Contrat PECOSUDE

"Caractéristiques des petites pêches côtières et estuariennes de la côte atlantique du sud de l'Europe"

EC./DG FISH (DGXIV) : Contrat N° 99/024

FINAL REPORT

Portugal

Graça Pestana

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This project has been carried out with the financial assistance of the European Commission

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INTRODUCTION

Portugal is a country with an ancestral and strong maritime tradition in fishing activity. Its geographical location and the long coastline are characteristics that greatly contribute to that intense activity (map 1).

According to the information available from INE (1998), during the period 1989 - 1996, the fishing fleets decreased approximately 29% in number, 39% in gross registered tonnage and 21% in engine power.

There are some categories of the fishing fleet: the **local fleet** (*artisanal* fleet with multi-specific and multi-gear fishery, such as traps, nets, purse-seine, hooks, etc), the **coastal fleet** (using bottom trawl, lines and nets) and the **long distance fleet** (using bottom trawl and gillnets, operating mainly in NAFO and Irminger Sea). This classification is based on the geographical area where the fleets operate.

The local fleet is the greater fleet, being composed by a large number of small boats with low autonomy. The fishing period is seasonal and the vessels usually do not travel long distances, operating mainly in coastal and in inland waters. This fleet is distributed throughout the coast, using a large number of landing places (auction places).

The coastal fleet includes more autonomous vessels that operate in areas farther from the coast.

The long distance fleet consists of large vessels with even greater autonomy than the latest and, with more technical conditions for the preservation and transformation of the fish on board (INE, 1998).

The polyvalent fleet includes the entire local and coastal fishing vessels but with the exception of vessels using exclusively bottom trawl or purse seine. Vessels equipped with one or more alternative fishing gears compose the polyvalent fleet.

There are several types of harbours, mainly distinguished by its geographical location, coastline disturbance and period of activity.

Geographically the ports are maritime, fluvial and in lagoons. According with the coastline, they can be natural (without human intervention), with human intervention (with small engineer constructions) or artificial (with effective modification of coastline and with support infrastructures, like fuel supply, provisions, ice, among others) (Franca *et al*., 1998). In terms of the activity period they can be permanent or seasonal (Figure 1).

A B C

Figure 1- Harbours types. A- Natural (Armação de Pera); B- Human Intervention (Arrifana); C- Artificial (Sesimbra) (*in* Franca *et al.*, 1998).

Some harbours have small storage places were the fishermen keep their fishing materials, engines and sometimes the small vessels. In terms of the fishing gears it can be defined 9 groups, namely purse seine, beach seine, trawl, dredge, lift net, gill net, traps, hooks and lines. It is common the *artisanal* fleet accumulates more than one type of fishing gear. Each fishing gear has target species, with a seasonal pattern. So the fishermen use more than one gear throughout the year according to the target species.

Some landing places are located far away from the main harbours, this fact constitute a non-incentive for the fishermen sell their fishing product in official places. Another fact that contributes for the sells outside from the official places is the high commercial values of some species such as octopus, lobster, shrimp and lamprey, among others. In these cases the fishermen prefer to sell them, directly to consumers and restaurants.

Map 1 - 32 registered harbours and PECOSUDE regions of PORTUGAL

Part 1

Typology of the Portugal fishing fleet activity

1 MATERIALS AND METHODS

1.1 Criteria adopted for the definition of the PECOSUDE fleet

The PECOSUDE fleet was defined as the *artisanal* fleet that includes vessels with overall length equal or less than 15 meters and with engine power smaller than 147 kW (200 HP).

This fleet consisting of a total of 6 360 vessels involves about 13 600 fishermen.

The mean number of fishermen *per* vessel varies with the PECOSUDE region (figure 3 and Annex 1). North of Portugal is the region with more fishermen per vessel, 3 in average, followed by the Central region and Algarve (both with 2 in average) and by the Central-South (with 1).

In 1999 (reference year of the project) 3 535 of those vessels landed in 154 ports (122 small ports and 32 main ports) along the continental coast, about 17 700 t of fish with a value of 45.6 M€.

The coastal bottom trawl fleet and the purse seine fleet (excepting the very small purse seines) with sardine and horse mackerel as target species, are not included.

A priori conventions set that all the data included in PECOSUDE study contract concerns to the reference year of 1999. It was also defined that the Portuguese continental coast was divided in four regions: North, Central, Central-South and Algarve (South) (figure 3 and Annex 1). For more detailed information *see* "Fleet components typology, subchapter - Sampling".

Figure 2 – Typical vessels of *artisanal* fishing (Setúbal) *(*Franca *et al.*, 1998).

1.2 Inquiries implementation

The inquiries were performed since November 2000 until May 2001 (with 1999 the reference year).

For this purpose it was selected prior fisheries by region, according to the empirical knowledge of the target fleets, supported by an exploratory analysis of the fleets using the information on landings, fleet characteristics and fishing licenses available from the National Fisheries Data Base (BNDP) (*see* annex 4).

In this context, it is worthy to emphasise that the same type of fishery can be classified with different priority levels in different regions, due their regional importance.

These priorities were defined on a regional basis, mainly considering: i) the relative socio-economical importance of the fishery in the community, ii) the importance of the considered fisheries in terms of catch of target resources and iii) the existence of IPIMAR regional Laboratories (CRIPN, CRIPC and CRIPS) to carried out the work.

However, it was very difficult to perform the inquiries based on the priorities defined for fisheries, due the refuses of fishermen to answer and to the difficulty to find the skipper's boat for the 1st priority. Thus, sometimes the priorities order was not respected.

1.3 Inquiries difficulties

The main difficulties encountered in the implementation of the inquiries were related to some specific characteristics of the fishing communities themselves. Their suspicious nature implies a very careful approach and a specific ability to lead with the problems caused by some of our questions. Answers related to the costs and benefits are very delicate for fishermen and are hardly gathered with a high level of confidence.

In a general way, it is difficulty to establish a proximate and familiar relationship with fishermen in order to obtain reliable answers.

As fishermen sometimes practice some illegalities (such as to commercialise the fish out of auction places), and they frequently misunderstand the research work with fishery Inspection; generally they are afraid that their answers does not remain confidential.

Other important problem encountered was the difficulty to specify the time periods by months, namely the seasonal use of fishing gears and the variations in percentage of the target species. It was observed that this problem could be solved if the time periods will be enlarged (i.e. quarters).

Most of the inquiries were done in the auction places, at the end of the fishing journey, and since the present inquiry is too extensive, skippers frequently argued to be tired and did not collaborate in the answers.

Finally, there were two general factors influencing the good persecution of the inquiries: i) the implementation of a similar and obligatory inquiry by the DGPA (General Directorate of Fisheries and Aquaculture), carried out at the same time and ii) the extension of both inquiries, which lead some fishermen to refuse answer to the PECOSUDE inquiry.

For these reasons, the priorities initially established were not completely accomplished and by consequence the pre-defined fleet components were not all inquired.

1.4 DataBase

The Portuguese entity responsible by gathering information on the fleet characteristics, fishing licenses (operated fishing gears) and landings is the DGPA, being also in charge of the National Fisheries database (BNDP).

The IPIMAR database was designed in the relational database engine of Microsoft Corporation® "*Access 97*". As referred above, all data included in the IPIMAR database relates to the reference year of 1999.

For the introduction of the data gathered in the inquiries were built 4 similar Databases (also in *Access 97*) and each regional Laboratory was responsible for the maintenance of its Database. A factor that did not contributed to the better advance of this project was the impossibility to arrange together all the 4 regional databases. The main reason is related with the high quantity of support tables and data storage tables necessary for this purpose.

1.5 Methods

The methodologies used to define the typology of the fleet were:

- ✓ Discriminant Analysis (to classify the daily landings unknown into the fishing gears groups);
- ✓ K – Means clustering (to distribute the fleet vessels by different groups).

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Multivariate statistical method is a procedure for simultaneously analyses of a set of observations with two or more variables. The advantage of this approach over an univariate analysis (observations over only one variable) lies basically in the fact that the multivariate analysis takes into account relationships that may occur between the individuals within the population under study.

The description of the used methodology is presented in Annex 6

2 GLOBAL DESCRIPTION OF THE PORTUGUESE PECOSUDE FLEET

2.1 Fishing vessels fleet

The PECOSUDE fleet is composed of a total of 6360 vessels. Their most common typology is presented in figure 2.
When it was analysed the number of boats by region (Figure 3) it was observed that the Central-South and Algarve regions have the highest number of boats (1981 and 1846, respectively).

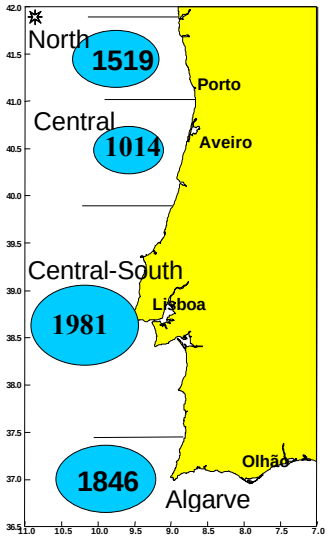


Figure 3- Number of vessels by PECOSUDE region.

Figure 4 shows the distribution of the PECOSUDE fleet by the 32 national register ports. Aveiro (A), Caminha (C) and Setúbal (S) are the fishing ports with highest number of boats (778, 521 and 485, respectively), representing 21% of the total fleet. São Martinho do Porto (SM), Ericeira (E) and Lisboa (LX) are the harbours with the smallest number of fishing boats registered (19, 25 and, 32 respectively). In the Lisbon region there are other *artisanal* fleets registered mainly in the fluvial harbours (Barreiro-B and Vila Franca de Xira-VX and Trafaria–TR).

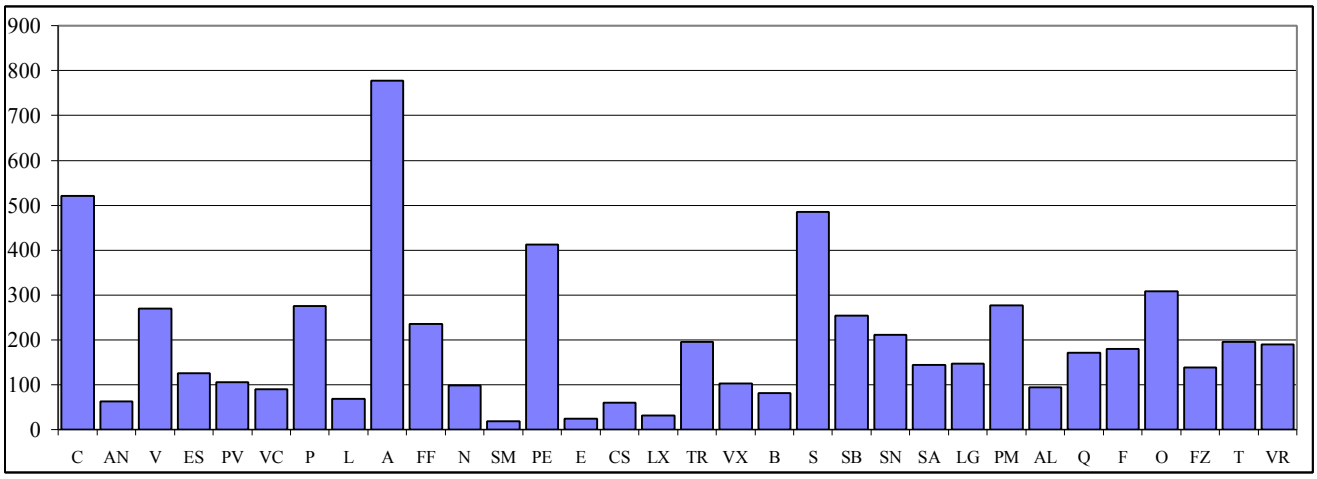


Figure 4 - Number of artisanal vessels by register fishing ports. For harbour information and codes *(*Annex 1).

Some technical characteristics of the fleet are described in the next figure (all data are mean values).

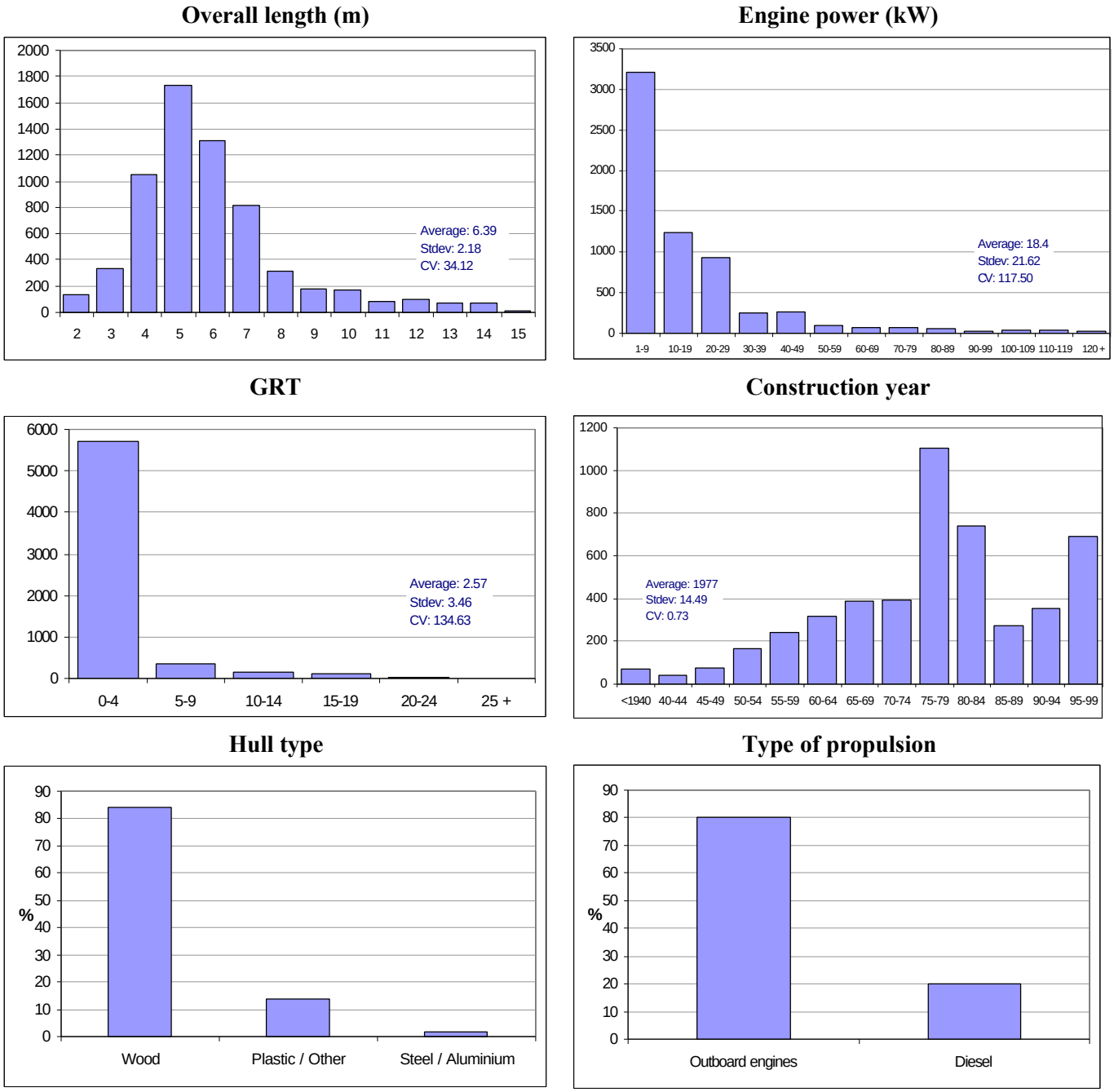


Figure 5 – Main technical characteristics of PECOSUDE fleet.

In what concerns to the mean length of the boats the *artisanal* fleet is characterise in average, by small vessels (the modal overall length is between 5 and 6 m). Figure 5 shows that the major part of the vessels has less than 4 GRT.

In terms of engine power, most of the fishing boats have less than 9 kW and have outboard engines (80%). The majority of the hull boats are constructed in Wood (84%), and a small percentage in Steel/Aluminium or Plastic (2 and 14%, respectively). The most part of the boats was constructed in the period of 1975 to 1979.

In average the fleet is roughly characterised by 6.39 meters of overall length, 18.4 kW of engine power, 2.57 GRT and around 25 years of old.

Additional information (average, standard deviation, CV and minimum and maximum for the technical characteristics of the fleet) is summarised in Annex 2.

2.2 Fishing gears in use

One of the main characteristics of the *artisanal* fishing activity is the use of a diversity of fishing gears and fishing methods. Some of these are traditional, legalised or not, and the others emerge from the inventive capacity of fishermen or from the importation of ideas (Franca *et al.*, 1998).

The following approach considers some of the fishing gears' families in terms of way of operation, target species and main fishing grounds.

2.2.1 Hooks and lines

- Fishing rod and handlines are equipment with one or more hooks that are usually held by the fishermen's hands.

To capture eels, the fishing rod or handline has, in the free end, a ball of earthworms instead of a hook.

- The longline has a set of hooks split on ganging or branch lines standing at a master rope or anchored line. Longline can be drift or bottom, in function of the species that intends to capture.

Figure 6 - Longline basket – Tagus river/Paço de Arcos (*in* Franca *et al*., 1998).

The target species of the longline are mainly the sparidae, pouting (*Trisopterus luscus)*, seabass (*Dicentrarchus labrax)*, European conger (*Conger conger),* morey (*Muraena* spp.) and the selaceans, for example, depending on the dimension of the hooks. Fishing rod, handline and longline are usually used in the entire coast and in inshore waters.

- Squid jig is a utensil composed of a ballast of lead painted with a clear colour, armed in one polo, with a metallic hooks crown and, in the other, with a ring which ties a thread/line. The fisherman handles this utensil.

On board of anchored vessels, mainly during night, with light attraction, squid jig is used to capture by wound *Loligo* spp. and *Sepia officinalis.*

This fishing gear is used along the entire coast, mainly in Peniche, Sesimbra and in 'Algarve', where it has a great importance in the summer season for the *artisanal* fleet.

Figure 7 - Squid jig- Arrifana beach (in Franca et al., 1998).

2.2.2 Purse seine

Fishing carried out using a tall, long net to form a wall. It is cast from a vessel and manoeuvred in order to surround the prey completely and then it is brought together at the bottom like a purse to prevent escape.

Purse seine nets target small pelagic species such as *Sardina pilchardus*, *Scomber japonicus* or *Trachurus trachurus*. Generally, the purse seine nets have dimensions of more than 1000 meters length and 20 meters depth. However, there are nets with smaller dimensions operated by smaller vessels and targeting several different species.

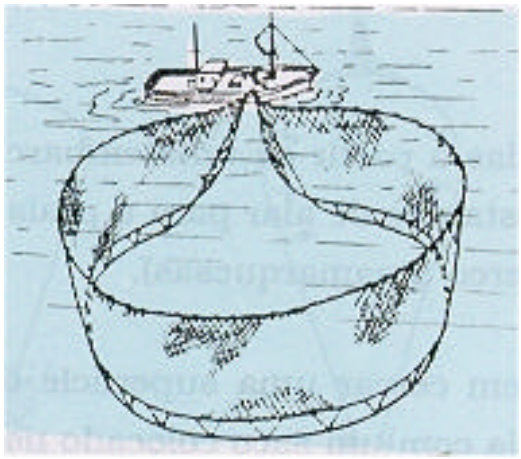


Figure 8 - Purse seine scheme (adapted from Leite, 1991).

