the income generation. Despite most of the species landed are by-catches of the traditional coastal fisheries, three deep-fisheries are already settled, from which two are with longline that began their activity in the early 80's (Anon, 1997).

Research on deep-water species from the Portuguese continental slope started at IPIMAR in 1994. Nevertheless, there is also previous data on these species that was collected during IPIMAR research surveys, particularly those targeting Black scabbardfish and Deep-water crustaceans, namely Norway lobster (*Nephrops norvegicus*).

By the end of 1995, IPIMAR research activities on deep-water species have been integrated into the EU - FAIR Project: Developing deep-water fisheries: data for their assessment and for understanding their interaction with and impact on a fragile environment.

This paper summarises the main information on deep-water species off Portuguese continental slope that is available both from landings and research surveys. It also presents some comments that involve aspects that should be further analysed in order to get better insights for a correct assessment and management of these species.

2. Landings

An independent Portuguese Administrative office is responsible for the establishment and updating of Databases on Portuguese fisheries.

Commercial fishing vessels are grouped into several categories, which are established according to the fishing gear used or the main fishing area where the fleet mostly operate. Only three categories are here considered: trawl, purse-seine and polyvalents, because the fishing vessels they include operate within the Portuguese EEZ.

Portuguese deep-water species landings are commonly assigned to polyvalent category that means landings reserved to vessels that have permission to fish with several fishing gears, namely, longline, traps, gillnets, etc.

Portuguese continental landings breakdown for the following selected *taxa* by month, landing port and fishing category were obtained:

Teleosteans

Alfonsino (*Beryx spendens*)

Alfonsinos (*Beryx spp.*)

Black scabbardfish

Blackspot seabream (*Pagellus bogaraveo*)

Bluemouth (*Helicolenus dactylopterus*)

European conger (*Conger conger*).

Forkbeards (*Phycis* spp.)

Greater forkbeard (*Phycis blennoides*)

Scorpionfishes (Scorpaenidae)

Silver scabbardfish (*Lepidopus caudatus*)

Wreckfish (*Polyprion americanus*)

Selachians

Blackmouth catshark (*Galeus melastomus*)

Gulper shark (*Centrophorus granulosus*)

Kitefin shark (*Dalatias licha*)

Leafscale gulper shark (*Centrophorus squamosus*)

Portuguese dogfish (*Centroscymnus coelolepis*)

Crustaceans

Red shrimp (*Aristeus antennatus*)

Scarlet shrimp (*Plesiopenaeus edwardsianus*).

Official landing data are based on species identification done by fishermen at each landing port. Thus some misidentifications can occur specially when dealing with closely resembling species.

A deep-water shark identification program carried out, on a regular basis, by IPIMAR technicians at Sesimbra port, took place from 1996 to 1997. During 1997 this Program was once executed at Viana do Castelo. In both landing ports, no problems on species identification were detected.

In terms of total weight landed, teleosteans and selachians are more important than crustaceans. However the later are, by far, the most valuable; in 1997, Red shrimp had an average price per kg, of 2376 PTE and Scarlet shrimp of 1713 PTE. Even thus at the same year, Wreckfish priced 2247 PTE per Kg and Blackspot seabream 1300 PTE.

Deep-water species, landed at Portuguese continental fishing ports, are markedly different in size. Regarding this fact, relative importance of 1997 landings, between the species listed above, are analysed based on their yearly total weights and on their mean commercial value per kg. Combining those two quantities the most important landed species are:

1st - Silver scabbardfish (total landings ≈2143 millions of PTE);

2nd Black scabbardfish (total landings ≈998 PTE);

3rd European conger (total landings ≈955 PTE);

4th Wreckfish (total landings ≈465 PTE);

5th Blackspot seabream (total landings ≈380 PTE);

6th Red shrimp (total landings ≈272 PTE);

7th Portuguese dogfish (total landings ≈192 PTE);

8th Leafscale gulper shark (total landings ≈115 PTE);

9th Gulper shark (total landings ≈105 PTE);

10th Alfonsino (total landings ≈69 PTE);

11th Bluemouth (total landings ≈6 PTE);

12th Blackmouth catshark (total landings ≈1.6 PTE);

13th Scarlet shrimp (total landings ≈ 1.5 PTE);

14th Greater forkbeard (total landings ≈.5).

Monthly total weight landings by fishing category, from 1992 to 1997 are presented in Annex I, Figs. 1 to 5. For most species the landing data available do not show a clear seasonal pattern of exploration.

More than 90 % of the deep-water fishes are landed by the polyvalent fleet while almost 87 % of the deep-water crustaceans are landed by trawlers - the so called crustacean trawl fishery from Algarve, later described.

Yearly total weights landed by port (Annex I, Fig. 6) are presented for each *taxa* in Annex II, Tables 1 to 5.

In 1983, Viana do Castelo was the leading fishing port of Gulper shark; this year corresponds to the beginning of the longline fishery that targeted this species. After 1994, landings at this port decreased and Peniche became the first landing port of the species.

During the whole time period under consideration Sesimbra has been the main landing port for Black scabbardfish, representing nearly 99 % of the species total landed weight. This port is also the most important for associated species: Portuguese dogfish (96 %) and Leafscale gulper shark (91 %). Almost 78 % of Silver scabbardfish landings are assigned to this landing port.

In 1993, both Bluemouth and Scorpaenidae species were mainly landed in Sines, but after 1994, Algarve landing ports were the most important ones. The main landing ports of Kitefin shark varied along the years: from 1991 to 1995 Sines was the main landing port, in 1996 it was Peniche and in 1997 it was Lagos. More than 50% of Blackmouth catshark, other squaloid shark, is landed in Algarve. The catshark is greatly appreciated in this region, especially during Christmas time, when it can reach a price per kg of about 4000 PTE.

For the remaining fishes Peniche is the major landing port.

Deep-water crustaceans captured by trawlers are mainly landed at Algarve landing ports: 99.5 % of Red shrimp total landings are recorded at Vila Real de Santo António while Portimão is the most important landing port for Scarlet shrimp. Nevertheless the polyvalent fraction of Red shrimp landings are assigned to Figueira da Foz .

3. Brief description of Portuguese deep-water fisheries

Despite the great variety of deep-water species landed at Portuguese fishing ports most of them are by-catches of fisheries targeting other species. Three Portuguese fisheries can be considered as deep-fisheries since they explore deeper areas where species diversity are mainly composed of deep-water species. One was mainly developed on grounds off the South and Southwest coasts, using trawl gears and directed to crustaceans. The other two use longliners, one directed to Black scabbardfish off the West Coast of Portugal and the other directed to sharks off the West Galician coast.

3. 1. Crustacean trawl fishery

The target species of this fishery are Rose Shrimp (*Parapenaeus longirostris*) and Norway lobster, which is caught at depths ranging from 200 to 700 m.

The deepest grounds are attained when it is intended to target Norway lobster that, in Portuguese waters, is mainly captured at depths ranging from 400 to 700 m.

The fishing fleet is made up of about thirty-five open deck stern trawlers (17-35 m) most of which are about 20 years old or more. However, there are five modern trawlers fitted with refrigerated holds that can undertake longer fishing trips than usual and thus operating far from the coast.

Despite the fleet operates mostly off the South and Southwest coasts of Portugal mainland there are also two trawlers registered at Cascais landing port, near Lisbon.

When trawling hauls are performed on deeper grounds about 15 deep-water fishes and 2 deep-water crustaceans are caught as bycatch species and some, such as European conger, Bluemouth, Greater fork-beard and Blackmouth catshark, are also landed for human consumption.

3. 2. Portuguese Black scabbardfish fishery

This fishery started only in 1983 at Sesimbra port and is only performed by longliners. The fishing takes place in hard grounds along canyon slopes off Sesimbra, on depths normally ranging from 800 to 1200 m, where the target species is more frequently found. Associated with the capture of Black scabbardfish, certain deep-water sharks important to the incomes generated by this fishing activity are also captured, namely Lefscale gulper shark and Portuguese dogfish.

In 1996 the longline fleet was composed of 22 longline vessels, all registered at Sesimbra harbour, that is also the base for their fishing activities. Fifteen of these vessels are involved on this fishery all the year round and the other seven join them seasonally.

The longline gears used are well adapted to the specific characteristics of the target species, fishing grounds explored and depths achieved.

Consumers buy this species fresh and without any transformation. Sharks, on the contrary, need processing on shore, being their livers used to oil production and later exported. Recently, the meat of sharks has increasingly been processed for human consumption, in form of fillets.

3. 3. Deepwater shark fishery

This longline fishery aims the capture of deep-water sharks and is based at Viana do Castelo. It was initiated in 1983, and their fishing gears received some technological influences from Sesimbra.

Longlines are set on grounds usually ranging from 800 to 1400 m deep but, if necessary, they can be set in deeper grounds.

The bulk of the captures consist of only one species, the Gulper shark, so, fishing yields attained are much conditioned on its abundance. However, other deep-water species are caught in smaller quantities, such as Leafscale gulper shark, Portuguese dogfish and also several bony fishes.

In 1992 the fleet landing Gulper shark in Viana do Castelo were composed of 6 open deck longliners (mean length of 18.6 m) fishing during all the year. Since then, the catch rates have decreased steadily, threatening the continuity of this fishery. In 1996 there have been only one longliner engaged in it at full time.

The gear setting is made at down and is hauled about three hours later by the end that was set first. This last operation takes 11 to 14 hours and occurs during daylight. Fishing trips usually last five days during which are performed three gear settings. Common bait is Sardine (*Sardina pilchardus*) but either Atlantic mackerel (*Scomber scombrus*) or Chub mackerel (*Scomber japonicus*) can be used.

During the first years of this fishery only the shark livers had commercial value. Livers continue to be important to the viability of this fishery, however, the fish caught is actually landed and also sold for filleting. To increase the value of landed fish, fisherman process now part of the catches on board.

4. Portuguese research surveys

IPIMAR research surveys held on board of the R/V "NORUEGA from 1990 to 1992 aimed to study the biology, distribution and abundance of Deep-water crustaceans, namely, Norway lobster, off the Portuguese south and southern west coasts. During these surveys several deep-water species were also caught and biological information collected. Based on these data a report on specific geographical and bathymetric distribution, as well as abundance estimates in weight or biomass estimates by species were accomplished by Figueiredo *et al.* (1994)

Since 1994, deep-water species research surveys have been performed along the Portuguese continental slope. Their main objectives are the study of biology, occurrence and distribution of deep-water species as well as biomass estimates by species. Three summer research surveys were done by R/V "Noruega" in 1994,1995 and 1997, covering depths ranging from 200 m to 800 m, except for the last one, that only explored areas more than 400 m deep.

A stratified sampling program was adopted for these surveys (Figueiredo I., 1995). In each *stratum* two hauls, at least, are randomly performed using a special trawl gear designed for the capture of crustaceans with a cod-end of 20 mm and an horizontal opening of 30 m. Each haul lasts about 1 hour and the vessel is kept at a constant speed of around 3 knots. Occasionally, with rough grounds, a Norwegian Campel Trawl gear (ref. FGAV005) with a cod-end mesh size also with 20 mm is used.

During these research surveys, many species are caught. According to their relative importance the following species were selected for implementation of studies on distribution, abundance and biology:

Teleostens

Bluemouth

European conger

Greater forkbeard

Mediterranean redfish (*Hoplostethus mediterraneus*)

Mediterranean longsnout grenadier (*Trachyrhynchus trachyrhynchus*)

Roughtip grenadier (*Nezumia sclerorhynchus*)

Holocephals

Rabbitfish (*Chimaera monstrosa*)

Seleachians

Blackmouth catshark

Birdbeak dogfish (*Deania calcea*)

Gulper shark

Kitefin shark

Crustaceans

Giant red shrimp (*Aristeomorpha foliacea*)

Golden shrimp (*Plesionika martia*);

Red shrimp

Scarlet shrimp

Mediterranean geryon (*Geryon longipes*)

For each of these species biological data on individual length, total weight, sex and maturity stages are obtained based on samples collected by simple random sampling. Supplementary samples for extraction of otoliths, vertebrae and dorsal spines are also collected.

Density (kg by square nautical mile) and biomass (t) estimates were determined using a stratified sampling estimator (Cochran, 1977), for Alentejo and Algarve regions (Figueiredo *et al*, 1994).

A multivariate method - cluster analysis - was applied to the study of composition and distribution of deepwater species off the Portuguese south coast (Moura *et al.*, 1995).

Several results based on IPIMAR ongoing studies on deep-water species are summarised below.

Greater fork-beard and Roughtip grenadier are commonly caught, being evenly distributed along the slope. Bluemouth presents a patchy distribution, being more frequent at depths lower than 800 m.

It is worth to mention that Bluemouth has been referred by Albuquerque (1956), as common in Madeira, but rare off the Portuguese continental coast. However during these surveys it was noticed that the species was abundant in grounds off the south coast deeper than 400 m, mostly around submarine mountains in the neighbourhood of deep canyons (Figueiredo M.J., 1995).

The abundance and occurrence of European conger presents an increasing tendency towards the south. A direct relationship between total length of this species and depth is observed; smaller individuals tend to occur mostly at lower depths.

Mediterranean redfish and Mediterranean longsnout grenadier are more abundant at Alentejo region.

Rabbitfish despite being more frequent at Alentejo and Algarve regions, at depths greater than 400m, is absent offing Cape S.Vicente.

Blackmouth catshark is the most frequent captured selachian species; the highest mean yield estimates are attained at depths ranging from 600 till 800 m.

The occurrence of Birdbeak dogfish is scarce at Algarve region. This species is more frequent at the occidental slope, particularly at depths ranging from 800 to 900 m.

The occurrences of Gulper shark and Kitefin shark are very low, the former is only captured on few *strata* off the Algarve coast.

Golden shrimp is a common crustacean species, presenting a regular distribution along the whole surveyed area.

Red shrimp is relatively common along the Portuguese continental slope but presents a very irregular distribution pattern. Both Giant red shrimp and Scarlet shrimp are infrequent species.