2.2.3 Traps

The traps group includes several types of fishing gears, such as pound nets, fish, cephalopods and crustaceans traps, fyke net, stow net, stake gillnet and aerial trap. The capture is made by inducing fishes to the trap's interior.

- Gillnet on stakes and stake gillnet are a barrage traps that stops the fish's passage.

Figure 9 - Stake gillnet-Cávado river/Fão (*in Franca et al.*, 1998).

- Netpots can have different designs and can be constructed in several materials such as wire or lined rigid structures with synthetic net. They can be rigid or dismountable, have two or more entrances and are normally baited.

Figure 10 - Dismountable netpots Tagus River /Cruz Quebrada (*in* Franca *et al.*, 1998).

The more common netpot is constructed in plastic net assembled in metal structures and used in the entire coast. Fishes, crustaceans and cephalopods are the target species, depending on the position of the entrance of the netpot.

Figure 11- Rigid half-cylindrical netpot Arrifana beach (*in* Franca *et a.l*, 1998)

Figure 12 - Rigid polyhedral netpot ballast with cement Cascais/Pescadores beach (*in* Franca *et al.*, 1998)

Figure 13 - Rigid cylindrical netpot Angeiras beach (*in* Franca *et al.*, 1998)

Iron pot is a type of netpot totally constructed in wire, in which the meshes are triangular. Fishes are the target species.

Figure 14 - Wire pot fleet – Vila do Conde (*in* Franca *et al.*, 1998)

- "Bombos"(drum) is a dismountable trap composed by two lined metallic and synthetic hoops. When operated it takes the cylindrical form, stretching due to the four parts of wood that move away the hoops one from each other. This trap is more used in the North zone.

The shrimp, *Palaemon serratus* is the target specie.

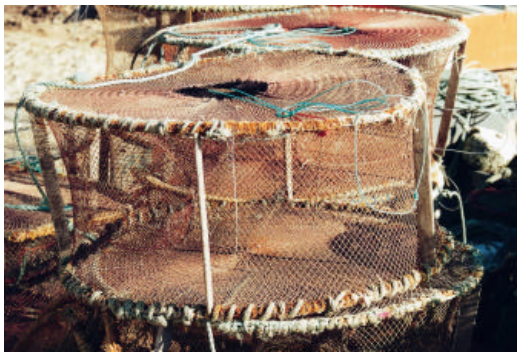


Figure 15 - "Bombos" – Vila Chã (*in* Franca *et al*., 1998)

Octopus pot is a particular trap that works, as shelter, manufactured in adobe (by tradition), and catchs *Octopus vulgaris*. Its origin is essentially from Algarve, but it was generalised to the remaining of the Portuguese continental coast. The fishing efficiency depends on topographical and climatic conditions and also on the physical sea conditions.

Figure 16 - Lined octopus pots – Ria Formosa/Arroteia (*in* Franca *et al.*, 1998)

The pot fleets is not baited, in both extremity there is ballast, that anchors the fishing gear, and a buoy that signals it at the surface.
The importance of the octopus pot in the context of *artisanal* fishing is due to the very selective performance.

2.2.4 Lift net

'Sombreira' is a fishing gear composed by a rectangular piece of netting. Mounting upper in a rope with floats and lowly with leads usually in form of rings. This gear is pulled to board, thought the joined of the braided, working as a bag that holds back the shrimps (target species).

Figure 17 - "Sombreira" – Praia de Angeiras (*in* Franca *et al.*, 1998)

2.2.5 Gillnet

Fishing gear consisting of a wide, usually low, vertical wall of one layer (gillnet), kept vertical by floating lines and weights. These may be used individually or in hunting parties and the species become trapped in the nets. Gillnets belong to the group of passive fishing gears. Generally, in the Algarve, they are set on the bottom for more than 1000 meters long and less than 6 meters high. This gillnet targets multiple benthonic and demersal species of fishes such as hake and Sparidae.

Figure 18 - Gillnet -Vila Chã (*in* Franca *et al.*, 1998)

A gillnet consisting of three layers with different sized mesh (trammelnet) all hung on the same floating ropes and weights; the inner fine-meshed layer is carried by the fish through the coarse-meshed outer layers and encloses it in a pocket.

Trammelnets and gillnets are operated by similar techniques. Usually trammelnets are 1500 meters long and 3 meters high and they are set on the bottom of the sea. They also target multiple species, but contrarily to gillnets, mainly benthonic fishes and cephalopods are caught. Examples of species targeted by trammelnets are the flat fishes (soles and others), rays and cuttlefish.

Gillnets and trammelnets are the fishing gears more practised in the Portuguese continental coast. Although gillnet is a selective art, the raised number of fixed nets by boat, can widely reach a long distances. The very long time immersion confers an offensive degree that must be take into account.

2.2.6 Bottom Trawl

The fishing is carried out using an usually large net bag that is towed. This net is sometimes extended out to the side by small 'wings'. The net may be dragged along the ocean floor (bottom trawling) or between the ocean floor and the surface (pelagic trawling).

Figure 19 - Artisanal Beam trawl – Castelo do Neiva (*in* Franca *et al*., 1998)

- Beam trawl

A wood or metal pole assures the horizontal opening of the net, with two auxiliary iron beam head on each extremity that touches in the bottom and assures the vertical opening.

- Otter trawl

The opening bag is obtained by the use of trawl doors.

2.2.7 Dredge

- Boat dredge

The fishery is carried out using a metal structure with metal teeth or a metal blade underneath used to catch burrowing species (e.g. clams). The vessel pulls this dredge.

- Manual dredge

Manual utensil contain a metallic comb with number teethes and variable sizes joined to a wood rope. This rope is large if the comb has mounted in a net bag, or short if has not bags. If the rope have non-bag, the fishermen act in small deep or in the discovered ground by ebb tide.

The target species are bivalves, and fishermen use their strength to haul the dredge.

This fishing gear is practised in rivers and lagoons such as, Lima River, Óbidos Lagoon, Aveiro Lagoon and Mondego River, among others.

Figure 20 - Manual dredge Costa de Caparica (*in* Franca *et al.*, 1998)

Figure 21 - Manual dredge Lima river/Darque (*in* Franca *et al.*, 1998)

Figure 22 - Manual dredge Óbidos Lagoon/Foz do Arelho (*in* Franca *et al.*, 1998)

2.2.8 Beach seine (Xávega)

The "Xávega" fishing gear could be define as a big beach seine, with a bag in the central region and two lateral wings, where the ropes are on. Its principal of function is simple: the boat leaves the beach where a rope stays, and goes offshore, dropping the net and returns. The net is hauled to the beach by mean of adapted farm-tractors or human force (with small fishing gears).The biggest "Xávegas" operates in North region, between Espinho and Mira beachs.

The characteristics of vessels are two prows, high and curved, usually with beautiful decorations. Due to the operating method this gear has a seasonal pattern, and intent to catch small pelagic fishes that are close to the beach.

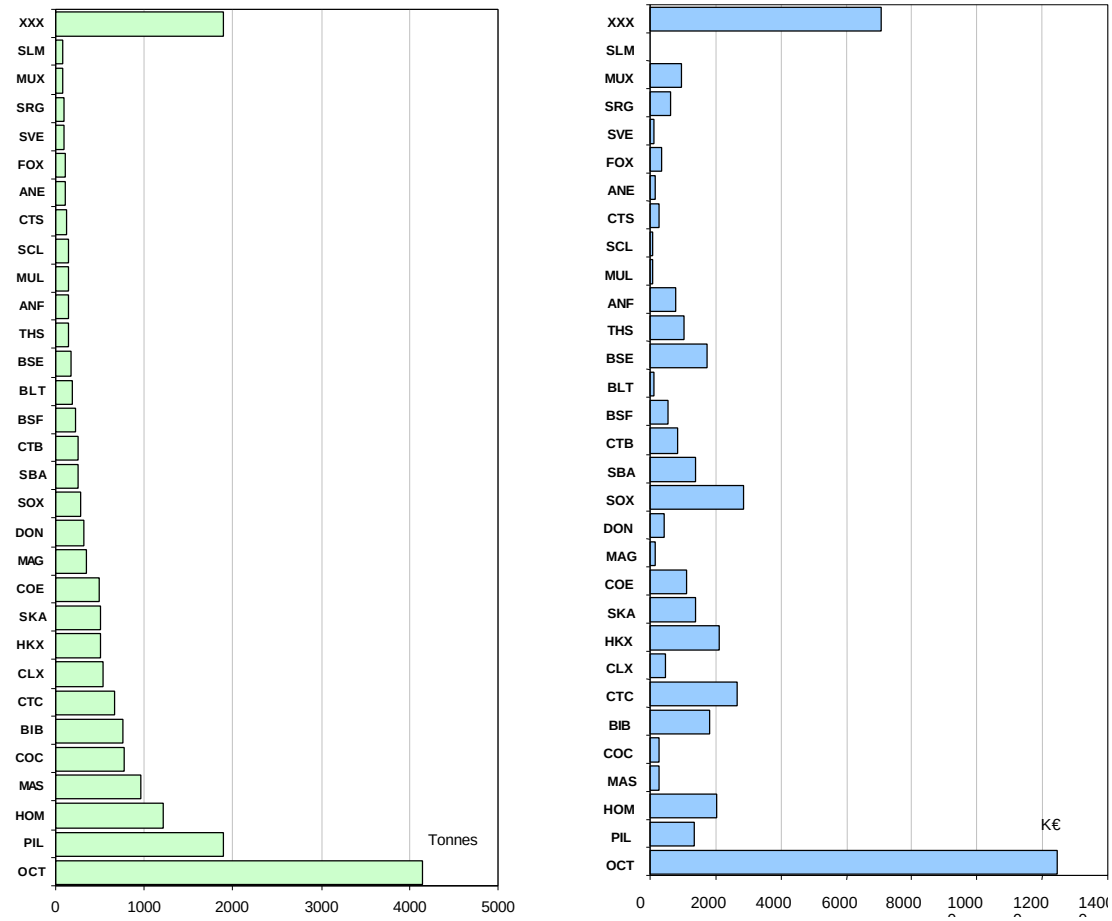
Figure 23 - Beach seine (Xávega) – Espinho (*in* Franca *et al.*, 1998)

Figure 24 - "Chinchorro" –Óbidos Lagoon (*in* Franca *et al.*, 1998)

In lagoon waters exists another type of beach seine, "chinchorro" with several target species (pelagic fishes, eel, etc).

2.3 Landed Species

The PECOSUDE target species were considered the 30 species with largest landings. It was taking into account the total catches of the PECOSUDE fleet (figure 25). It was used the FAO[1] code for species (Annex 3). The other species (beyond the 30 main species) were grouped in a category designated by "XXX".



A B

Figure 25 - Total landings of the 30 target species from the PECOSUDE fleet in 1999, A-tonnes, B- k€. (FAO code species).

Octopus (OCT) is the most important landed species, in weight, followed by sardine (PIL). Octopus is also the most important species in value; the sole (SOX) and the cuttlefish (CTC) occupy the second and the third place.

In order to compare the importance of species related to the total landings and commercial values (figure 26), the 30 PECOSUDE species were grouped as follow: cephalopods, pelagic fish, demersal fish, bivalves, flat fish and others.

1 FAO- Food and Agriculture Organisation of the United Nations

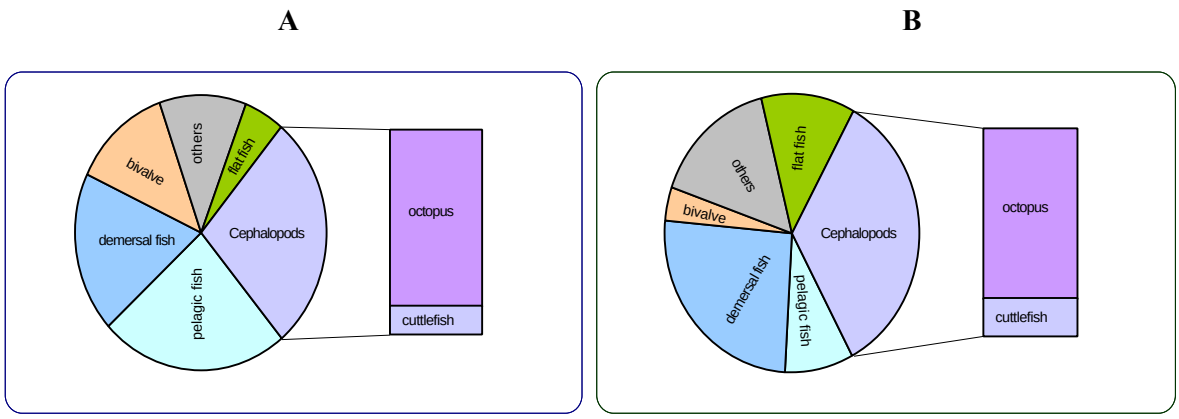


Figure 26 - Groups of species distributed by: A- landings, B- value.

Cephalopods are the group with a higher presence in both tonnes and value. Inside the cephalopods group the octopus is the main species. Several groups of species, for example pelagic fishes and bivalves, are more important in landings than in value. However, demersal fishes and flat fishes have a higher importance in terms of value to the detriment of landing.

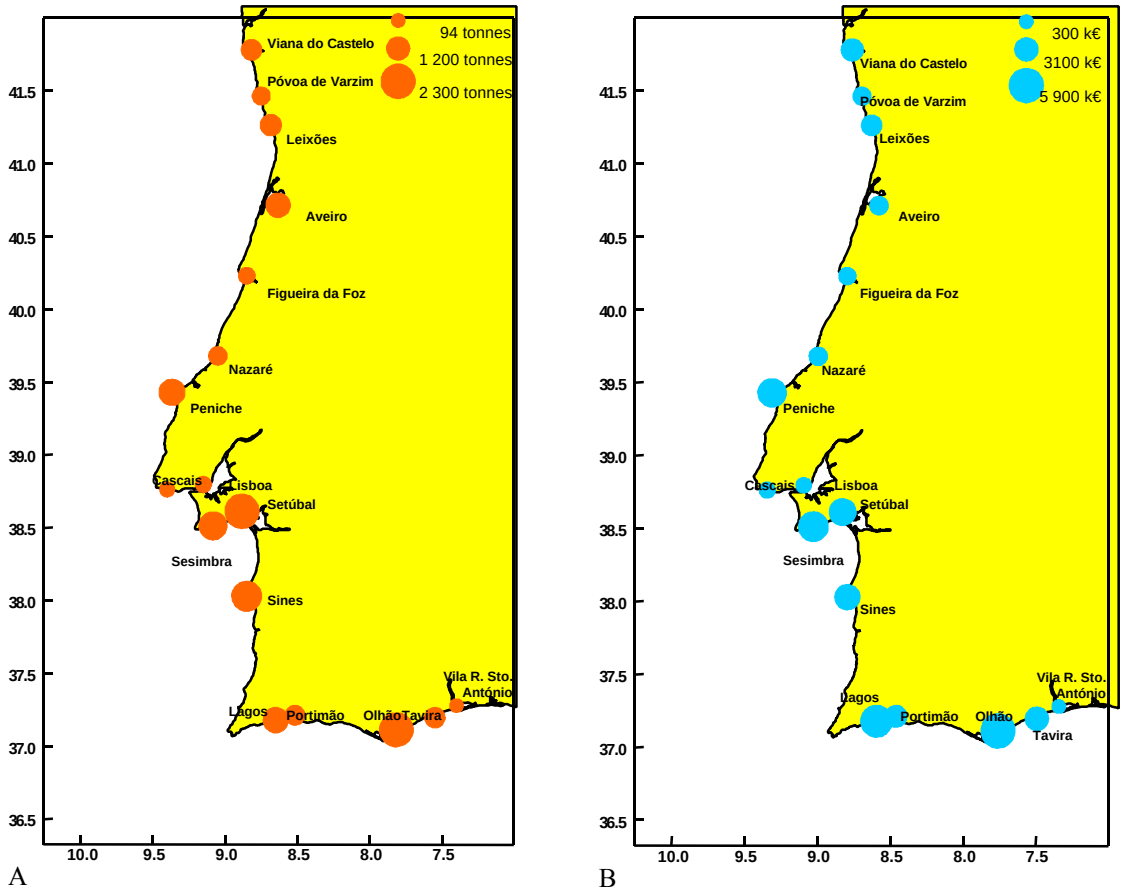


Figure 27- A- Abundance of the landings (in tonnes) by main auction places.
B- Value (K€) of the landings distributed by main auction places.

Figure 27 presents the landings in weight and value for the main harbours. Olhão is the harbour with the more valuable landings. However Olhão and Setúbal are the more important landings harbours in weight. Cascais, Lisboa and Vila Real de Santo António are the ports were the landings have less importance.

In order to know the landings composition by species in each harbour, two charts were performed (figure 28 and 29). To define the species included in the chart it was assumed that the sum of the species

landings reach about 50% of the total harbour landings. The same procedure was adopted for the species value by harbour.

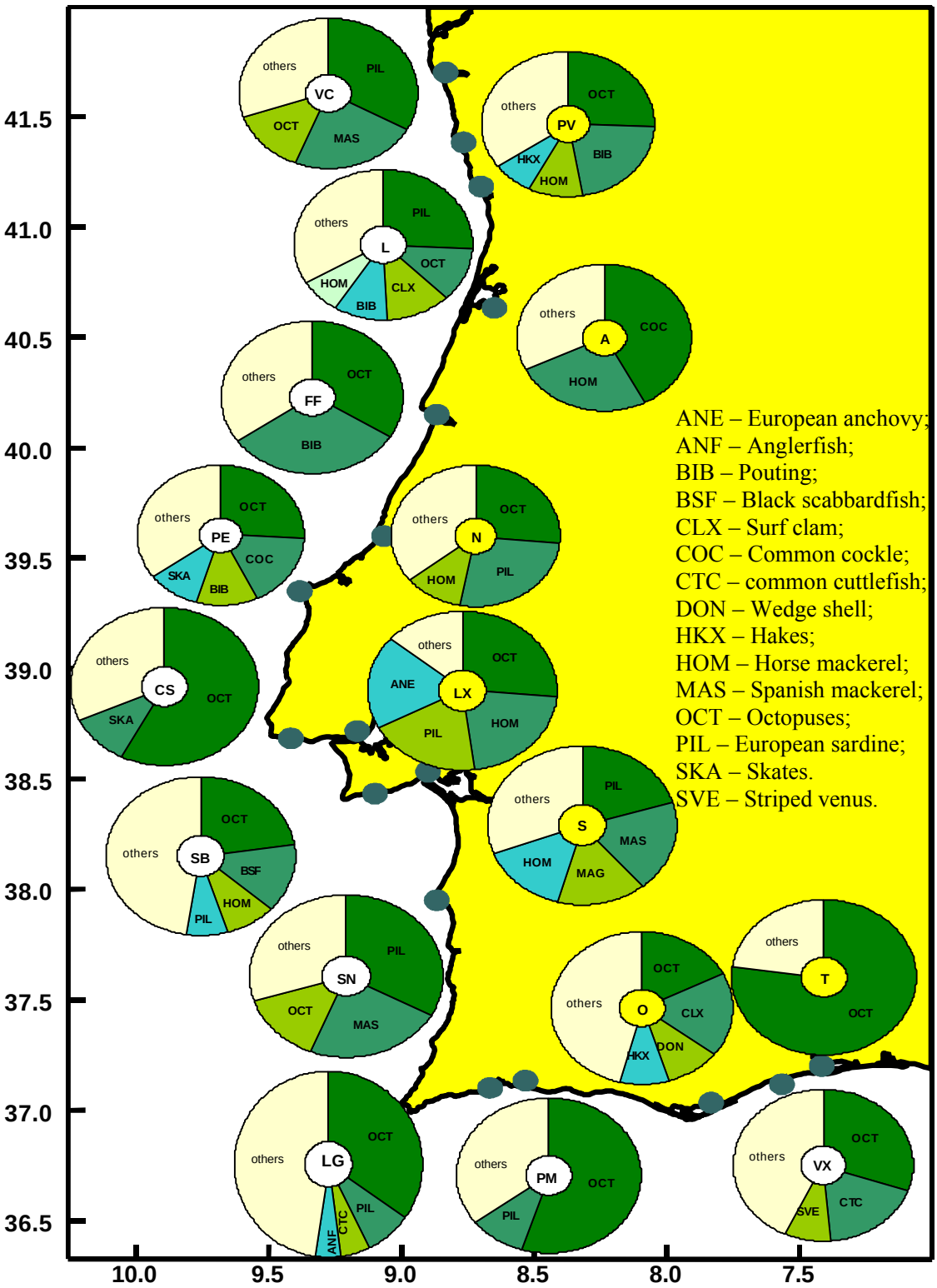


Figure 28 - Distribution of the most important species in weight (tonnes) by harbour (FAO species code) (*See* Annex 4).