Mediterranean geryon distributes preferentially at depths greater than 600 m, being more common along the occidental slope, namely, at the northern region.

Most of biological studies already undertaken focussed the adaptation and development of ageing techniques necessary for the identification and enhancement of growth bands. Growth structures such as otoliths in bony fishes (Moreira, 1998) and vertebrae (Correia and Figueiredo, 1997) and dorsal spines (Bordalo Machado and Figueiredo, 1998) were used with success.

5. Final comments

Most of deep-water species landings are by-catches of fisheries targeting other species that live close to the coast but whose distribution area may extend deeper.

The capture of those deep-water species may be thus considered as a direct consequence of a recent global trend of the coastal fishing fleet to move to deeper and unexplored areas where the traditional overexploited species may be present.

A close inspection of the most important deep-water species landed in Portuguese continental landing ports with those commonly captured during IPIMAR research surveys show a different composition pattern between both. For instance deep-water sharks, such as Portuguese dogfish and Gulper shark are not so frequent on research surveys as they are on landings. Among several factors that can contribute for this discrepancy, it is worth to mention two major ones:

- fishing gear - research surveys use only a bottom trawl while landings are mainly from the polyvalent fleet that can operate with more than one fishing gear;

- fishing area - the area covered by the bottom trawl used during IPIMAR research surveys is restricted to the trawlable one and fishing hauls can not extent to regions deeper than 900 m, on the contrary the commercial fleet can operate over a more extended and deeper area.

Biological studies, such as growth and reproduction, are in an initial phase of development. Different ageing techniques have been developed with success and macroscopic maturity scales have been also used, nevertheless several limitations, mainly related with spatio and temporal data availability, may cause in the future an undesirable deceleration of biological studies. A continued collection of biological data is fundamental for determining important population characteristics, such as, time and area of spawning, fecundity, growth parameters and feeding habitats.

Acknowledgements:

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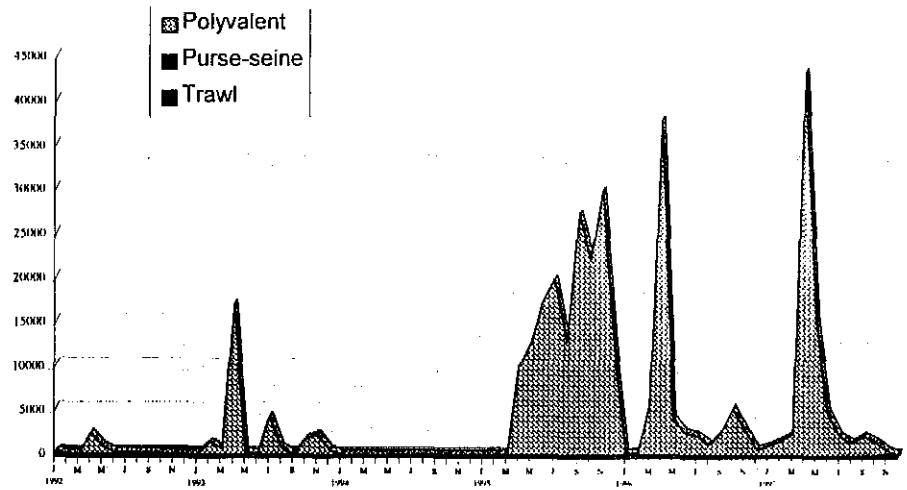
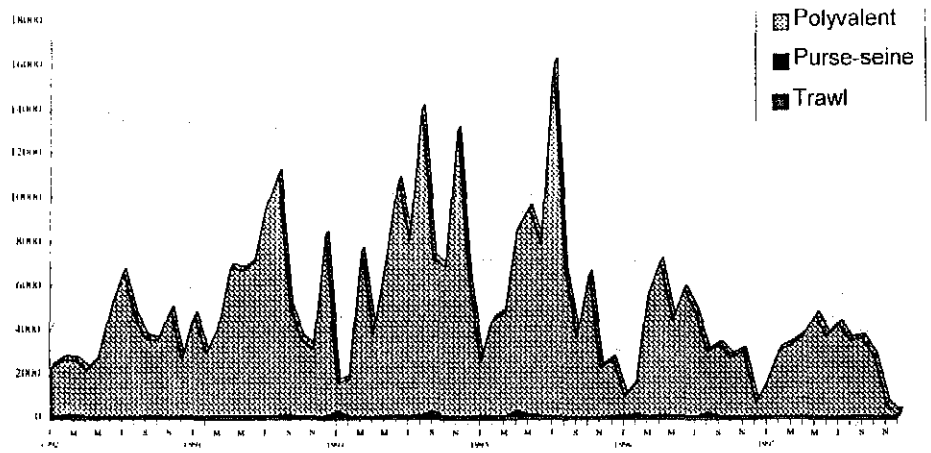
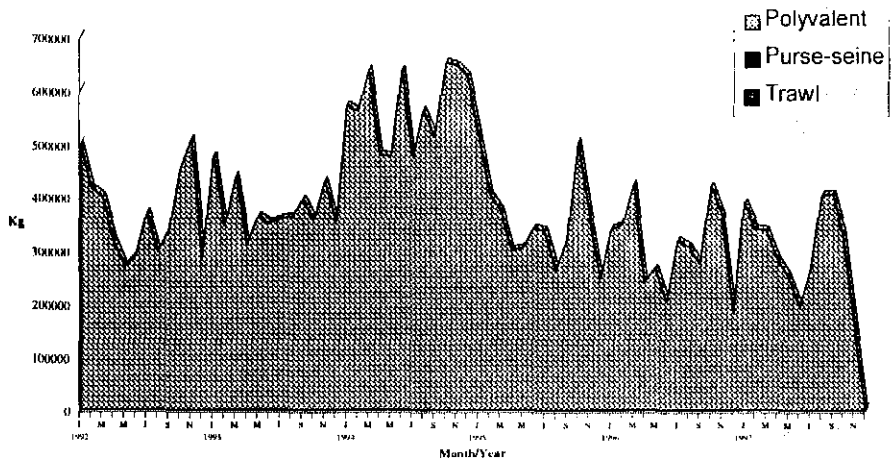
Annex I



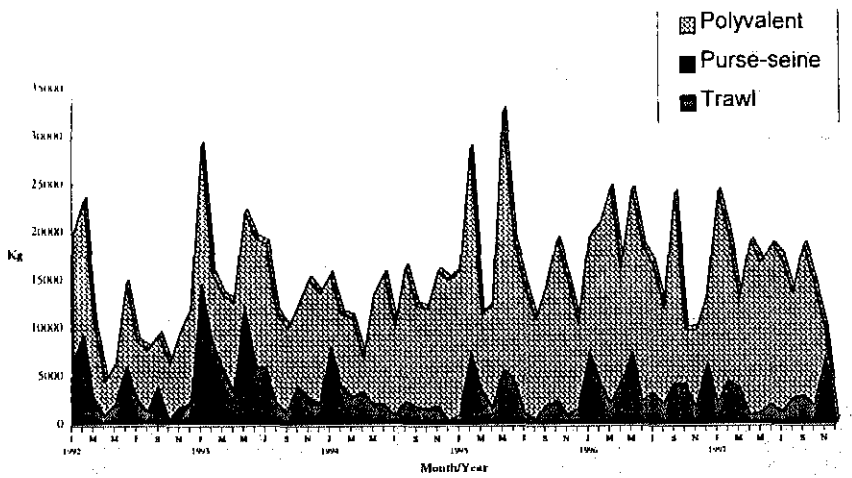
Alfonsino



Alfonsinos

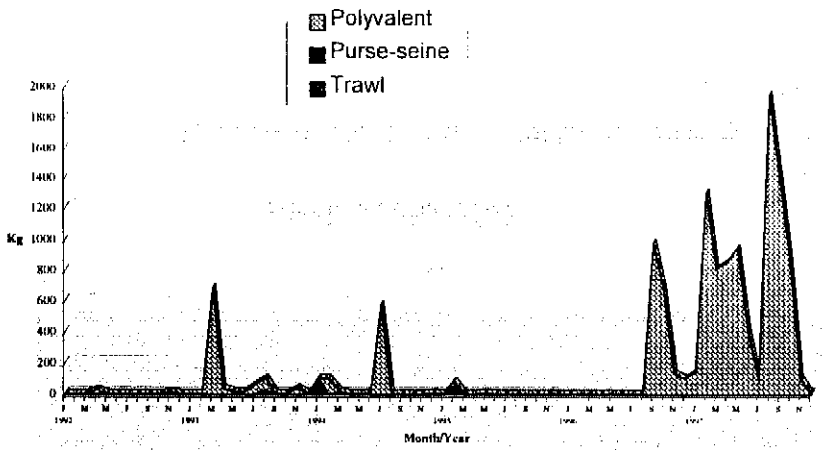


Black scabbardfish

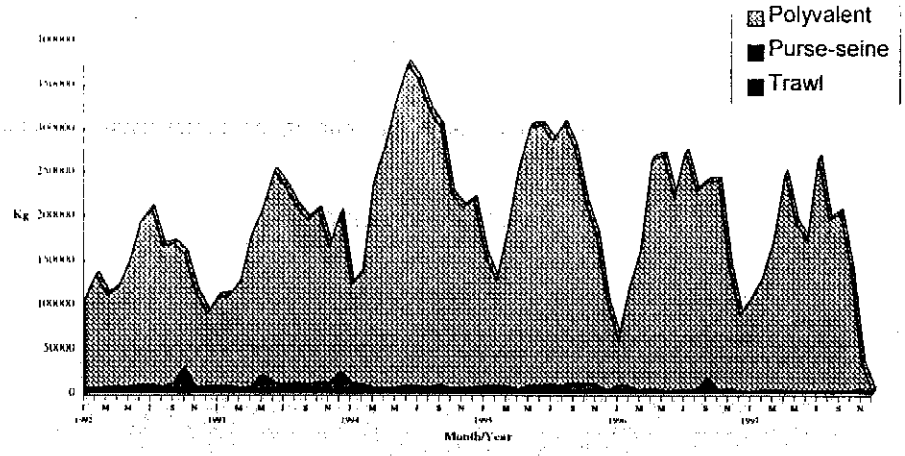


Blackspot seabream

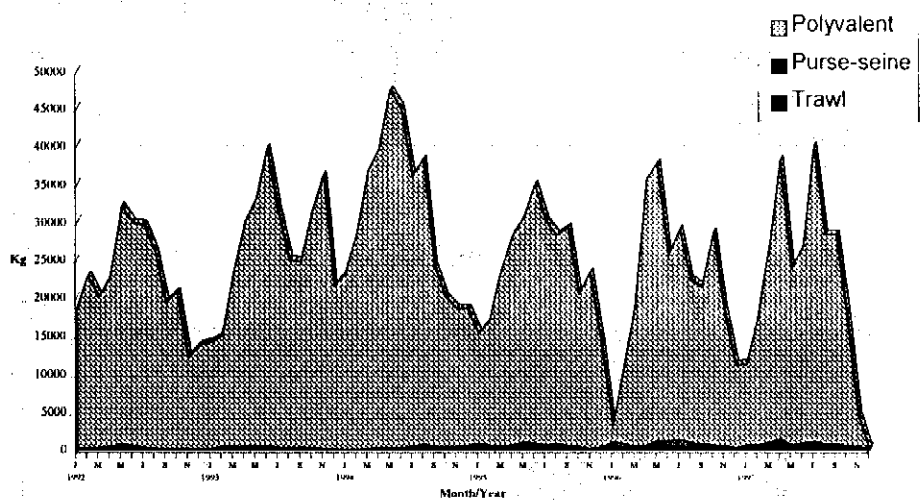
Figure 1 – Monthly landings by fishing fleet category of **Alfonsino, Alfonsinos, Black scabbardfish** and **Blackspot seabream** (1992-1997)