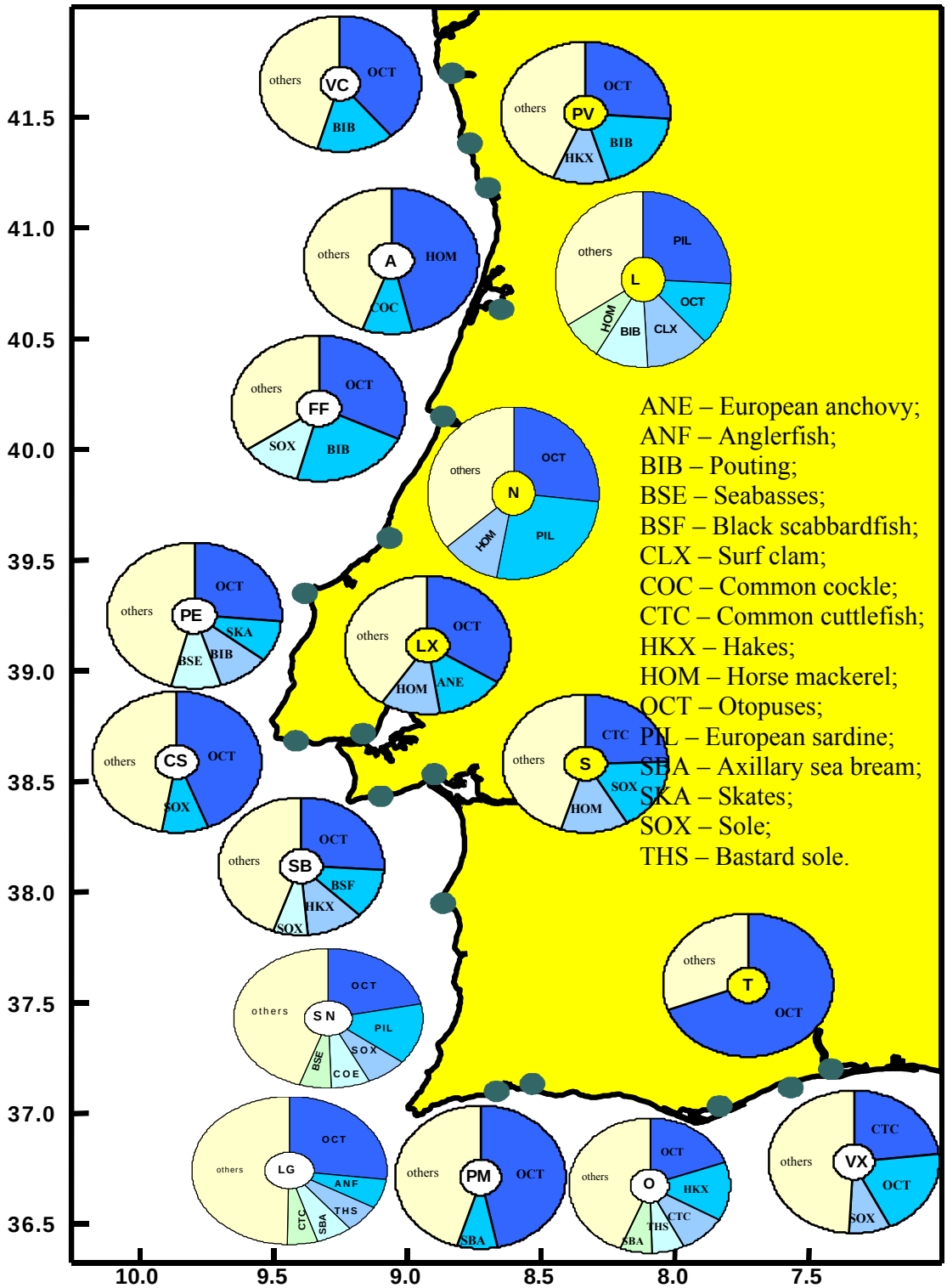


Figure 29 - Distribution of the most important species in values (Euro) by harbour. (FAO species code) (*See* Annex 4).

In Algarve region, octopus is the main species landed, reaching more than 50 % of the total landings in Portimão and Tavira. Traditionally, Tavira is a harbour where the use of octopus pots is widely spread. This explains the higher percentage of octopus catches, about 75%, related to the total of all species. Olhão is the harbour in Algarve where the bivalves landings are larger and surf clam and wedge shell are the two main species with above 25% for both.

In the Central-South region, the main species landed in Sines and Setúbal are pelagic fishes, specifically, sardine and Spanish mackerel. Between Sesimbra and Nazaré the more landed species is again

octopus, with percentages near to 25%, except in Cascais where octopus is more than 50% of total landings.Central region is the zone with more common cockle landings, almost exclusively in Aveiro auction place. Figueira da Foz have two principal landed species, octopus and pouting.

Viana do Castelo and Leixões are the two harbours in the North region with more sardine landings related to the other regions. The value of each species landed vary from harbour to harbour that prevent the comparison of figures among harbours.

So, the charts of values only can be analysed inside each harbour (e.g. figure 29).

2.4 Fishing seasonal pattern

The fishing seasonal pattern is different from year to year. It is due, sometimes to the annual changes in the regulations and other times to the environmental conditions that may influence the fishing activity. So, an analysis for the year 1999 can not be extrapolated for other years.

Bullet tuna have a different pattern from all other species. There are no catches until May and the effective catch start in June with higher landings in September and October.

For the other species presented in figure 30 there is not a marked seasonal pattern, thus a description of the monthly variations for each species would be exhaustive.

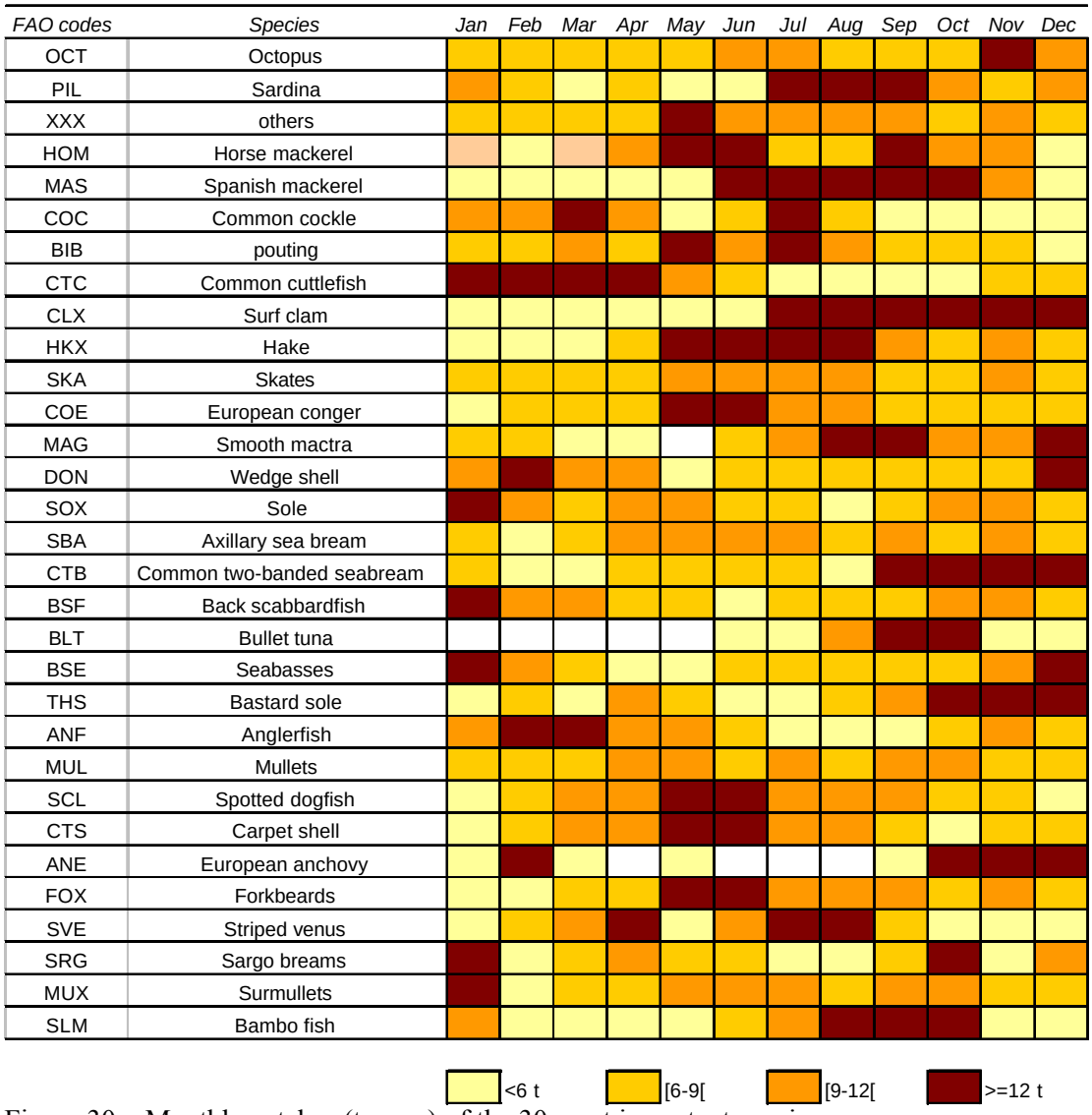


Figure 30 – Monthly catches (tonnes) of the 30 most important species.

3 FLEET COMPONENTS TYPOLOGY

3.1 Multivariate Analysis

As we said at the beginning, the methodologies used to define the typology of the fleet were:

- ✓ Discriminant Analysis (to classify the daily landings unknown into the fishing gears groups);
- ✓ K – Means clustering (to distribute the fleet vessels by different groups).

3.2 Results

It was create several Ks by the *K-means clustering.* To choice of the best K that identifies the fleet components, comparisons between the relative weight of the 30 most important species landed and the usage of the different gears were made and, after some adjustments, 10 components (C1, C2,…, C10) were assumed (tables 1 and 2):

Table 1- The number of vessels (N) and inquiries by the10 fleet components.

Component	N	Number of Inquiries	Percentage inquired
MD	499	47	9
TR1	677	29	4
OTR	478	26	5
BOT	227	29	13
SPS	112	33	29
TR2	816	16	2
GTN	355	34	10
TN	250	17	7
BS	39	19	49
BD	82	27	33
Total	3535	277	8

The analysis of the optimal number of groups resulted in a discrimination of 10 different fleet components, described below (Table 2). The seasonal character of several fisheries can explain the great quantity of fishing gears presented in some fleet components.

Table 2- Description of the fleet components by main fishing gears and main region of operation

Fleet components	Main fishing gears	Code	Main region	N
Fleet component 1	Manual dredge in lagoon waters + Gillnets + Hooks and lines	MD	Central	499
Fleet component 2	Gillnets + Hooks and lines + Traps	TR1	Algarve	677
Fleet component 3	Octopus pots + Octopus traps	OTR	Algarve	478
Fleet component 4	Otter trawl + Gillnets + Traps + Hooks and lines	BOT	North	227
Fleet component 5	Small purse seines + multi-specific	SPS	North + Central-South	112
Fleet component 6	Traps + Trammel nets +Hooks and lines	TR2	Central-South	816
Fleet component 7	Beam trawl + Gillnets + Hooks and lines + Traps	GTN	North	355
Fleet component 8	Bottom trammel nets + octopus pots	TN	Central-South	250
Fleet component 9	Beach seines	BS	Central	39
Fleet component 10	Boat dredge in marine waters	BD	Algarve	82

Note: for more information about the fishing gears *see* chapter 2.3.

Only 8% the population was inquired. The fleet component with lower sampling (2%) was TR2.

4 DESCRIPTION OF THE FLEET COMPONENTS

The following figure shows the proportion of the number of vessels by fleet components and region:

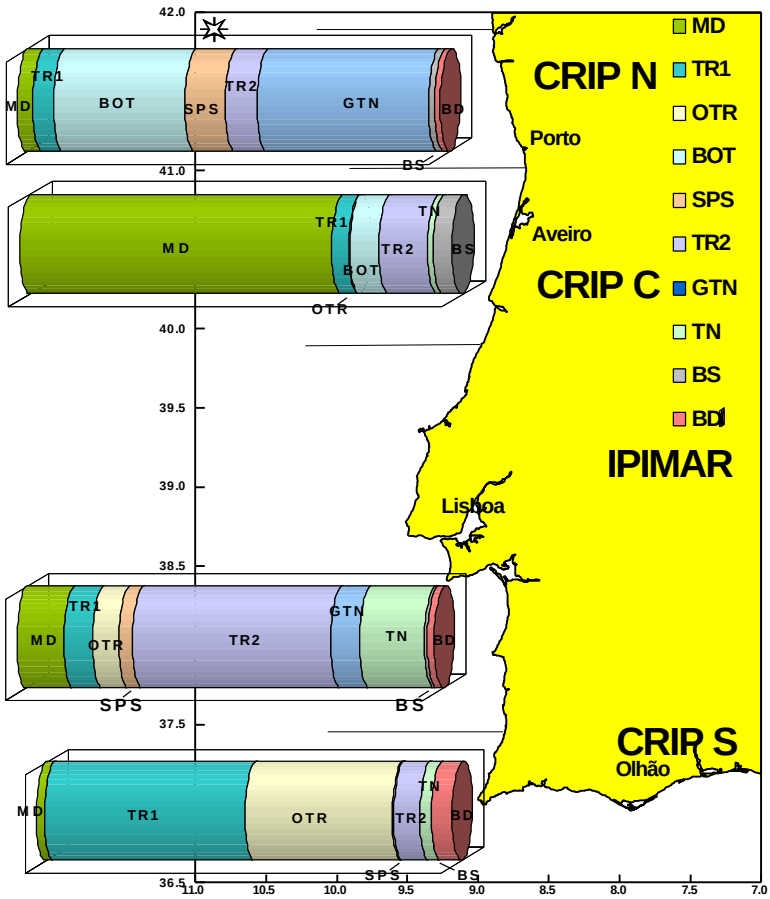


Figure 31- Number of vessels by fleet component and region

All regions are characterised by different main fleet components and does not exist overlapping of the main fleet components *inter* regions.

Fleet components MD and TR2 and TN mark the Central region and the Central-South region respectively. In Algarve (South) region predominates mainly the fleet components TR1 and OTR, and in the North region the fleet components BOT and GTN.

North and Central-South are the main regions to the fleet component SPS.

Central-South and Algarve are the regions with highest number of vessels (respectively 1377 and 1108).

In 1999 there was 130 different type of fishing licenses, including oceanic and non-oceanic licenses. Those fishing licenses are attributed or renovated according to the effective use of the fishing gears in the former year and for authorised fishing areas.

Next figure shows the number of fishing licenses distributed by fleet component.

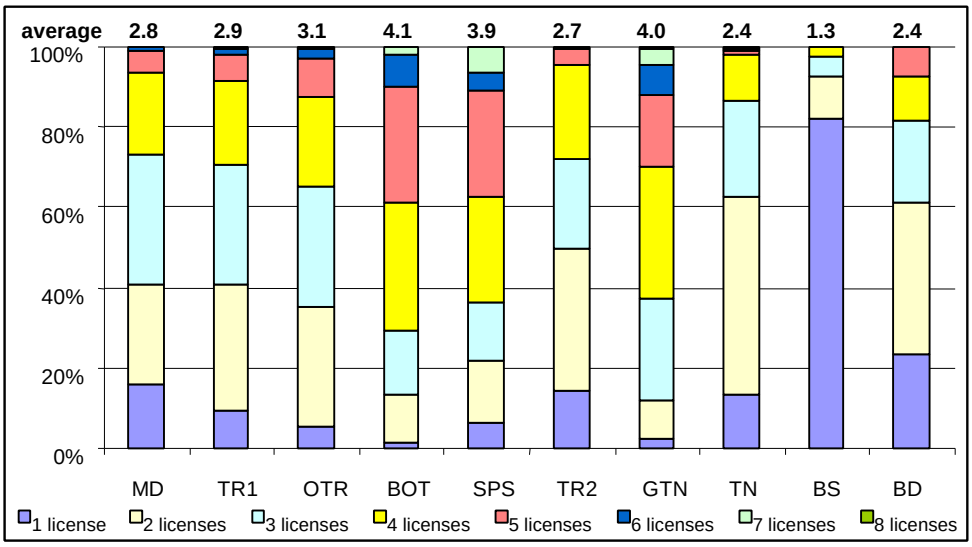


Figure 32 - Percentage of boats with 1 to 8 licences and average of licenses by boat of each component.

The only component with 1 license is BS (beach seine); the others have 2 or more licenses in average. With 4 licenses in average there are the fleet components BOT, SPS and GTN.

FLEET COMPONENT MD

Manual dredge in lagoon waters + Gillnets + Hooks and lines

Characteristic of the fleet component:

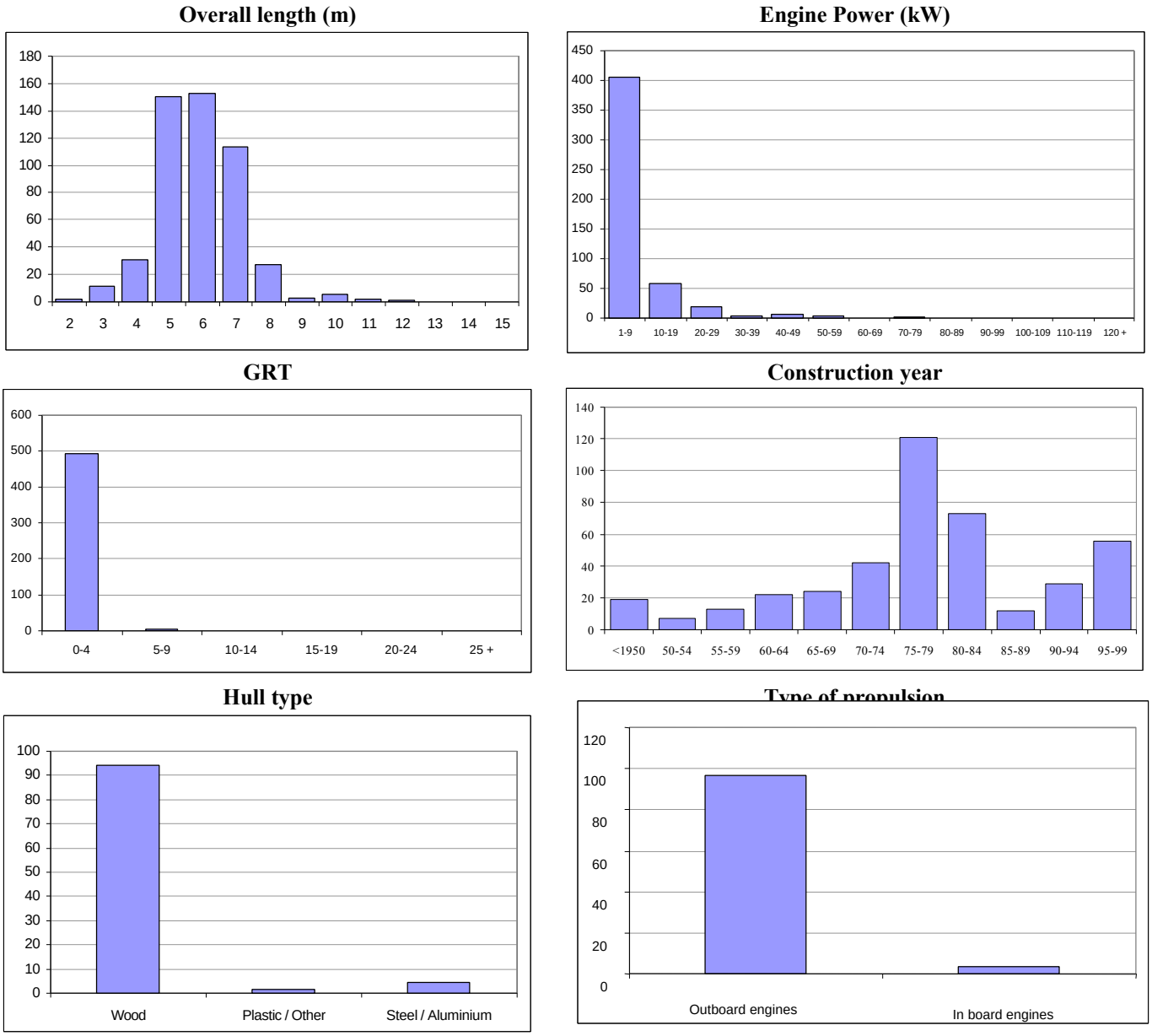
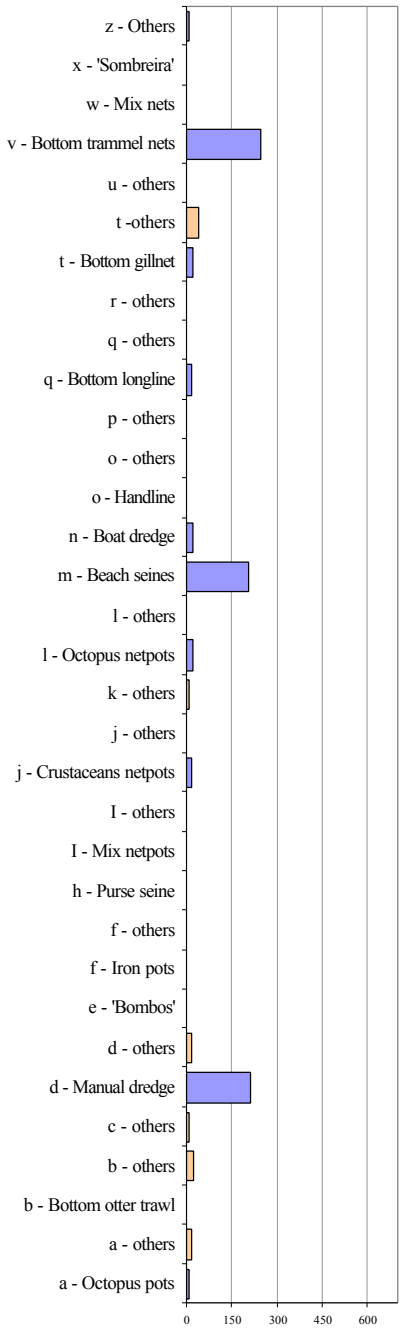


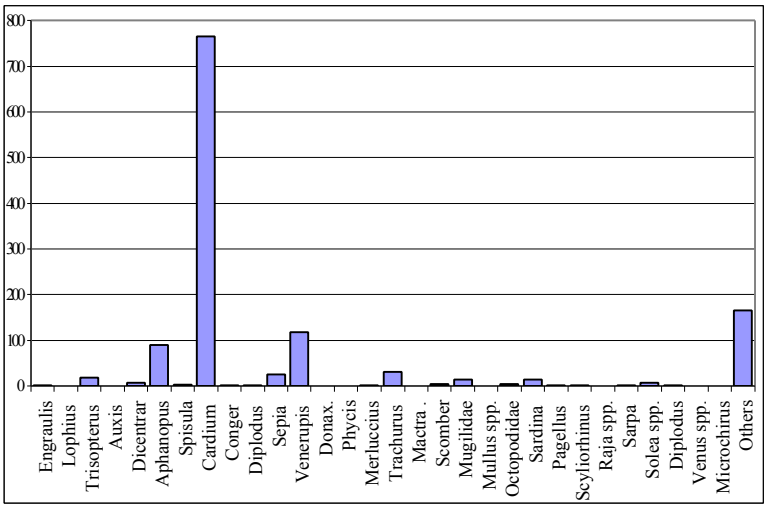
Figure 33- Technical characteristics of the fleet component MD.
Note: Hull type and Type of propulsion categories are the DGPA definition.

***Component* MD : Manual dredge in lagoon waters + Gillnets + Hooks and lines**

Number of months using the fishing gears



30 species most landed (tonnes) by fleet component MD



Monthly catches

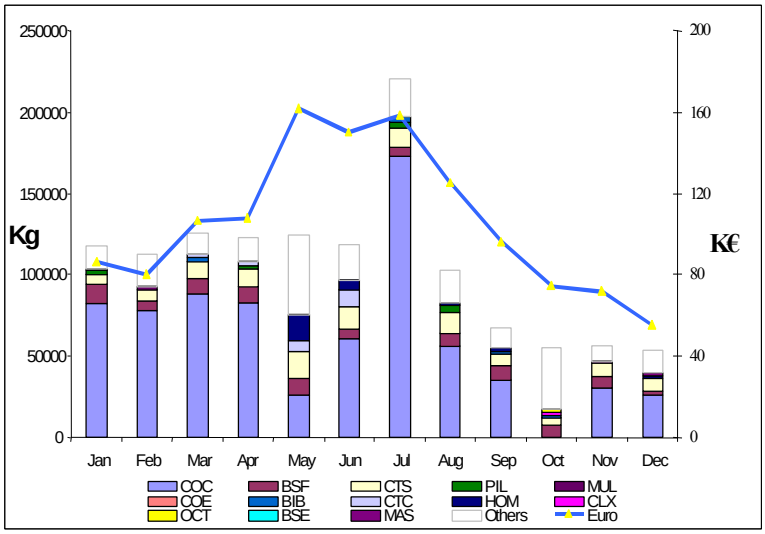


Figure 34 - 30 species landed number of months using fishing gears, catches by fleet component MD and the respective values (k€).

The fleet component MD is composed of 499 vessels. A typical artisanal vessel of this component has in average 6.4 meters of overall length, 8.6 kW, 1.39 GRT, a wood hull type, 25 years old, and uses an outboard engine (figure 33).

Central region vessels are represented by the fleet component MD mainly. The error associate to Discriminant Analysis (DA) in this region was 26%, besides that the inquiries were done only in 8 % of the total fleet. These values are very low to characterise, in terms of importance the fishing gears used.

In figure 34, the relationship between the months using the fishing gears and the species caught, in 1999, seems not be correct. For the reasons described above the fishing gears used by each vessel (not inquired) could be wrong classified (Annex 6) due to the reduced number of samples. On the other hand the small sampling percentage could be another explanation.

For instance, when it is analysed the figure 34, beach seine is probably one of these cases; i.e., the target species are not highly represented in the total landings.

In spite of some relationship are not clarified, with precaution it is possible to associate some gears to the species landed.

The species most landed by this fleet is common cockle, a target species of manual dredge. In what concerns to bottom trammel nets this gear catch mainly common cuttlefish.

Concerning to the monthly catches we adopted the five species more landed in each month as the criterion of analyses. The remaining species were classified as *others*. In the frame time between January and April the common cockle landings are almost constant, however in July there is an increase of catches. After July the catches decreased and in October there is no catches of this species.

FLEET COMPONENT TR1

Gillnets + Hooks and lines + Traps

Characteristic of the fleet component:

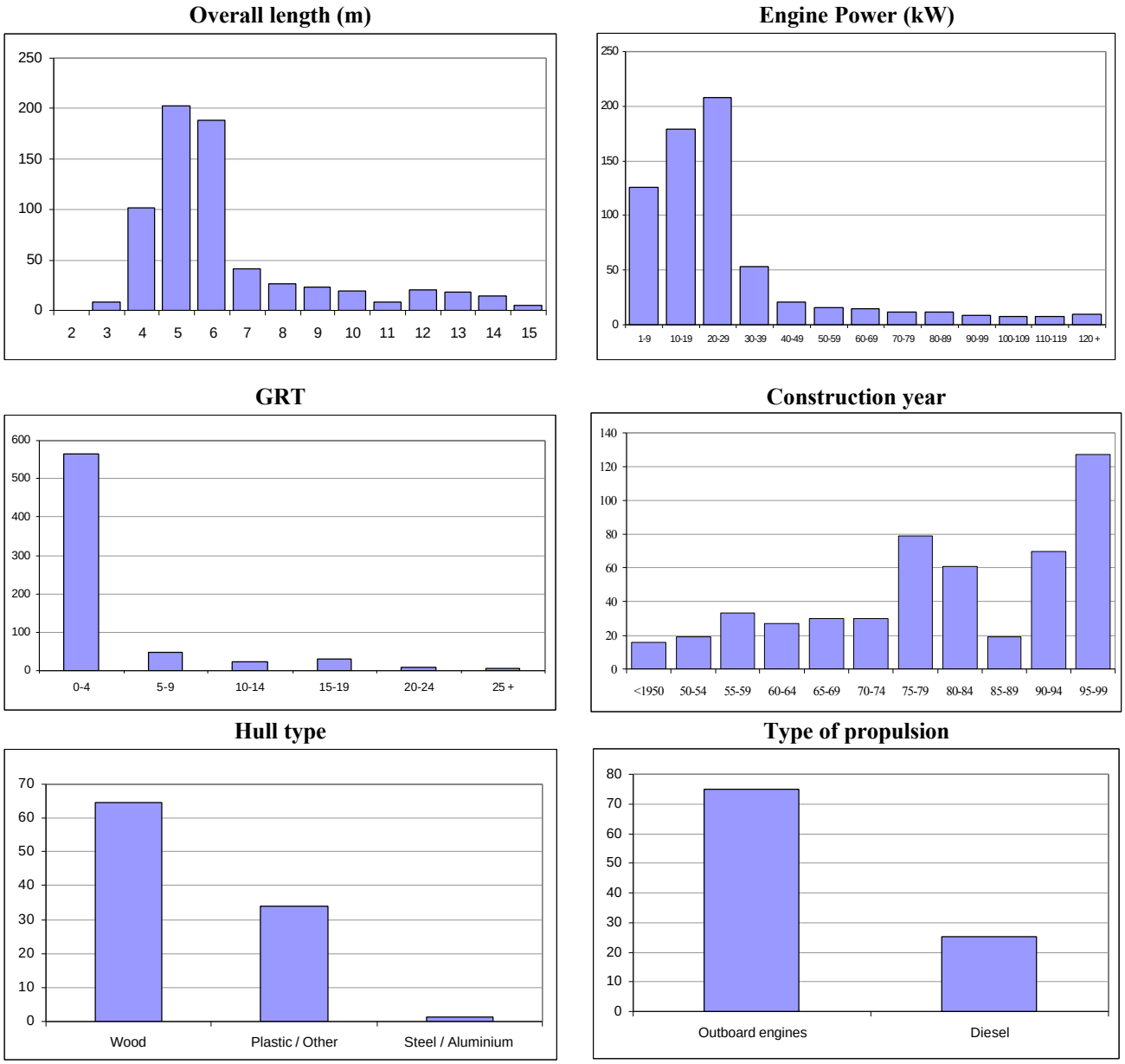


Figure 35 - Technical characteristics of the fleet component TR1.

Note: Hull type and Type of propulsion categories follow the DGPA definition

***Component* TR1 : Gillnets + Hooks and lines + Traps**

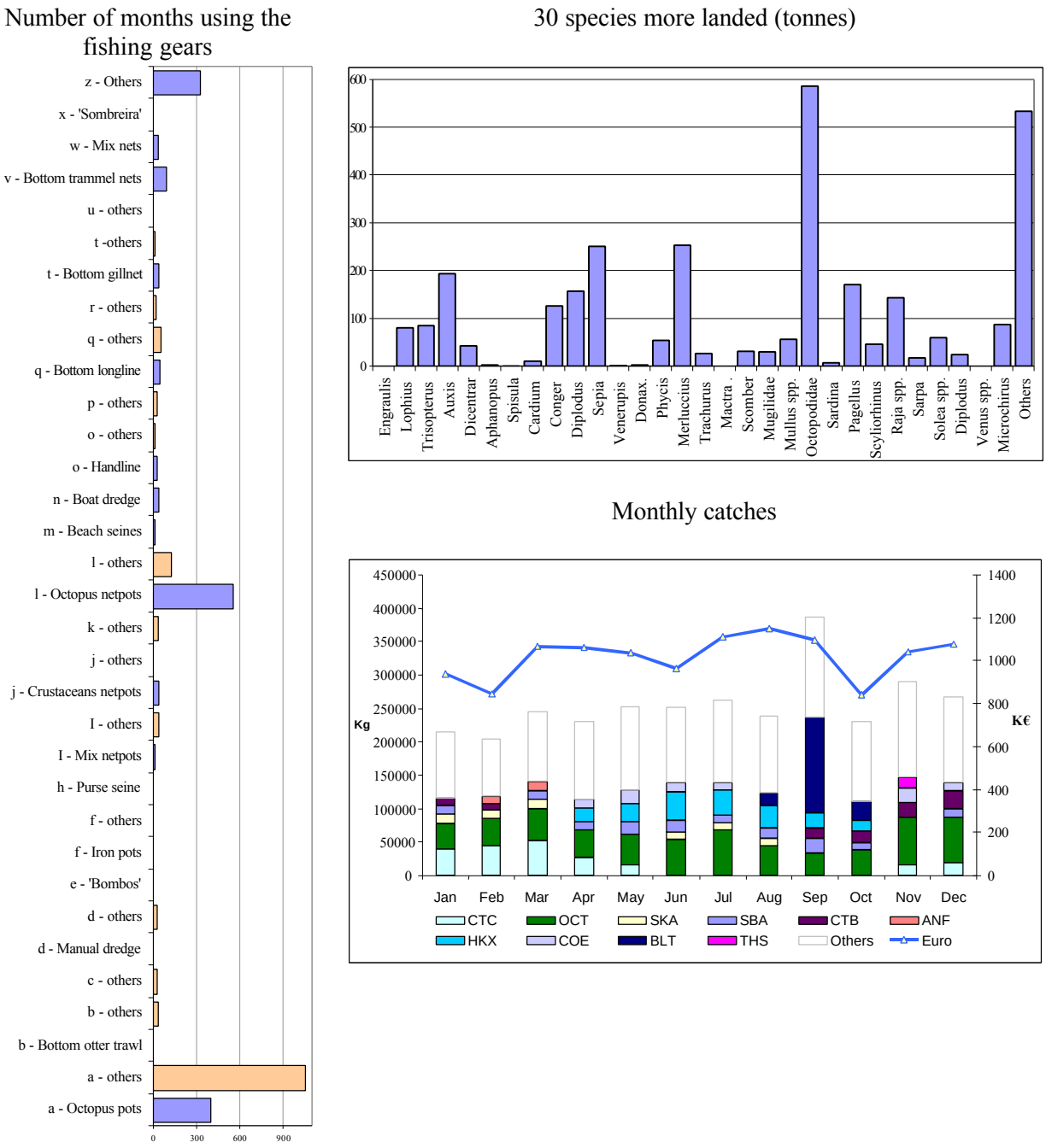


Figure 36 - 30 species landed, number of months using the fishing gears, catches (Kg) by fleet component TR1 and the respective values (k€).

The fleet component TR1 is composed of 677 vessels.

Algarve is the principal region of the fleet component TR1. A typical artisanal vessel of TR1 has in average 6.9 meters of overall length, 29.1 kW, 3.8 GRT, a wood hull type, 22 years old, and uses an outboard engine (Figure 35).

This fleet component is characterised by multi-specific gears (3 licenses *per* boat in average) and therefore catch a large diversity of species (*see* figure 36). However it seems that all the vessels have in common octopus netpots and octopus pots (Annex 7, codes ***l*** and ***a***), contributing to the highs catches of Octopus. The other fishing gears associated are the trammel nets, that contribute to catch others species more landed (cuttlefish, for example).

In terms of monthly catches there are a seasonal pattern for all the species except for Octopus.