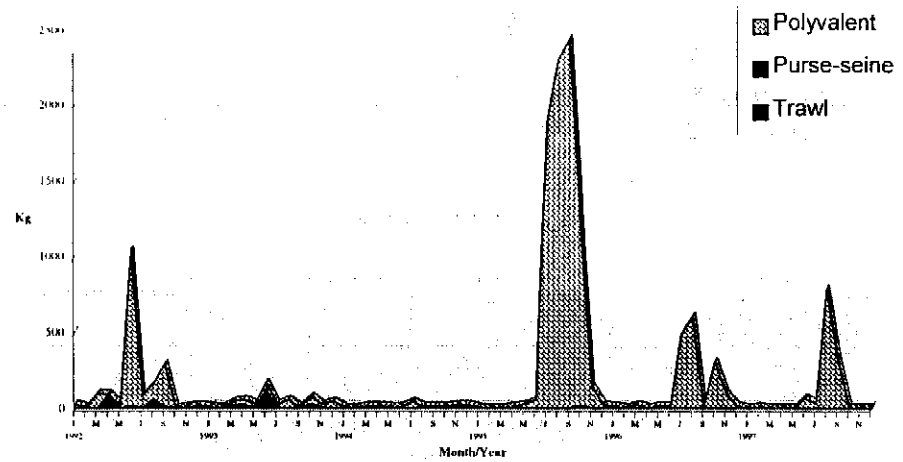
Bluemouth



European conger

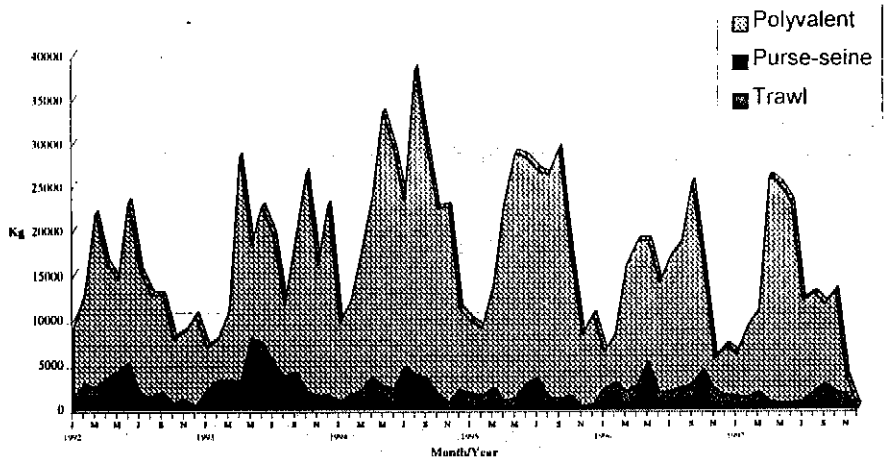


Forkbeards

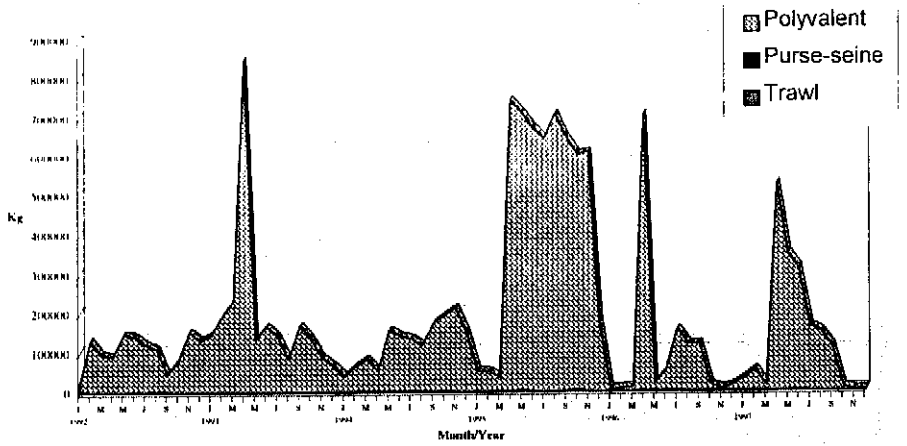


Greater forkbeard

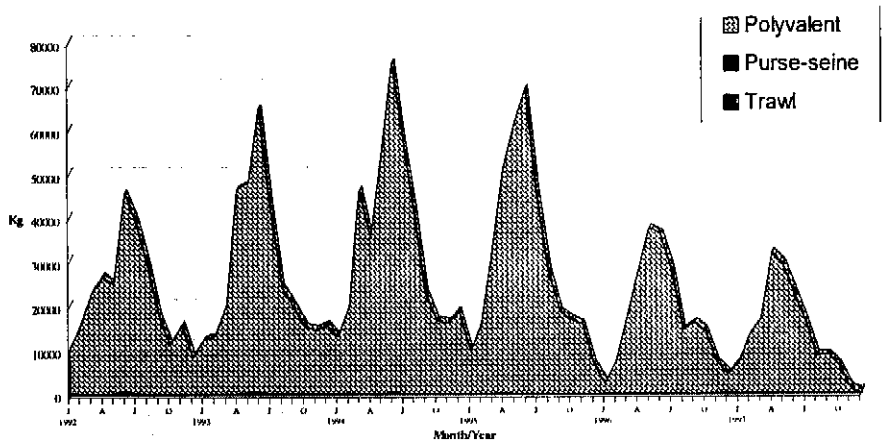
Figure 2 – Monthly landings by fishing fleet category of **Bluemouth**, **European conger**, **Forkbeards** and **Greater forkbeard** (1992-1997)



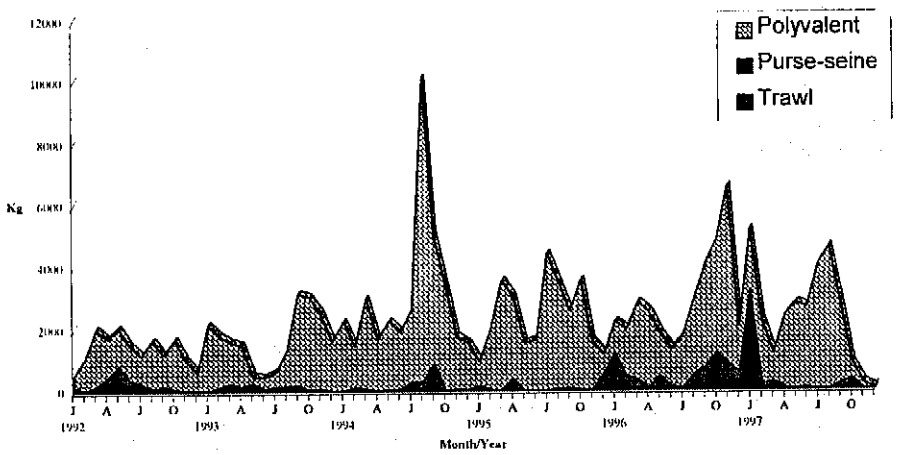
Scorpionfishes



Silver scabbardfish



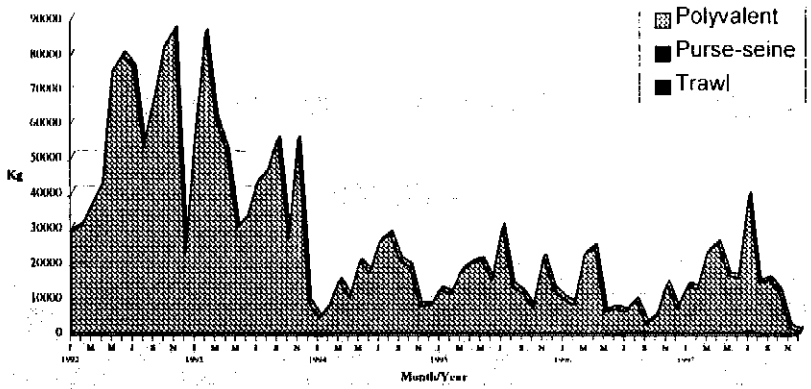
Wreckfish



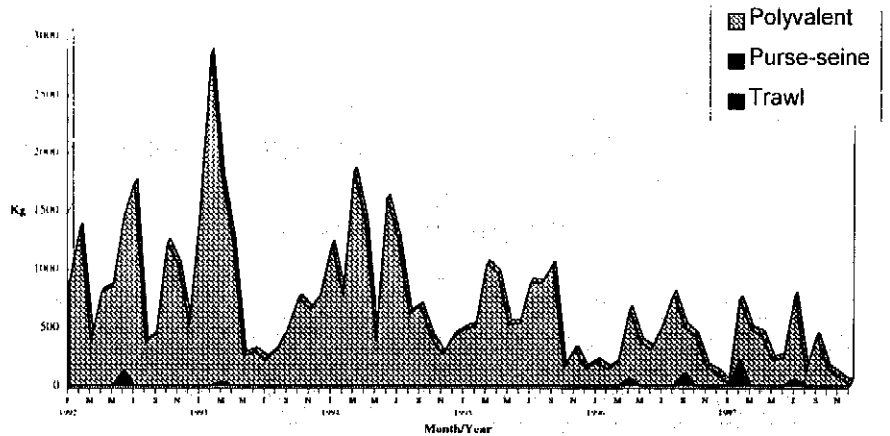
Blackmouth catshark

Figure 3 – Monthly landings by fishing fleet category of **Scorpionfishes, Silver scabbardfish, Wreckfish** and **Blackmouth catshark**