FLEET COMPONENT OTR

Octopus pots + Octopus traps

Characteristic of the fleet component:

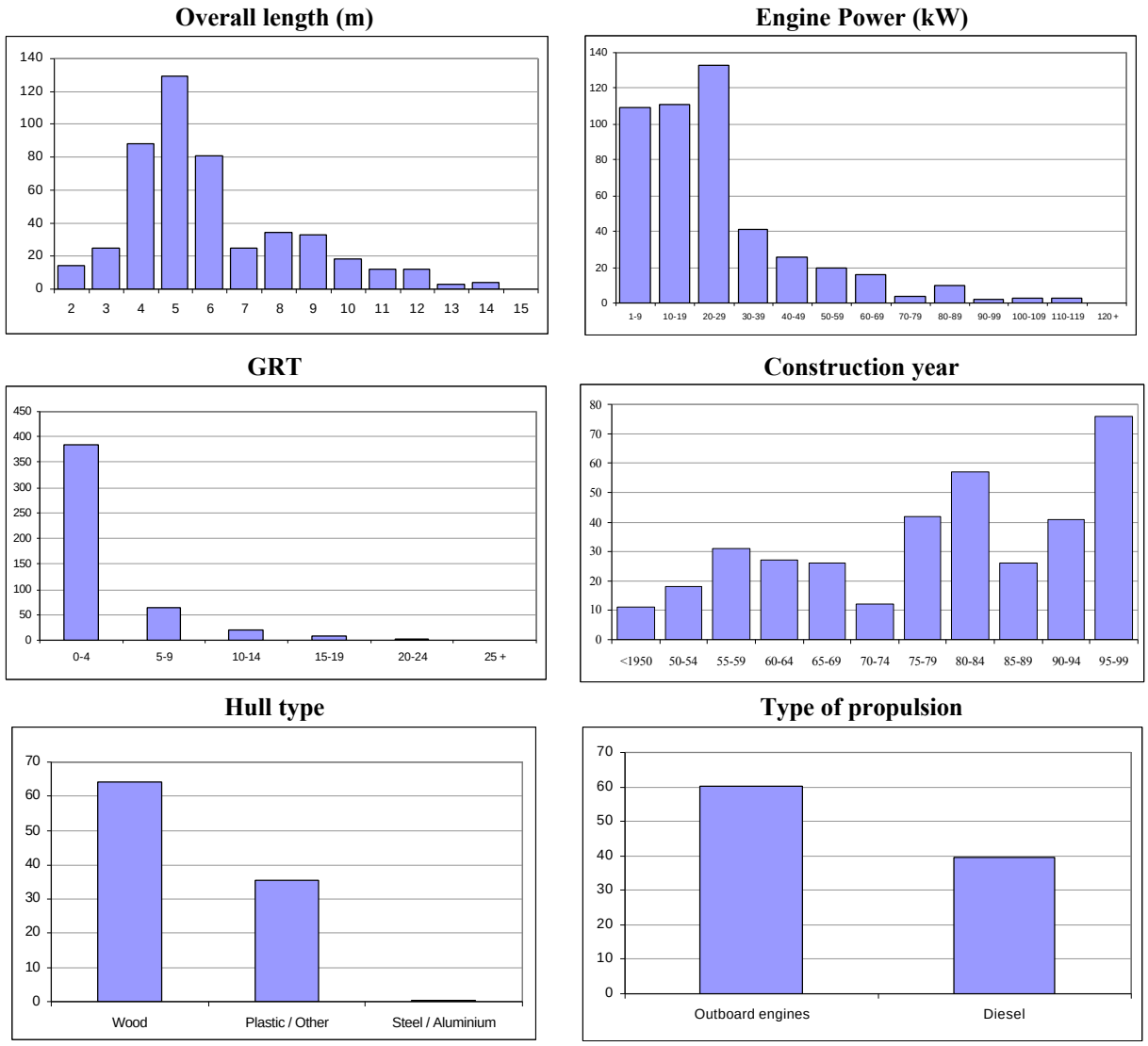


Figure 37 - Technical characteristics of the fleet component OTR.
Note: Hull type and Type of propulsion categories are the DGPA definition

***Component* OTR : Octopus pots + Octopus traps**

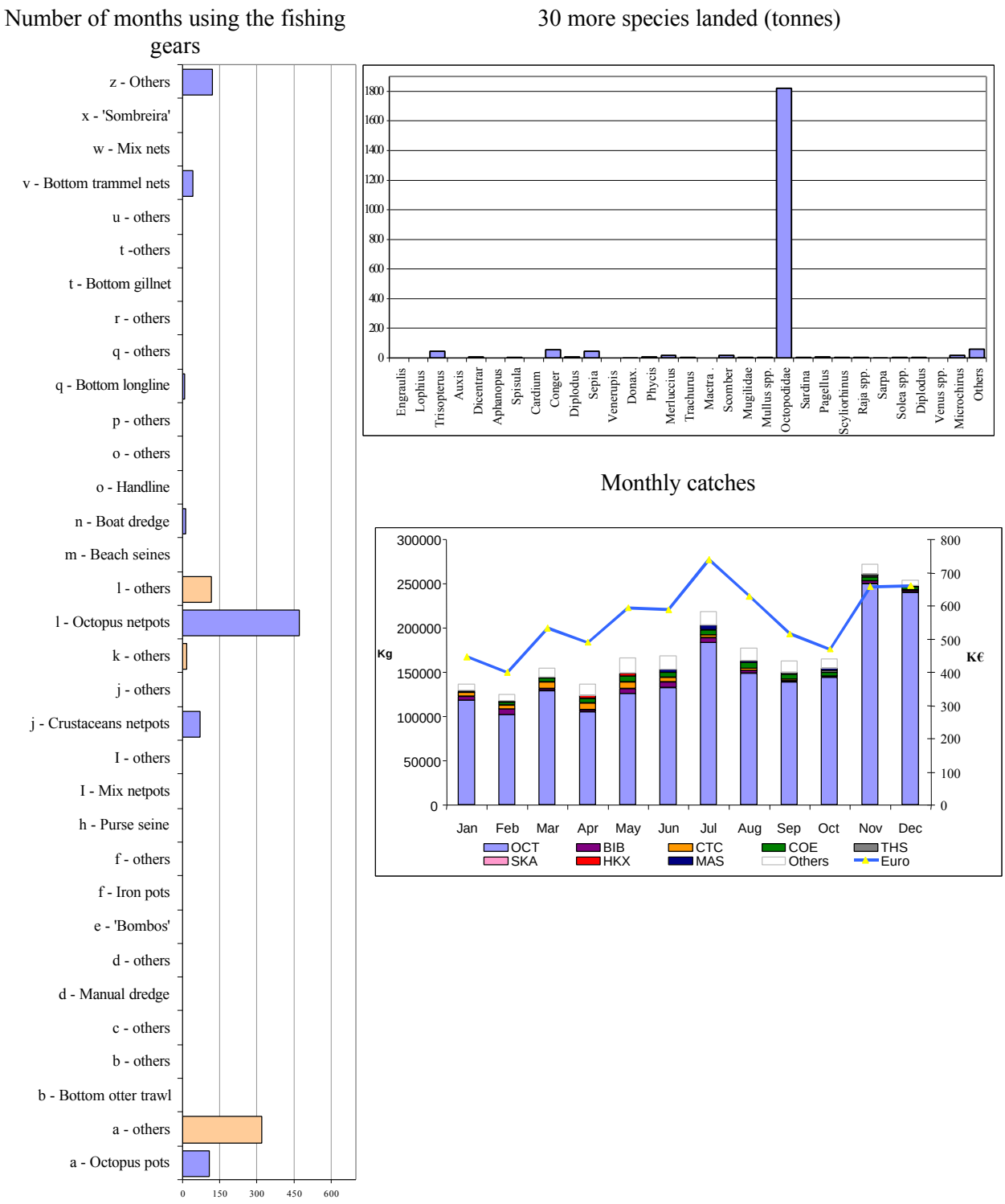


Figure 38- 30 species landed, number of months using fishing gears, catches by fleet component OTR and the respective values (k€).

478 vessels compose the fleet component OTR.A typical artisanal vessel of this fleet component has in average, 6.5 meters of overall length, 26.2 kW, 3.3 GRT, a wood hull type, 24 years old, and uses an outboard engine. Once more the Algarve is the mainly region of this fleet (Figure 37).

The target species is Octopus, caught with octopus pots and octopus netpots. The cephalopods are caught through the year, with highest values in November and December (*see* Figure 38).

FLEET COMPONENT BOT

Otter trawl + Gillnets + Traps + Hooks and lines

Characteristic of the fleet component:

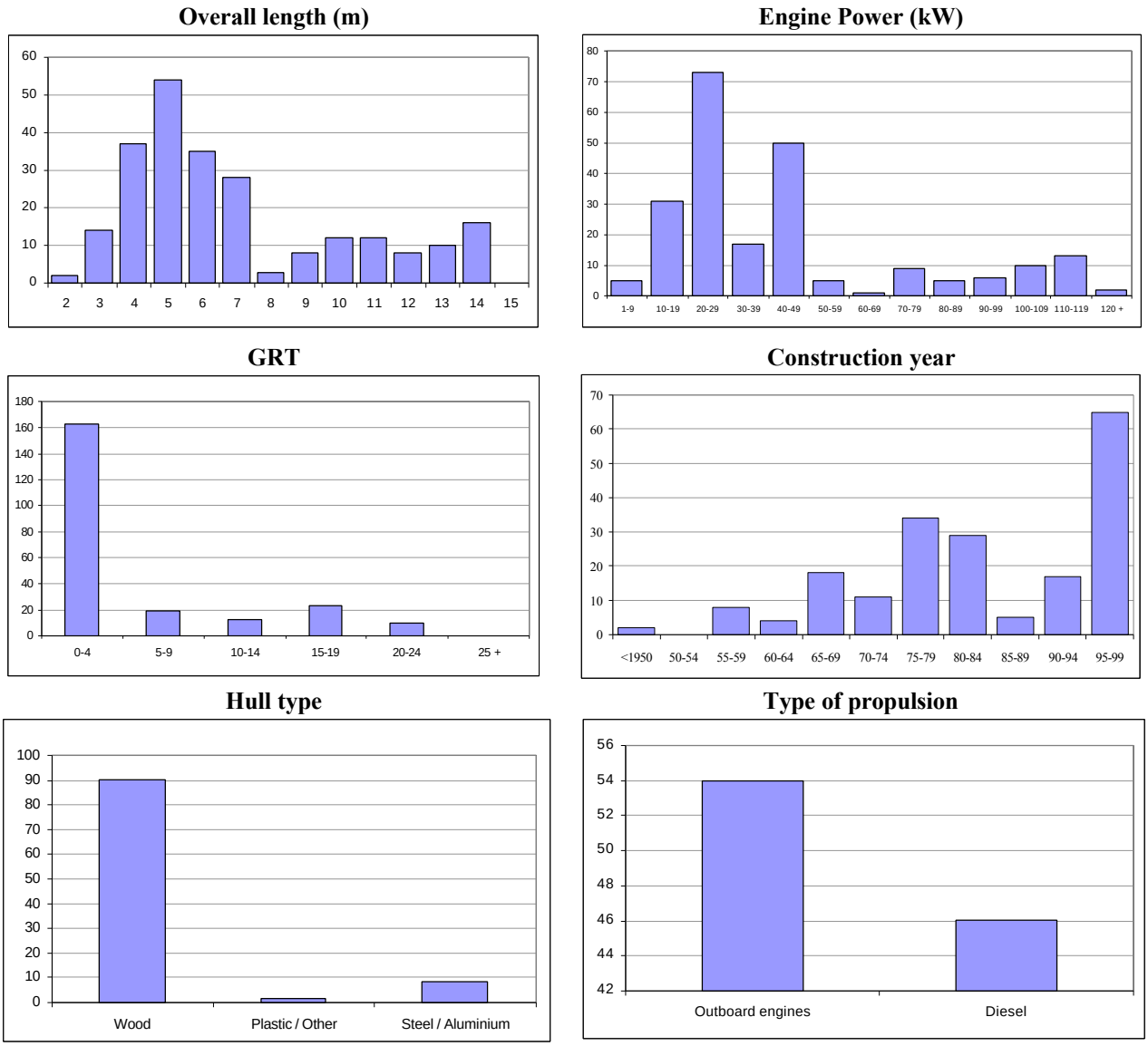
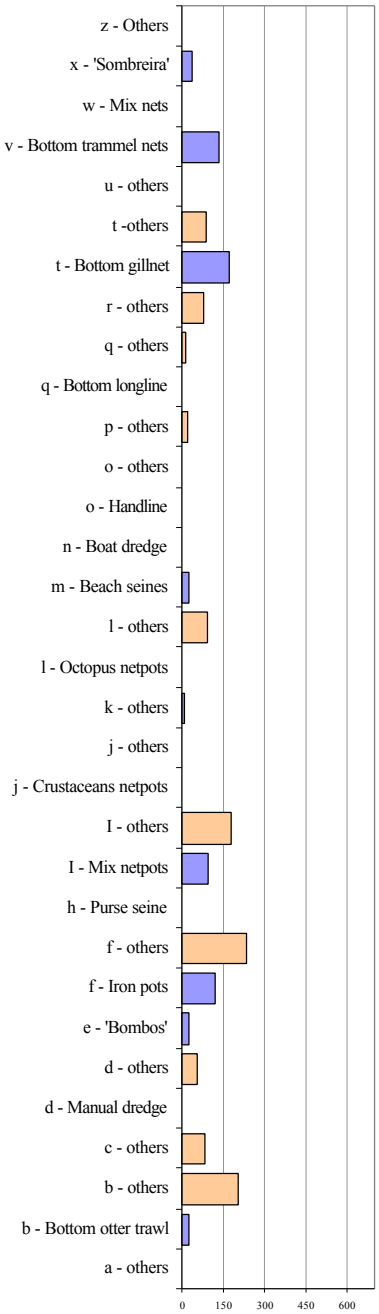


Figure 39 – Technical characteristics of the fleet component BOT

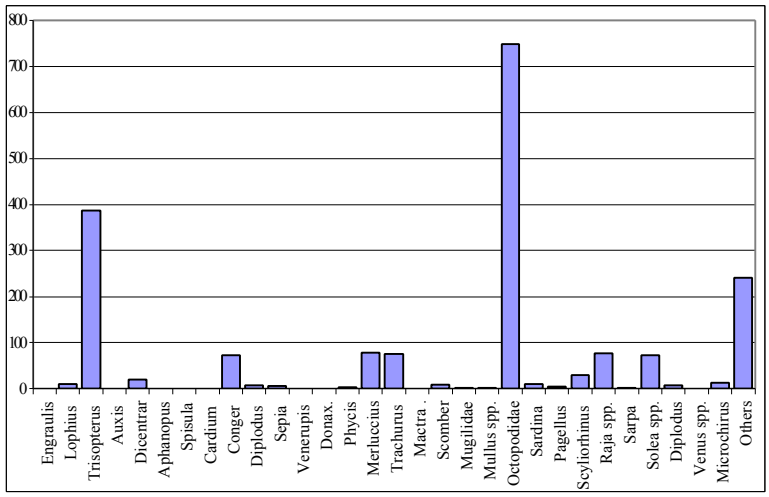
. Note: Hull type and Type of propulsion categories are the DGPA definition

***Component* BOT : Otter trawl + Gillnets + Traps + Hooks and lines**

Number of months using the fishing gears



30 more species landed (tonnes)



Monthly catches

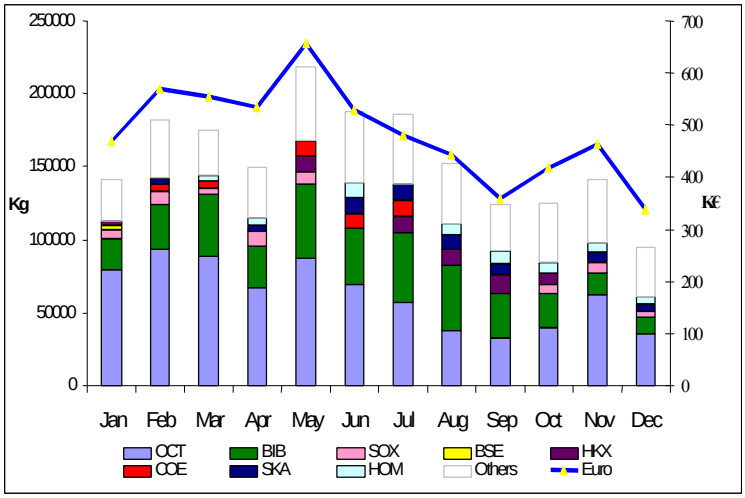


Figure 40 -30 species landed, number of months using fishing gears, catches by fleet component BOT and the respective values (k€).

This fleet component is mainly from North region. Typically the artisanal vessel has in average 8.1 meters of overall length, 45.3 kW, 5.8 GRT, a wood hull type, 18 years old, and uses an outboard engine. The fleet component BOT is composed of 227 vessels (Figure 39).

Octopus, pouting, and others are the species more landed by this fleet component. They caught mainly with otter trawl, bottom gillnets, trammel nets and iron pots. Those gears were used during the most part of the year (*see* Figure 40). As figure 40 shows 'Bombos' and trammel nets ('Sombreira') are also very used in North region. The target species is the shrimp, which is, included in the Others category.

Concerning the monthly catches in general there is a decreasing in Octopus catches in August and September and in the other months presents fluctuations. For pouting, the landings are lower in the winter season.

FLEET COMPONENT SPS

Small purse seines + multi-specific

Characteristic of the fleet component:

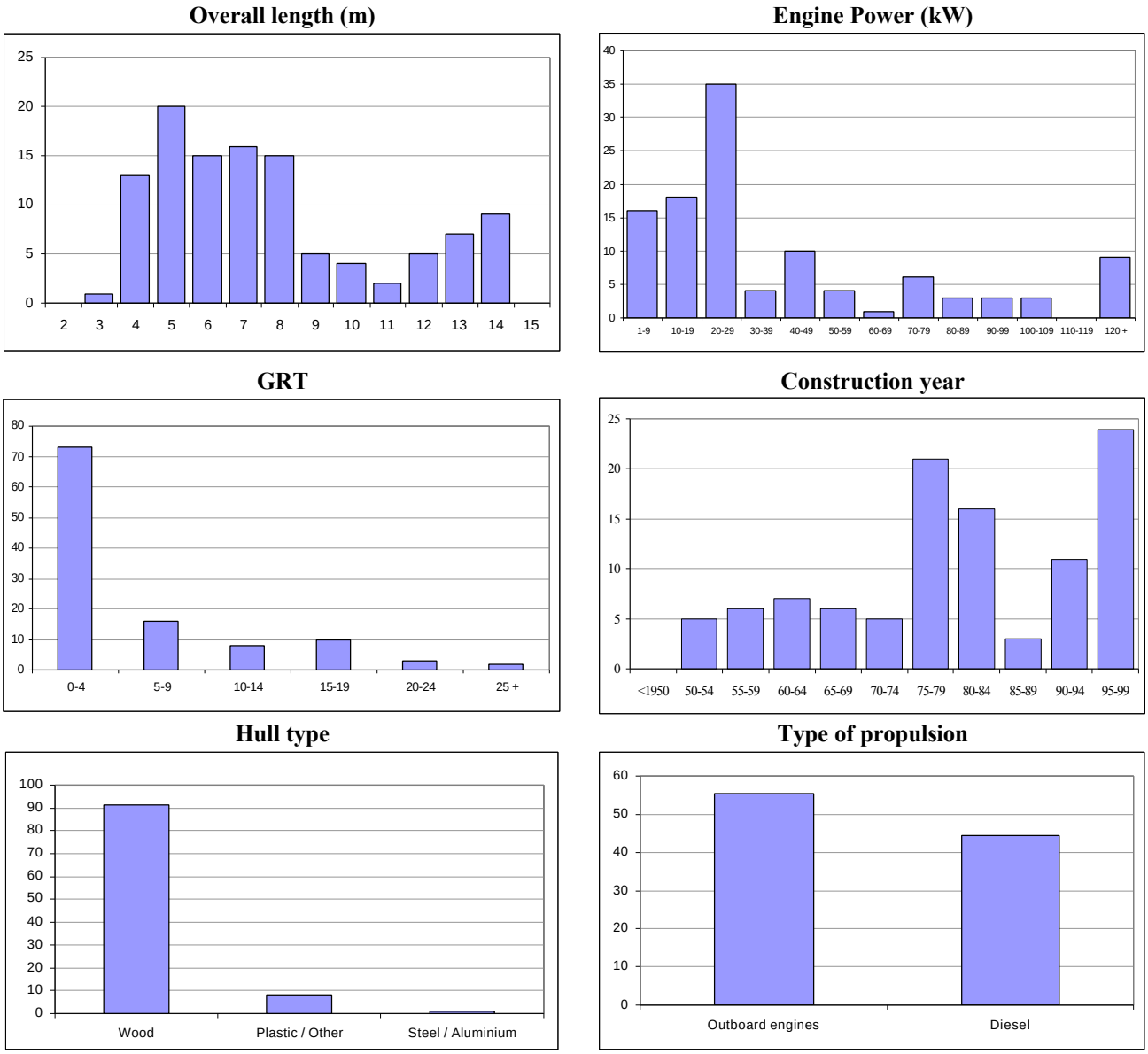


Figure 41 - Technical characteristics of the fleet component SPS.
Note: Hull type and Type of propulsion categories are the DGPA definition.

***Component* SPS : Small purse seines + multi-specific**

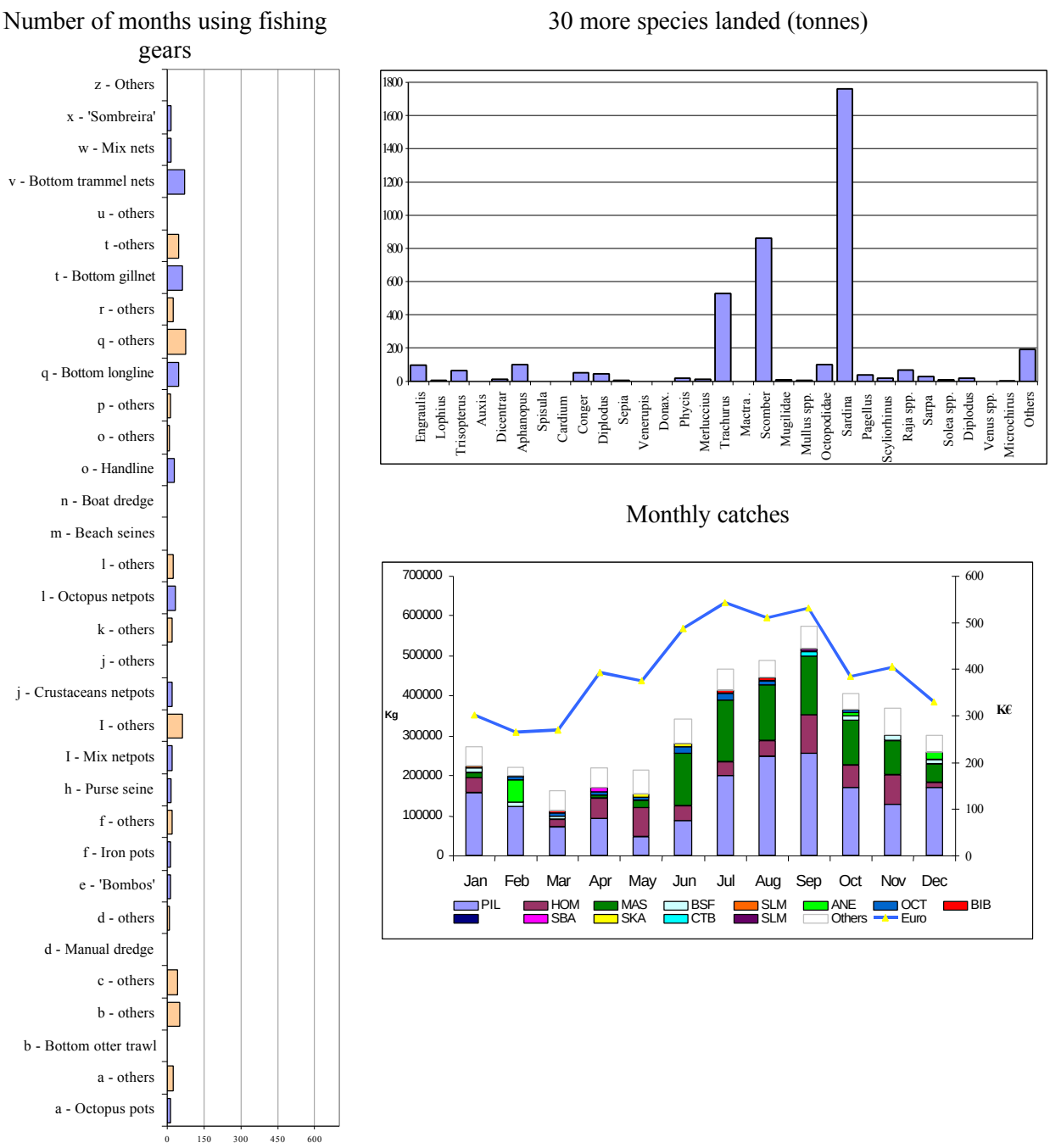


Figure 42- 30 species landed, number of months using fishing gears, catches by fleet component SPS and the respective values (k€).

The fleet component SPS is constituted of 112 vessels and belongs mainly to North and Central-South regions.

A typical artisanal vessel, has in average 8.2 meters of overall length, 43.0 kW, 6.1 GRT, a wood hull type, 22 years old, and uses an outboard engine (Figure 41).

The target species are sardine, Spanish mackerel and horse mackerel.

Small purse seine should be the main fishing gears, however it does not appears with great evidence (see Figure 42). Due to small number of inquiries, it was not collected enough information about purse-seine gear, thus the error percentage of Discriminant Analysis was 48% and 66% (for Central-South and North, respectively). In term of the monthly catches sardine has higher catches in summer season, Spanish mackerel also but extended until the autumn.

FLEET COMPONENT TR2

Traps + Trammel nets +Hooks and lines

Characteristic of the fleet component:

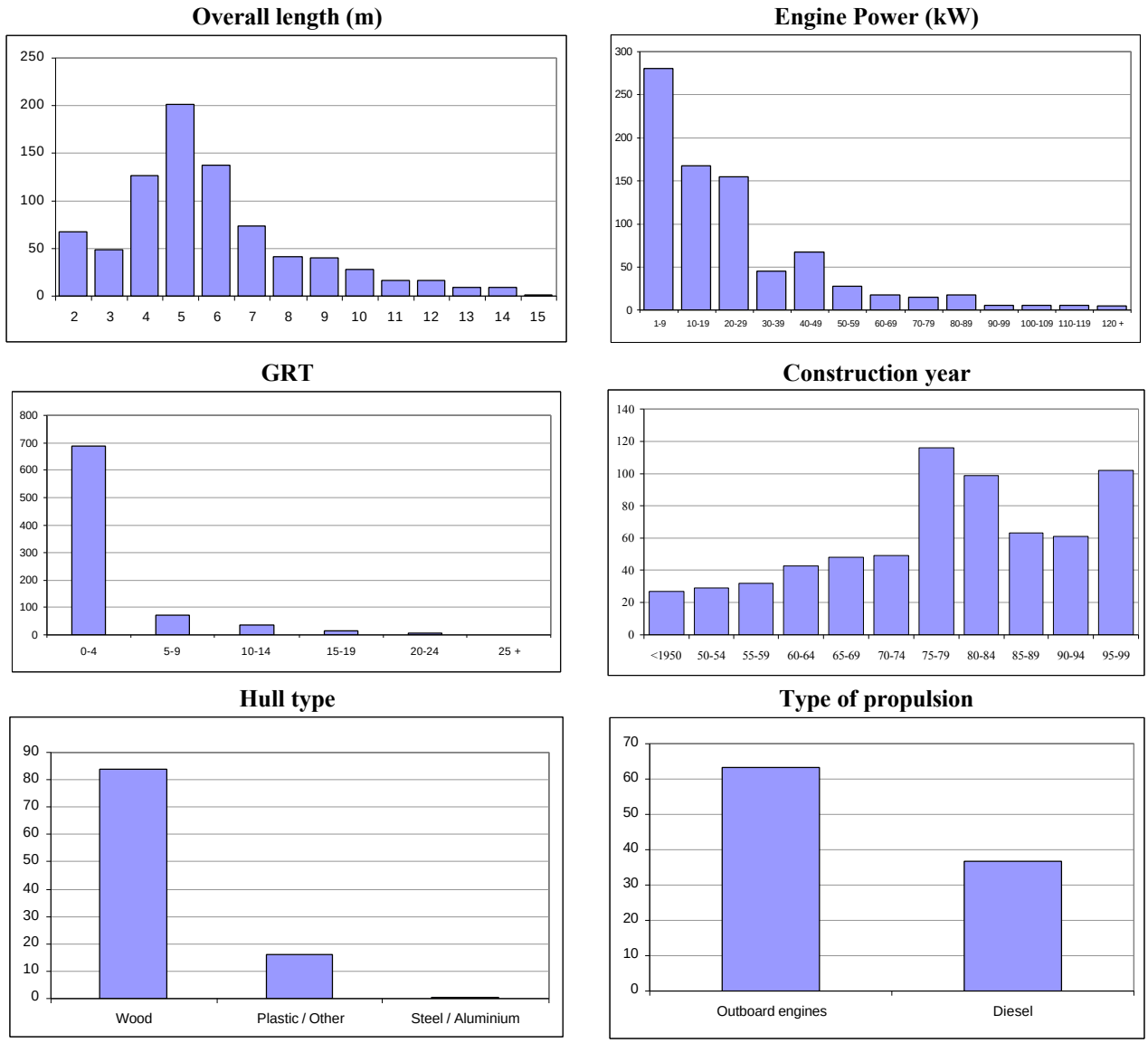


Figure 43 -Technical characteristics of the fleet component TR2.
Note: Hull type and Type of propulsion categories are the DGPA definition.

***Component* TR2 : Traps + Trammel nets +Hooks and lines**

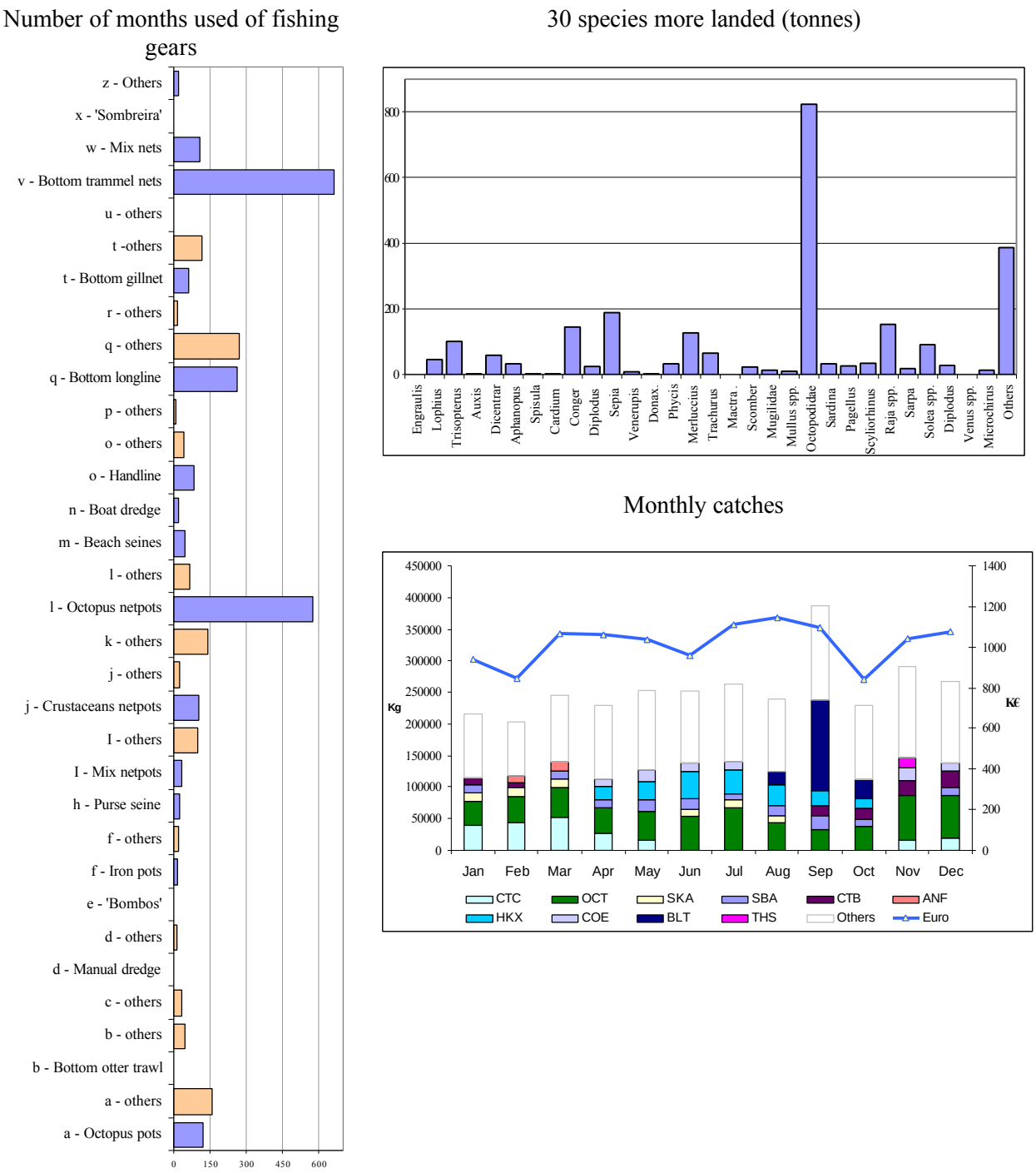


Figure 44 - 30 species landed, number of months using fishing gears, catches by fleet component TR2 and the respective values (k€).

A typical artisanal vessel of the fleet component TR2 has in average 6.3 meters of overall length, 25.1 kW, 3.2 GRT, a wood hull type, 24 years old, and uses an outboard engine. This fleet component is composed of 816 vessels and belongs mainly to Central-South region (figure 43).

As figure 44 shows, once more the Octopus are the species with the highest landings. Bottom trammel nets and octopus netpots are the fishing gears more used to catch this species. Bottom longline is used often to catch Black scabbardfish.

All the species have fluctuations through the months, however for Common cuttlefish this fact is more evident, i.e., in June, July and August there are no landings; for hake the catches are from May forward.

FLEET COMPONENT GTN

Beam trawl + Gillnets + Hooks and lines + Traps

Characteristic of the fleet component:

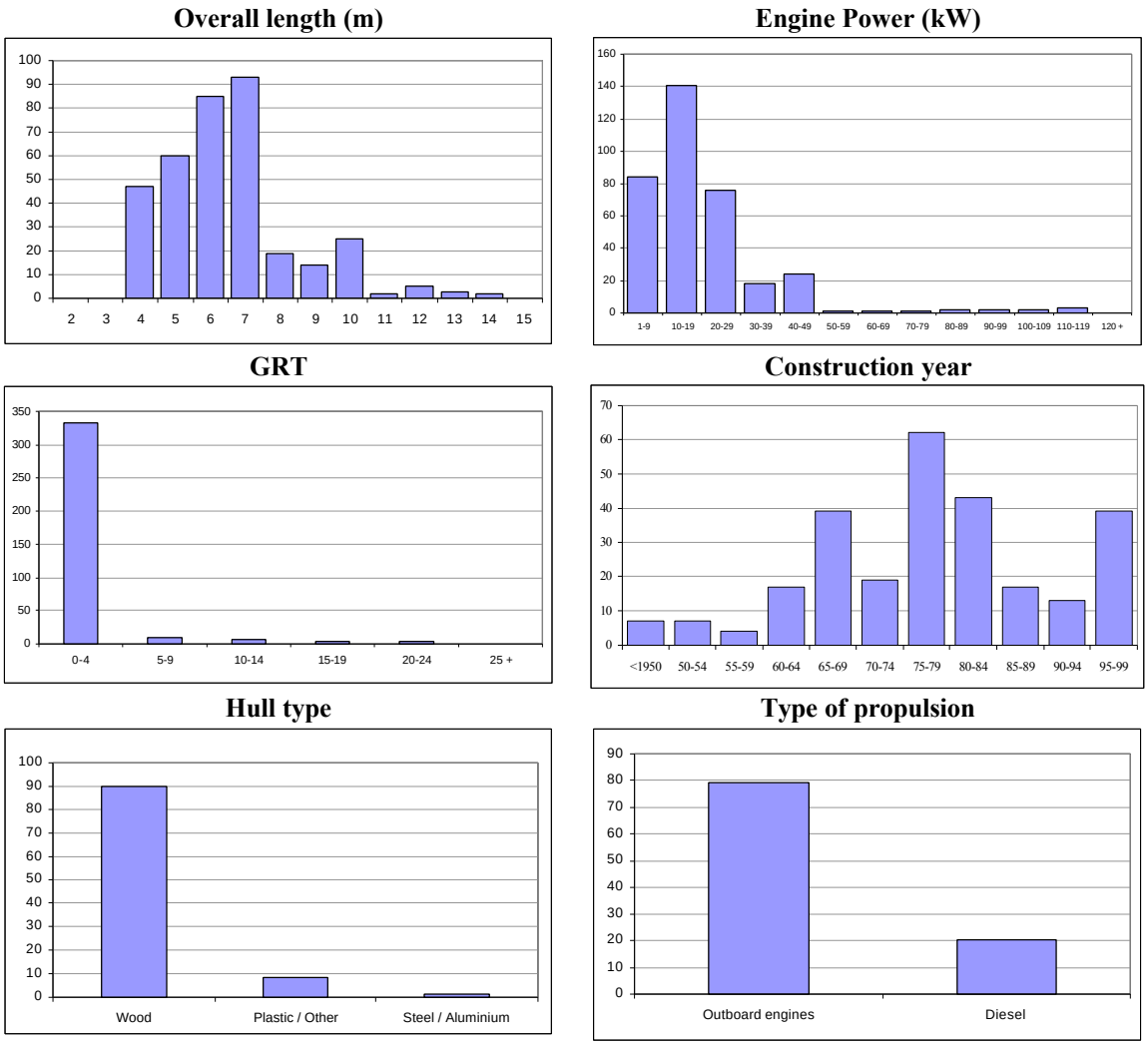


Figure 45 -Technical characteristics of the fleet component GTN.
Note: Hull type and Type of propulsion categories follow the DGPA definition

***Component* GTN : Beam trawl + Gillnets + Hooks and lines + Traps**

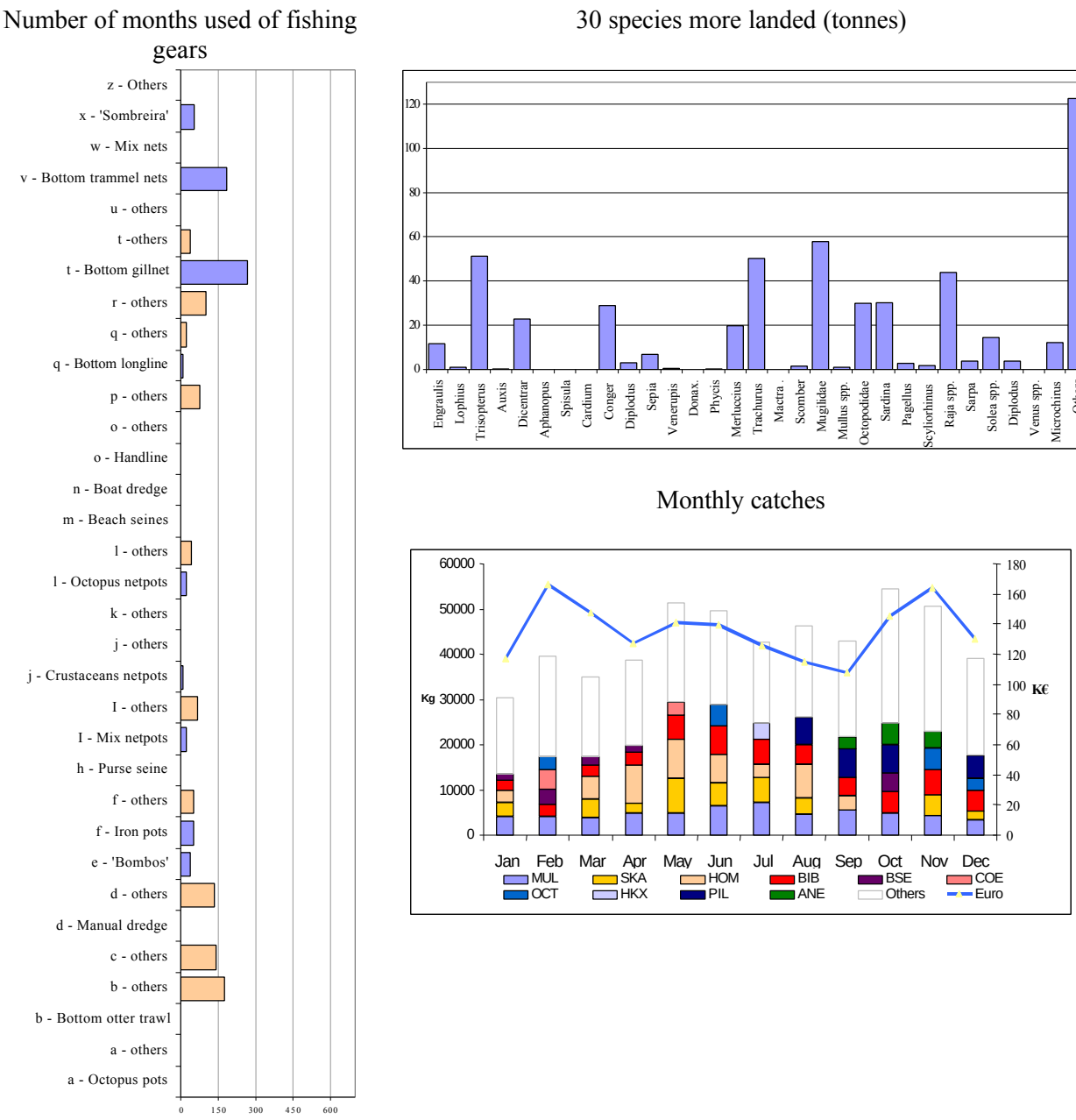


Figure 46- 30 species landed, number of months using fishing gears, catches by fleet component GTN and the respective values (k€).