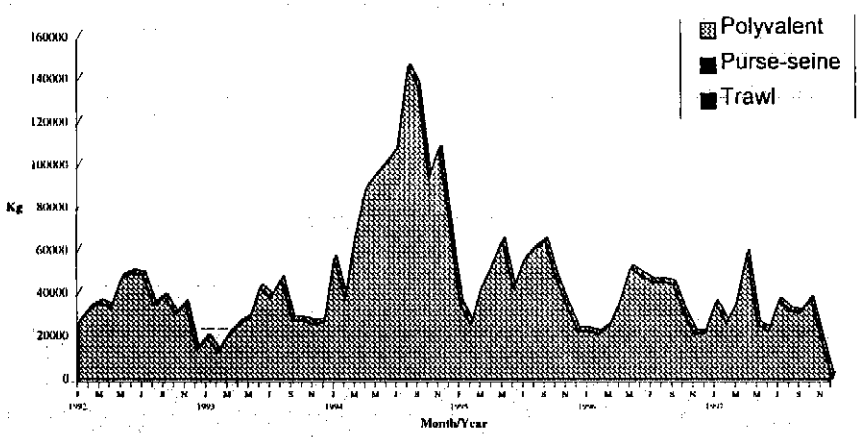
(1992-1997)



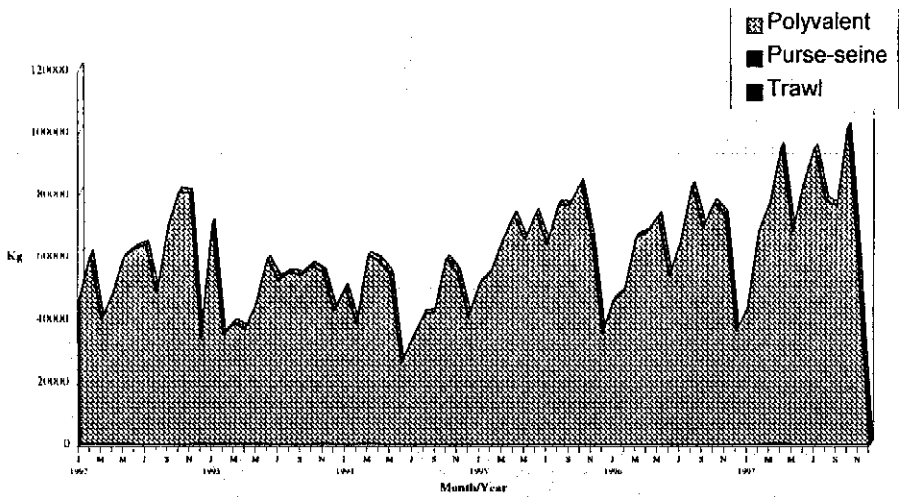
Gulper shark



Kitefin shark

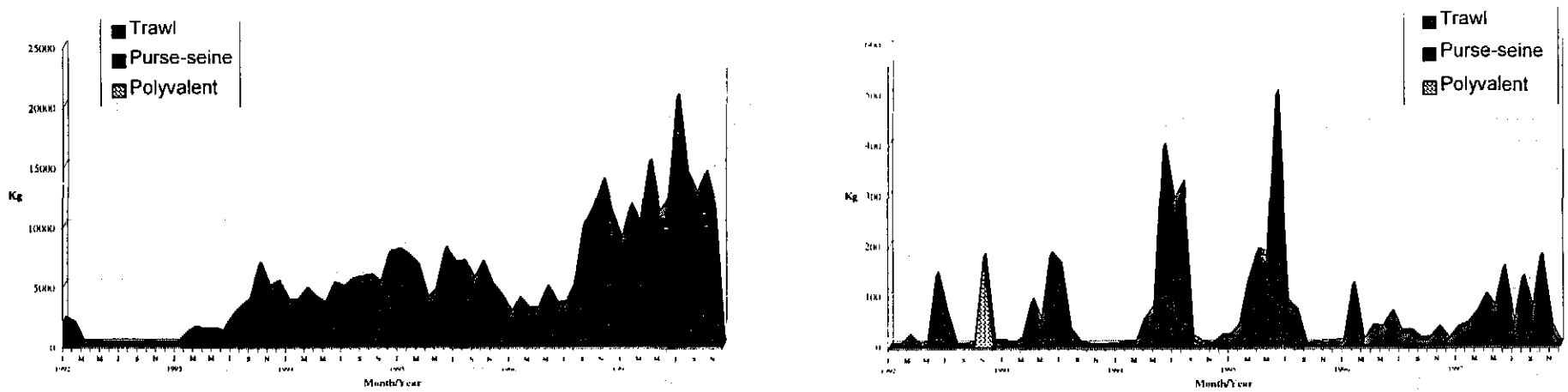


Leafscale gulper shark



Portuguese dogfish

Figure 4 – Monthly landings by fishing fleet category of **Gulper shark, Kitefin shark, Leafscale gulper shark** and **Portuguese dogfish** (1992-1997)



Red shrimp

Scarlet shrimp

Figure 5 – Monthly landings by fishing fleet category of **Red shrimp** and **Scarlet shrimp** (1992-1997)