A typical artisanal vessel of the fleet component GTN, has in average 7 meters of overall length, 21.2 kW, 2.7 GRT, a wood hull type, 25 years old, and uses an outboard engine. The fleet component is composed of 355 vessels and belongs to the North region (figure 45).

This component is a typical multi-specific fleet for the North region and there are no target species. The species behind the five selected are also an important contribute for the highs values of category '*others*' (figure 46).

The gears more used are bottom gillnet, bottom trammel nets and beam trawl (combined with others gears).

Concerning to the monthly catches all the species has a striking fluctuation, except the Mullets that have constant landings in all months.

FLEET COMPONENT TN

Bottom trammel nets + octopus pots

Characteristic of the fleet component:

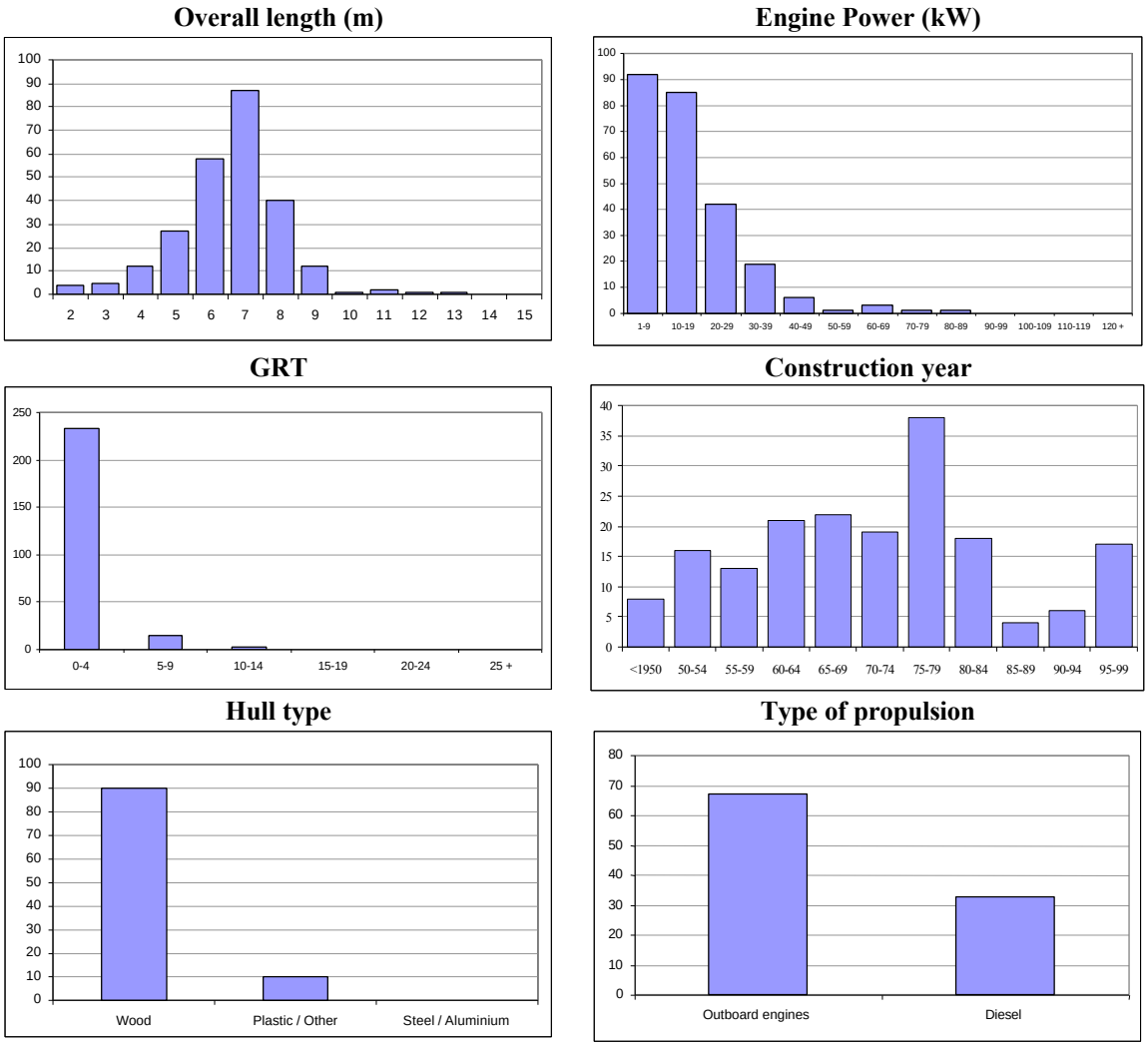


Figure 47 - Technical characteristics of the fleet component TN.

Note: Hull type and Type of propulsion categories follow the DGPA definition.

***Component* TN : Bottom trammel nets + octopus pots**

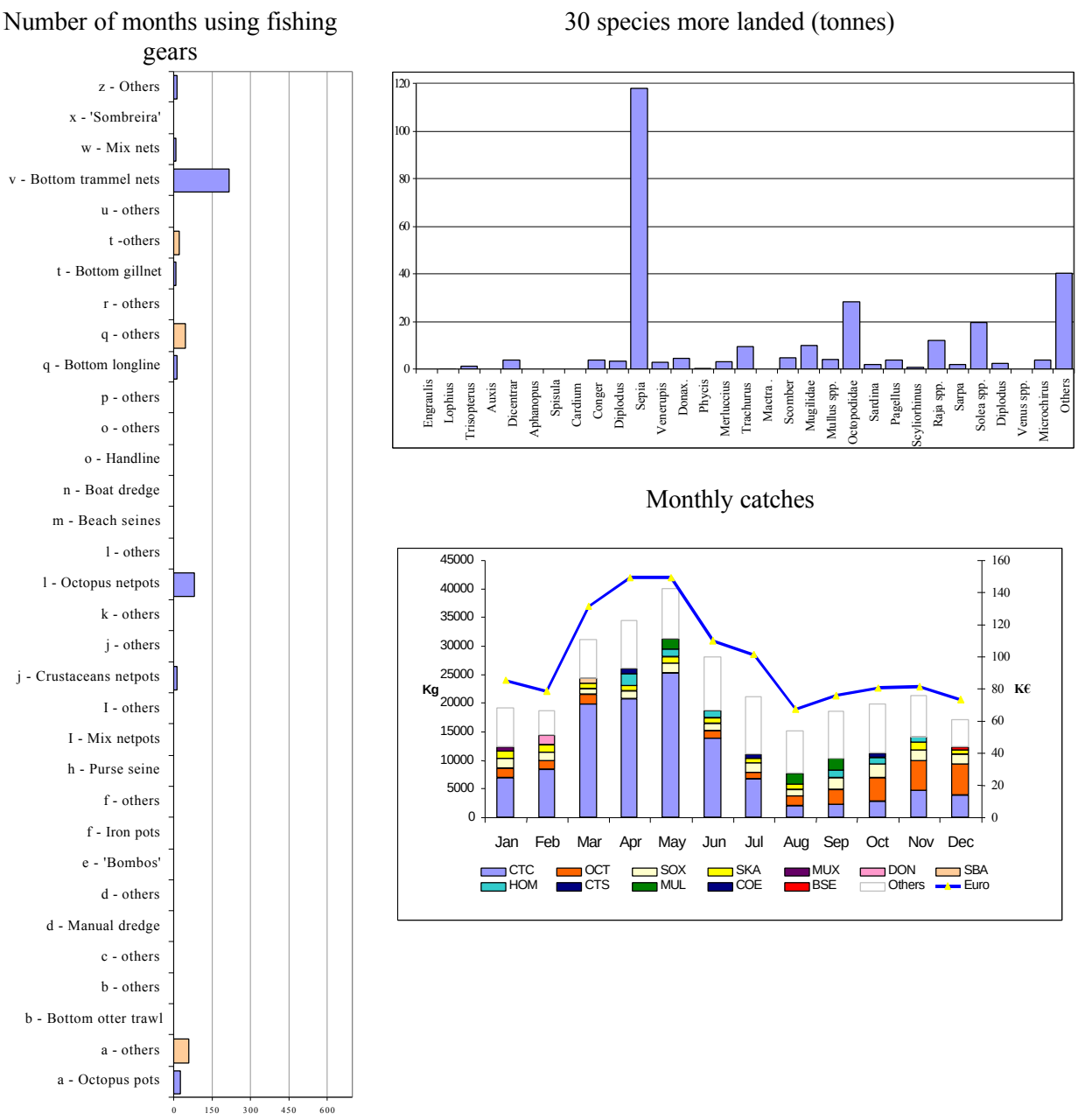


Figure 48- 30 species landed, number of months using fishing gears, catches by fleet component TN and the respective values (k€).

The main region of the fleet component TN is Central-South.

In average a typical artisanal vessel of this component, has 7.1 meters of overall length, 16.9 kW, 2.5 GRT, a wood hull type, 31 years old, and uses an outboard engine. This fleet is composed of 250 vessels (figure 47).

Figure 48 displays that common cuttlefish, Octopus and others are the species with more landings caught with bottom trammel nets and octopus netpots, respectively.

Concerning the monthly catches common cuttlefish is more caught in the months between January and June. Octopus has a striking fluctuation pattern and does not appears in April and May landings. From August to December the catches of common cuttlefish decrease and the octopus catches increase in the same period (*see* figure 48).

FLEET COMPONENT BS

Beach seines

Characteristic of the fleet component:

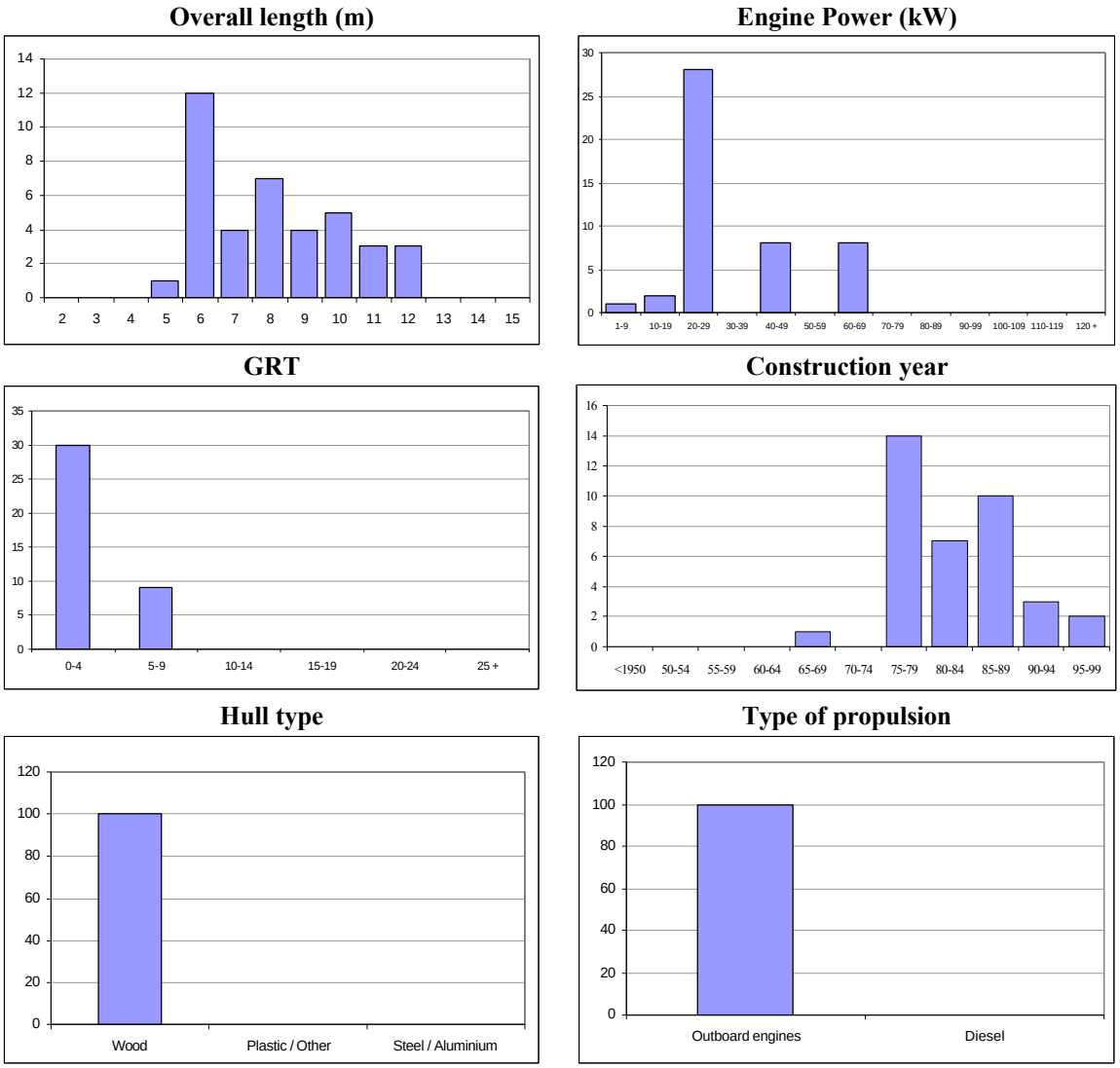


Figure 49 - Technical characteristics of the fleet component BS.
Note: Hull type and Type of propulsion categories follow the DGPA definition

***Component* BS : Beach seines**

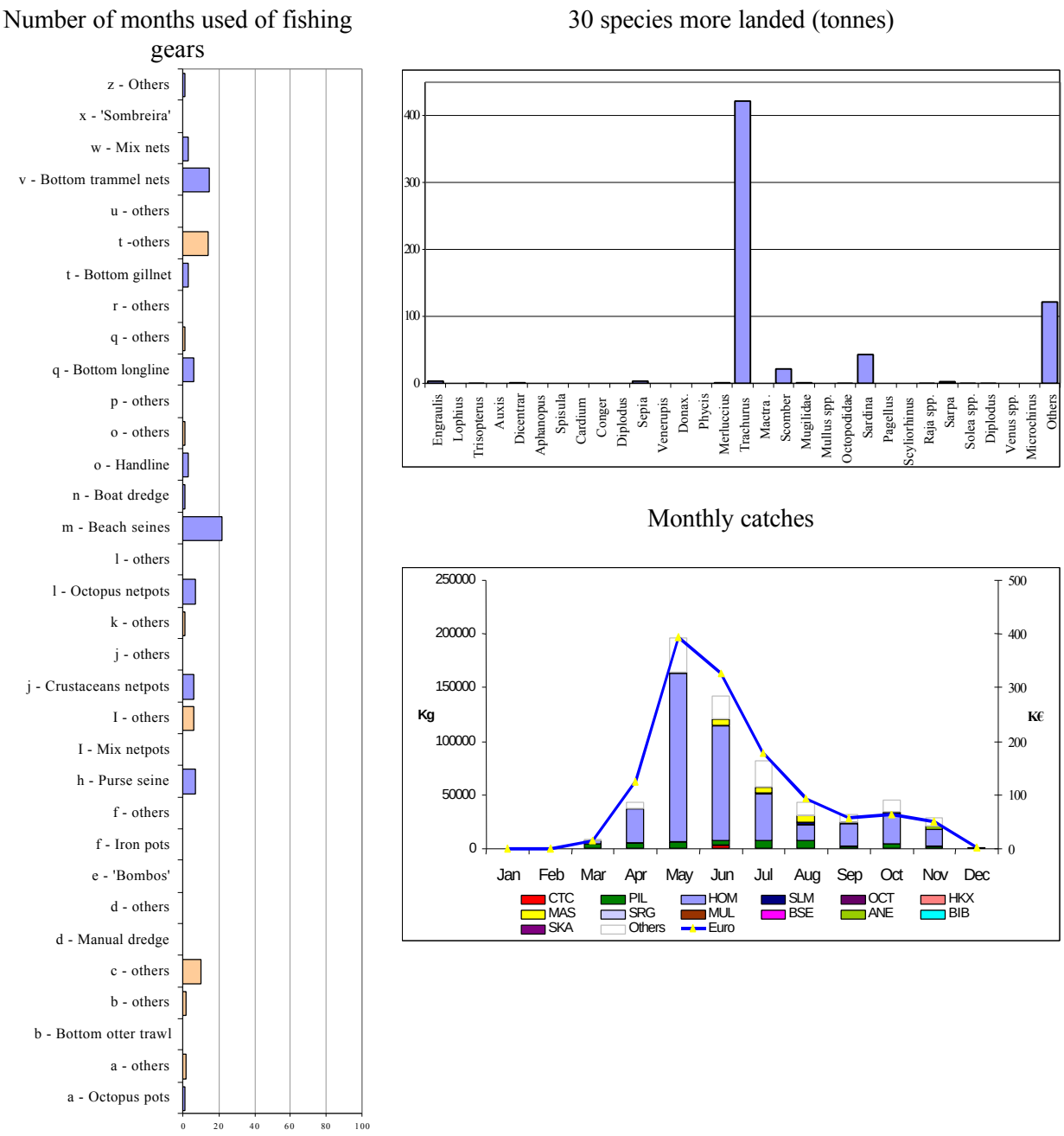


Figure 50- 30 species landed, number of months using fishing gears, catches by fleet component BS and the respective values (k€).

The fleet component BS is composed of 39 vessels and belongs to the Central region.

A typical artisanal vessel has in average, 8.6 meters of overall length, 31.4 kW, 4.0 GRT, a wood hull type, 20 years old, and uses an outboard engine (figure 49).

The target species are small pelagic (horse mackerel, Sardine and Spanish mackerel) and others. These species are caught with beach seines.

Figure 50 shows others fishing gears beyond the beach seine (‘Xávega’). In this fleet the mean number of licenses is 1 by vessel. Only about 20% of vessels have more than one license, for this reason it is not probably that in this component exist much more gears besides beach seine. This occurrence is probably related with the percentage of misclassification (26%) in this Central region.