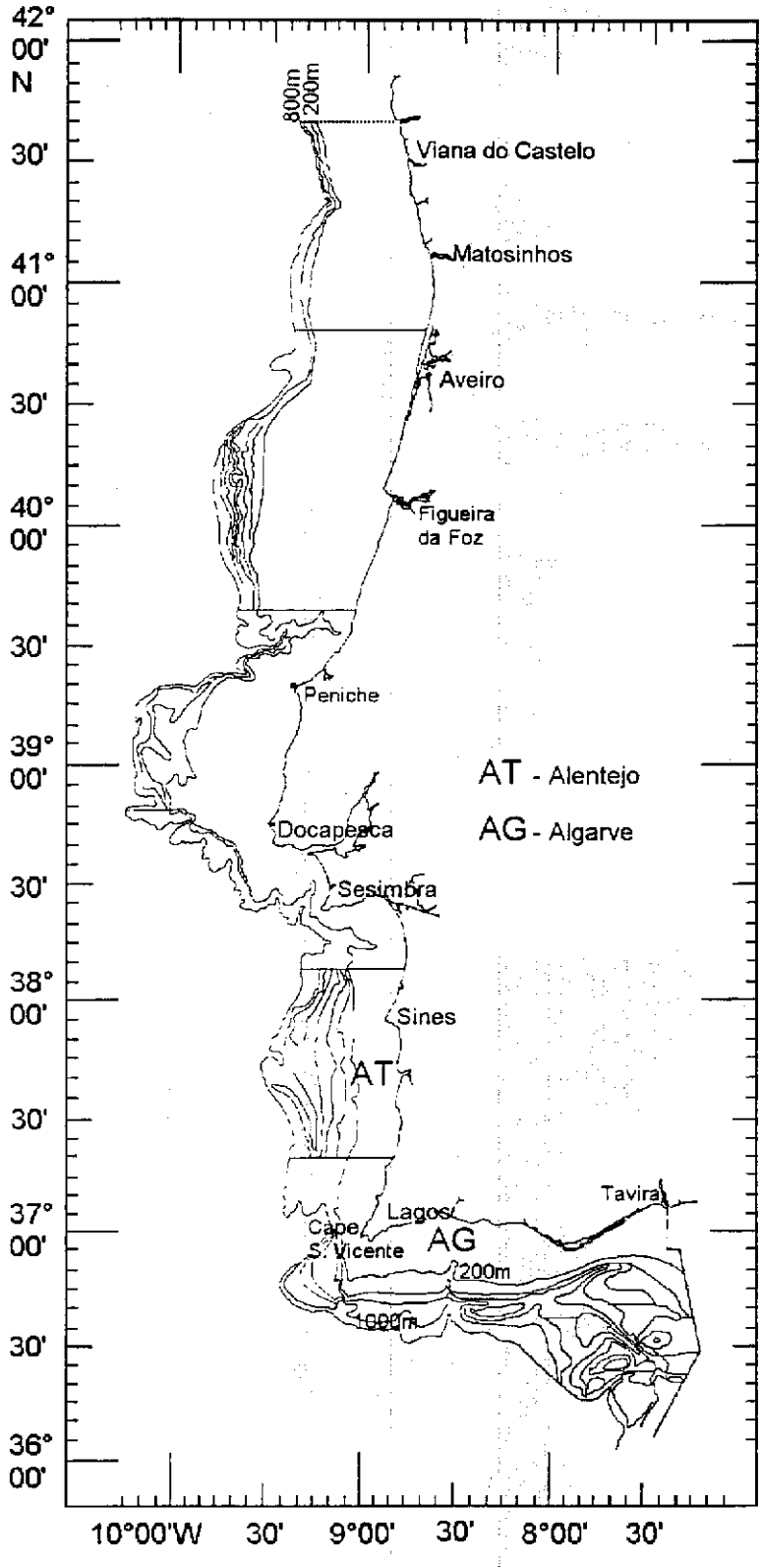


Figure 6 – Map of fishing landing ports along the Portuguese continental coast.

Annex II

Table 1 – Yearly Species Landings (in tons) by fishing port (1992-1997).

Species	Alfonsino						Alfonsinos					
Landing port	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**
Viana do Castelo									5970			
Póvoa do Varzim					22	559	2088	7402	2240	3237	2599	5081
Matosinhos	10			12								
Aveiro									8	10		
Figueira da Foz							174					11
Nazaré		2			2705		3162	5847	5554	1637	1622	1802
Peniche				8755	23955	23327	18254	35104	44349	28232	9126	7695
Ericeira												
Cascais							79	124	921	116	133	18
Sesimbra	2950	25336		156522	38064	51682	9893	7522	5970	8119	6338	3605
Setúbal	1044	2114		346	651	372	370	567	1513	676	1504	3065
Sines							1855	4548	2956	5792	5388	1044
Lagos					215	629	5701	7726	14305	13649	10864	9370
Portimão							61	183	49	4613	370	8
Olhão							882	2993	3704	8874	4355	2447
Tavira							1					
V.Real S. Ant.												
Docapesca	191	1652					10	272	7		42	29
TOTAL	4196	29104		165634	65612	76569	42531	72287	87545	74957	42341	34176

Species	Blackscabbardfish						Silver scabbardfish					
Landing port	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**
Viana do Castelo	427	452	3420226	15	7	2	753	1167	470706	3242	720	328
Póvoa do Varzim	13	655	841	241	100	209	430	129	8318	1444	5	1
Matosinhos			677	720	61	168	24127	411	11391	6184	47	83
Aveiro								57	518	78	200	
Figueira da Foz									509	2	20	
Nazaré	56	621	74	113	96	149	297	12906	8827	2716	548	
Peniche	24930	1528	5013	3897	2300	26709	134832	215946	235181	218585	108720	76669
Ericeira												
Cascais												
Sesimbra	4389045	4512552	3420158	4260409	3682493	3322847	779280	1488274	470091	5260472	1091042	1633185
Setúbal						102	107982	376245	149373	17597	350	
Sines		13		9	3		2427	46	130259	65126	3068	
Lagos			934	536	551	4	21228	66947	11282	54506	1581	94
Portimão	159						47408	75895	11423	12681	12308	6718
Olhão						4	13530	18942	15685	26546	18338	3191
Tavira									50			10
V.Real S. Ant.								7	86	327	448	330
Docapesca	8833	2778		5782			130271	139639	159	2685	11	2035
TOTAL	4423462	4518599	6847923	4271722	3685612	3350193	1262565	2396612	1523857	5672190	1237405	1722644

Table 2 – Yearly Species Landings (in tons) by fishing port (1992-1997).

Species	Scorpionfishes						Bluemouth					
Landing port	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**
Viana do Castelo												
Póvoa do Varzim												
Matosinhos	12	388	598	300	612	501						
Aveiro	5772	7979	5631	1233	1344	1360			17			
Figueira da Foz	3708	2562	2351	2221	2484	1673						
Nazaré	5971	25284	13455	8638	6805	6644						
Peniche	77189	98705	166659	123174	100849	117724						
Ericeira												
Cascais	367	865	3301	3396	6745	3589						
Sesimbra	11683	6135	3287	21790	11547	4856						
Setúbal	914	8774	1119	1019	391	555		27				
Sines	3803	2189	5305	3180	2070	1812		901	1			
Lagos	11123	23853	24907	14739	8971	3696	28	20		34	1885	8902
Portimão	5949	7394	9850	8475	15680	3276						
Olhão	32703	18141	35671	43788	9325	5044		9	209	54	5	
Tavira	51		147					3	587			
V.Real S. Ant.	596	442										
Docapesca	6256	9139	2727	555	6140	4078						
TOTAL	166097	211849	275008	232507	172962	154807	41	960	814	88	1890	8902

Species	European conger						Wreckfish					
Landing port	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**
Viana do Castelo	136847	145165	258223	164226	156767	131838	109	187	12882	4570	1434	190
Póvoa do Varzim	85033	127519	170642	120501	100492	89356	1339	2034	2493	1220	1824	959
Matosinhos	269016	267410	436709	417324	265935	173888	4973	5669	16440	7921	2972	2264
Aveiro	36320	51548	33331	27591	16949	2409	164	498	239	79	13	82
Figueira da Foz	69905	72067	99408	99692	87050	50507	57	70	38	40	20	104
Nazaré	62494	123979	166541	101380	84876	67479	10162	23288	19811	10471	4169	5170
Peniche	454388	707992	1160904	983268	923966	795167	83110	148690	219662	184711	129119	116223
Ericeira	8609	6462	10115	5347	10905	13858	16					
Cascais	21709	24758	29875	15981	14460	10872	597	919	2051	2564	580	244
Sesimbra	122143	104248	95414	181662	143771	106370	17372	20413	12546	43008	15642	7022
Setúbal	5178	15654	15550	27609	35202	18196	1232	4141	2323	3509	1855	1486
Sines	182772	217569	209450	214470	188175	165252	16842	18138	27577	22646	9695	3585
Lagos	89303	133290	174426	142765	121807	133138	76524	65595	63170	67115	41016	23346
Portimão	37712	57098	50484	44822	53176	35611	2116	1183	615	192	422	377
Olhão	101760	92686	152898	96698	50988	41815	51794	45733	38228	23869	4561	2150
Tavira	10554	10427	9715	9826	12619	4571	36	27	81	7	3	
V.Real S. Ant.	5592	22871	22004	13530	24139	5600	38	123	42	87	87	61
Docapesca	5650	6979	5125	6285	5588	7104	1469	1425	87	132	121	186
TOTAL	1704985	2187720	3100811	2672978	2296867	1853033	267950	338133	418283	372138	213533	163449

Table 3 Yearly Species Landings (in tons) by fishing port (1992-1997).

Species	Forkbeards						Greater forkbeard					
Landing port	1992	1993	1994	1995	1996	1997	1992	1993	1994	1995	1996	1997
Viana do Castelo	1482	3939	18318	5211	2487	501						
Póvoa do Varzim	1875	17599	12235	473	10190	4158						48
Matosinhos	17122	4021	10606	2554	4858	1922						
Aveiro	24	501	63	25	30	16						
Figueira da Foz	1256	591	752	1045	1837	688						
Nazaré	7245	19524	14206	10085	9751	8476						
Peniche	111065	158295	182928	123406	96363	98170						
Ericeira	993	535	706	466	876	2608						
Cascais	3890	4128	5442	5136	4515	2857						
Sesimbra	27905	13458	17188	45690	28924	31010						
Setúbal	827	2263	4054	3426	1378	1070						
Sines	38305	38016	40422	33587	46712	50262	3					
Lagos	41187	48569	47402	42228	37697	49226				8053	1526	1140
Portimão	7784	6029	6682	10021	10400	7384						
Olhão	4976	5798	15141	10668	5738	5639			4			
Tavira	1584	1315	538	195	208	29						
V.Real S. Ant.	723	834	472	1357	1751	1139						
Docapesca	180	630	389	609	498	613	1822	507	131	74	38	18
TOTAL	268424	326046	377543	296182	264214	265768	1825	511	131	8127	1564	1206

Species	Blackspot seabream						Portuguese dogfish					
Landing port	1992	1993	1994	1995	1996	1997	1992	1993	1994	1995	1996	1997
Viana do Castelo	9309	25593	18945	7455	11685	12661	97629	86743	10299	6832	1838	16304
Póvoa do Varzim	3680	15722	9189	4836	5274	4731		16179				
Matosinhos	12219	37788	32325	29765	44898	24872						
Aveiro	7137	9171	2479	1620	5327	2281						
Figueira da Foz	3103	2518	3228	5184	15308	3769			58			
Nazaré	7546	24899	13874	18903	10813	11523						
Peniche	32092	29520	32733	102653	70785	72070	13507	8461	12107	7819	8932	9970
Ericeira	57	44	122	116	20	51						
Cascais	706	36	104	436	51	91						13
Sesimbra	12151	4891	3884	14308	14308	24042	577214	484807	529791	762915	740678	808520
Setúbal	1470	2807	688	1241	451	1340						
Sines	5121	2783	3445	3352	3363	3642						
Lagos	21444	15730	17598	6301	6623	18119				2628	4828	2835
Portimão	7212	11332	3757	2455	12630	803	20					
Olhão	3476	7042	11295	3153	1636	927	2591	1373	3921	3715	619	3496
Tavira		12		11								
V.Real S. Ant.		39	1	146	11	15						
Docapesca	4520	2327	555	1584	5285	2944						
TOTAL	131245	192255	154221	203518	208467	183878	690961	597564	556176	783949	756895	841138

Table 4 – Yearly Species Landings (in tons) by fishing port (1992-1997).

Species	Blackmouth catshark						Kitefin shark					
Landing port	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**
Viana do Castelo	397											
Póvoa do Varzim								99		4	6	
Matosinhos												
Aveiro												
Figueira da Foz	46						693	163				
Nazaré									4			
Peniche	1415	2136	6775	2606	3132	1775	3347	398	2073	1407	1509	1092
Ericeira												
Cascais												
Sesimbra	9									19	110	
Setúbal	7		311	315	39							
Sines			4				5446	9166	6842	4122	1054	2
Lagos	7659	12945	15667	16532	11860	7813	203	216	111	124	1016	2159
Portimão	2318	1315	1801	1235	5298	1280				134		
Olhão	4162	3701	12407	8650	13516	16303	1284	874	1730	1466	436	91
Tavira							22	49	55	15		
V.Real S. Ant.	19			143	34	49			13	128	67	290
Docapesca	22	46			1042	1738		60			105	
TOTAL	16054	20143	36964	29481	34922	28959	10994	11024	10828	7420	4303	3634

Species	Leafscale gulper shark						Gulper shark					
Landing port	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**
Viana do Castelo	1743	105	532751				467909	402712	41040	31398	13016	40122
Póvoa do Varzim	14110	29956	4864	6222	17224	5752	676	2826	5206	23	350	373
Matosinhos	12370	3178	5011	71		787					4	
Aveiro								32				
Figueira da Foz	14	26				14					3	
Nazaré	10272	8416	10533	4839	4444	2176	609	6327	1167	1465	735	891
Peniche	1833	6784	2667	2230	1790	1390	162830	108514	92292	114451	70656	102131
Ericeira									23			
Cascais			4		17	14	6				22	17
Sesimbra	372079	280919	530823	511904	380466	342677	13859	12710	14196	11459	16916	22951
Setúbal	392	460	548	306	123	111		198	24	9	19	37
Sines	815	1089	1456	1413	969	831	20	375	54	33	138	124
Lagos	6108	6138	18084	15602	5351	1347	15341	7377	17309	17526	13412	12735
Portimão							1538	19	350	141	825	163
Olhão	1353	505	1446	874	403	954	18906	13832	11507	16129	5443	9108
Tavira							113					
V.Real S. Ant.		62		41			273	225	331	98	101	933
Docapesca		47			8		78				7	5
TOTAL	421089	337686	1108186	543501	410796	356053	682157	555148	183498	192730	121648	189590

Table 5 – Yearly Species Landings (in tons) by fishing port (1992-1997).

Species	Red shrimp						Scarlet shrimp					
Landing port	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**
Viana do Castelo												
Póvoa do Varzim												
Matosinhos						4						
Aveiro												
Figueira da Foz	13086	5239	9029	16600	6731	13317	19					
Nazaré												
Peniche												
Ericeira			16									
Cascais	89				15	350					177	552
Sesimbra										3		
Setúbal	1046	240			4050	2295	87					
Sines												
Lagos	5	1		9				3				
Portimão	306	139	60	130	99	139	324	532	1199	1224	216	363
Olhão	1887	435										
Tavira												
V.Real S. Ant.	27663	28220	24274	62934	76659	102001						
Docapesca				5							4	
TOTAL	44081	34274	33379	79676	87553	118106	430	535	1199	1227	397	915