As figure 50 shows the fishermen between March and November use this mono-specific fleet. It is typically used in spring and summer seasons.

FLEET COMPONENT BD

Boat dredge in marine waters

Characteristic of the fleet component:

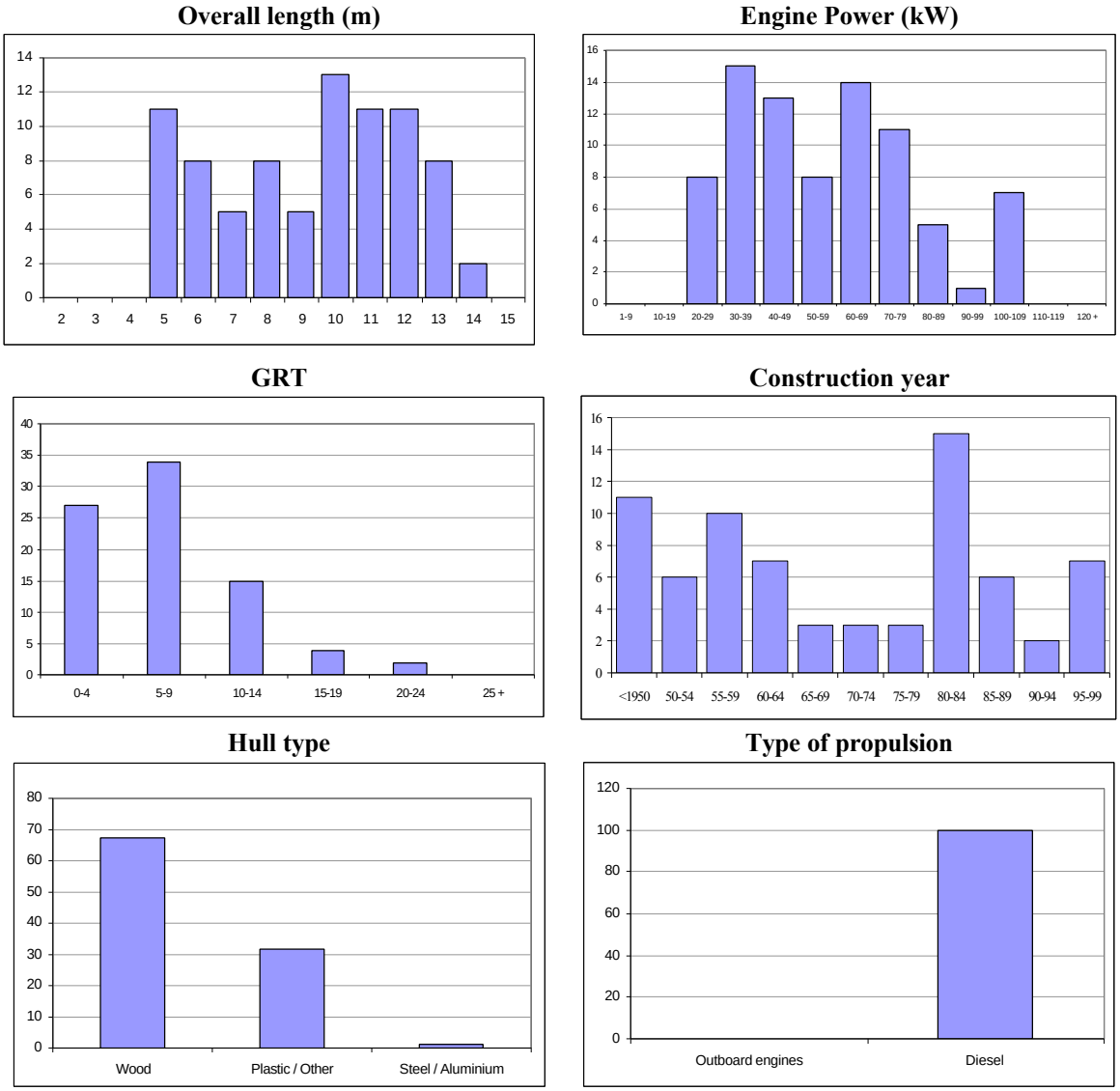


Figure 51 - Technical characteristics of the fleet component BD.
Note: Hull type and Type of propulsion categories follow the DGPA definition.

***Component* BD : Boat dredge in marine waters**

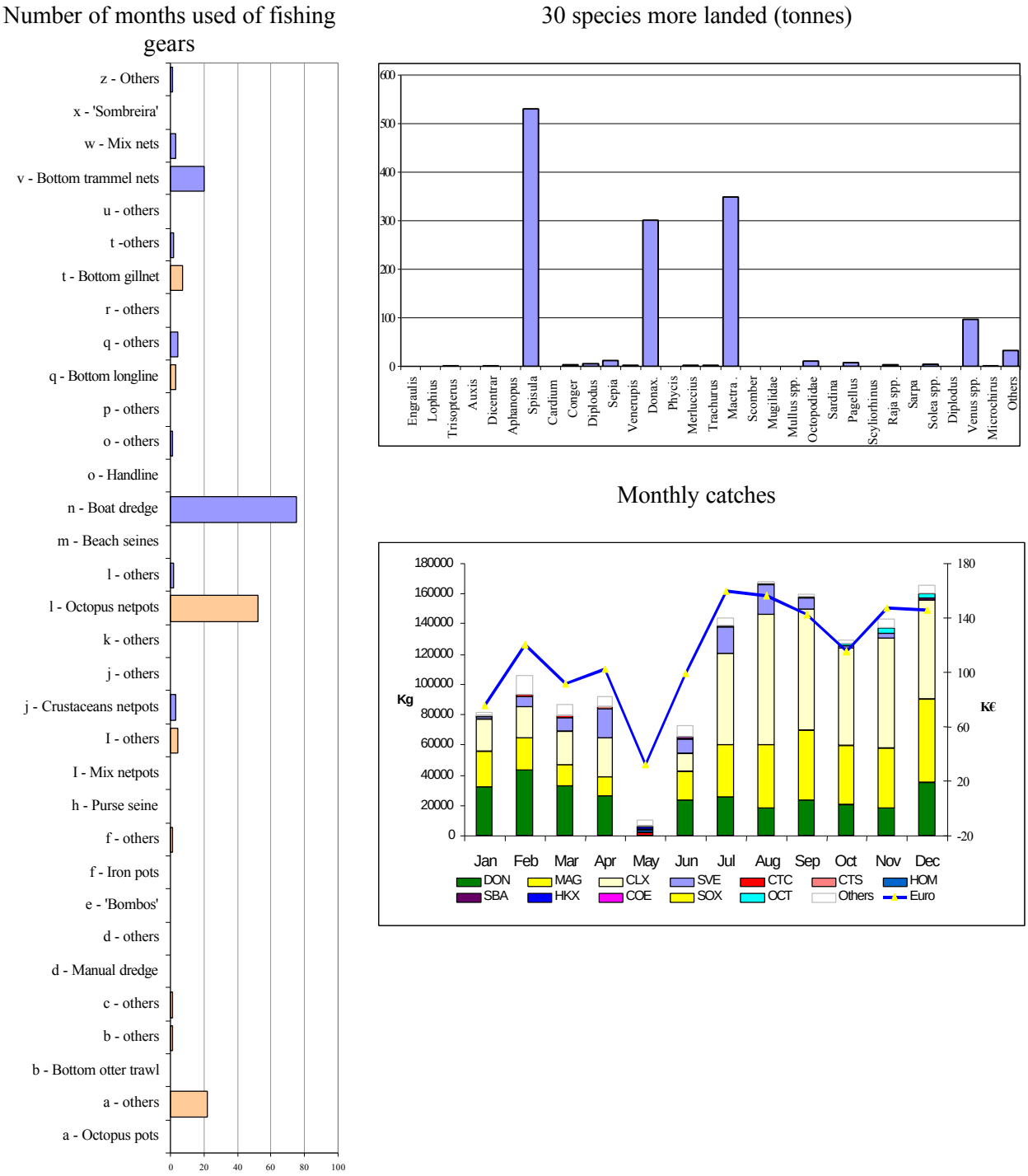


Figure 52 - 30 species landed, number of months using fishing gears and catches by fleet component BD and the respective values (k€)..

The fleet component BD belongs mainly to Algarve region and it is composed of 82 vessels. A typical artisanal vessel has in average 9.8 meters of overall length, 57.7 kW, 7.4 GRT, a wood hull type, 33 years old, and uses an outboard engine (figure 51).

Boat dredge is the fishing gears more used in this component and the main catches are surf clam, smooth mactra, wedge shell, and striped venus. This component has a second fishing license for octopus netpots as shown in figure 39.

In terms of monthly catches figure 52 shows that surf clam and smooth mactra are catch all year (except in May), reaching almost the double in the second semester. Between 1st May and 15th June of each year it is forbidden the fishing with this gear (Portuguese rule, D.L., no.102, II série, 03/05/1997).

4.1 Comparison of the technical characteristics by fleet components

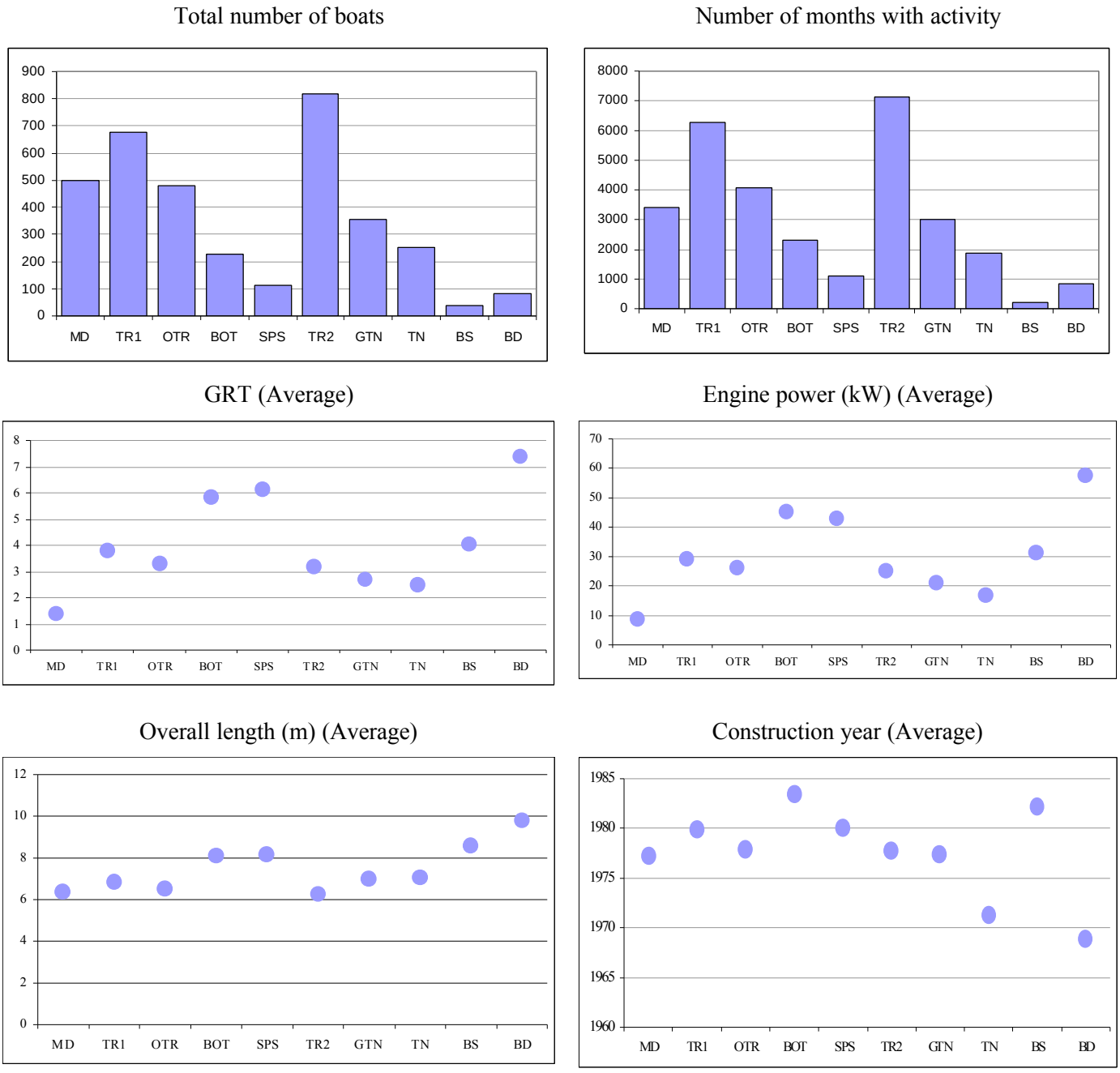


Figure 53- Main characteristics of the vessels by fleet component.

Analysing the figure 53 the boat dredge fleet component has the highest average of length overall (9.7m), the highest engine power (57.7 kW) and also the highest GRT value. This fact is related with the need of power to pull the gears used by this fleet. The BD is also the oldest component.

BOT and Beach seine (BS) contains the youngest boats (18 and 20 years old in average, respectively). Fishermen reconstruct some of these boats instead to buy new ones; it can be an explanation why there are no new vessels acquisitions in the last few years (*see* the socio-economic chapter).

The beach seine (BS) is the smallest fleet component. The growth of this component is suspended by the legislation that not allows new licences for fishing with this gear.

From the sales in auction places is the fleet component TR2 that operates more months by year; since this component has more boats than the others, this becomes evident. BS is the fleet component with less boats and additionally has a fishing seasonal pattern. So, the number of months operating is the lowest.

Another information about this item is depicted in Annex 2.

4.2 Species in weight and value by month

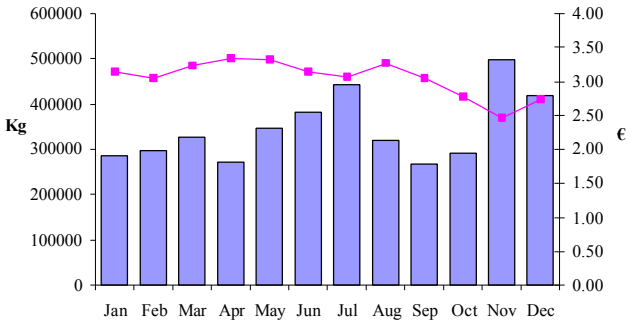
The weight (Kg) of the 10 species more landed and the respective values (€) by month are presented in the next figures.

In general a decrease in landing is followed by a raise of the prices. This fact is in conformity with the market laws. For example, the least catches of the pelagic fishes are in winter season and in this period the species are more expensive.

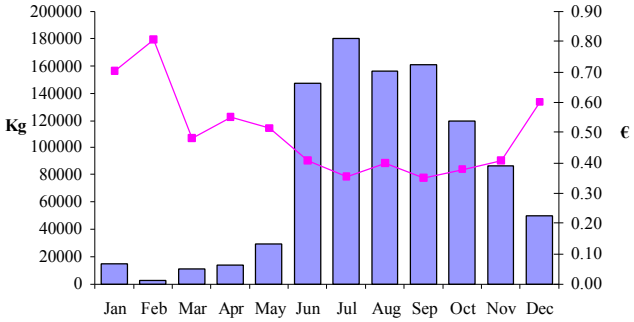
In terms of average price, common cuttlefish and hake are the most valuable species, always having values below 3.00 €/Kg (price of first sale). In what concerns to others species the mean values are variable, having the sardine and the common cockle the lowest values (between 0.30 €/Kg and 0.85 €/Kg).

The landings of octopus, pouting and skates are almost the same through the year, however the remained species have some variations.

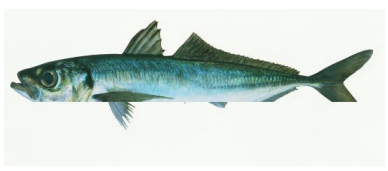
Octopus

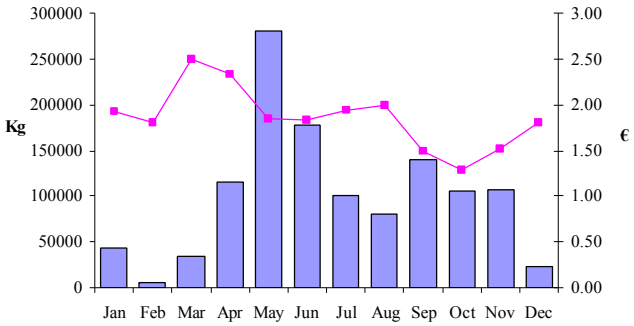


European sardine *(Sardina pilchardus)*

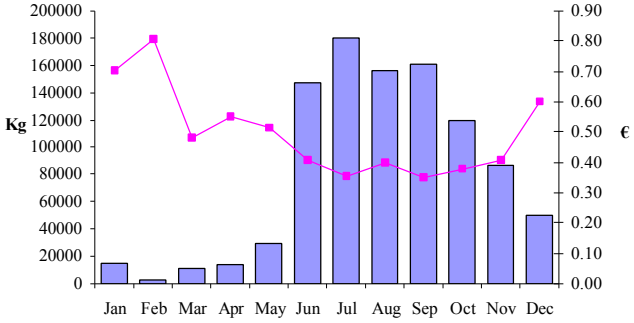


Horse mackerel *(Scomber scombrus)*

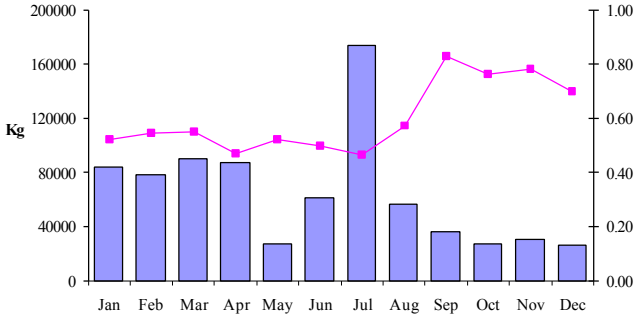




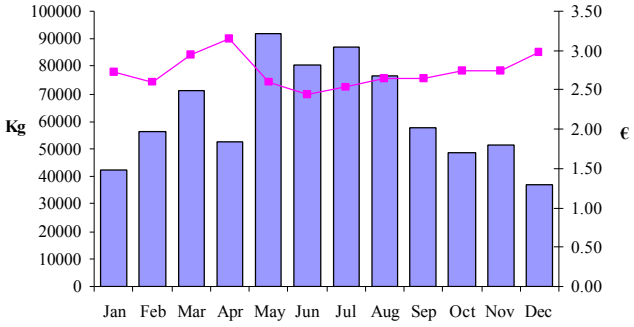
Spanish mackerel *(Scomber japonicus)*



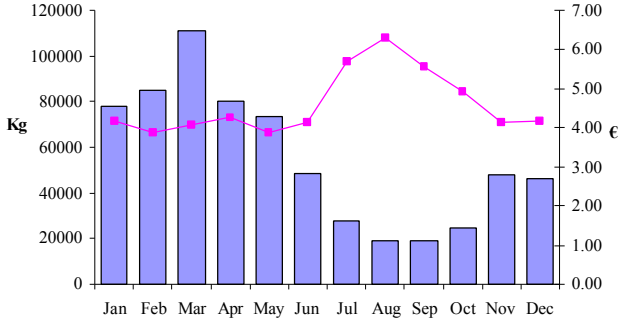
Common cockle *(Cerastoderma edule)*



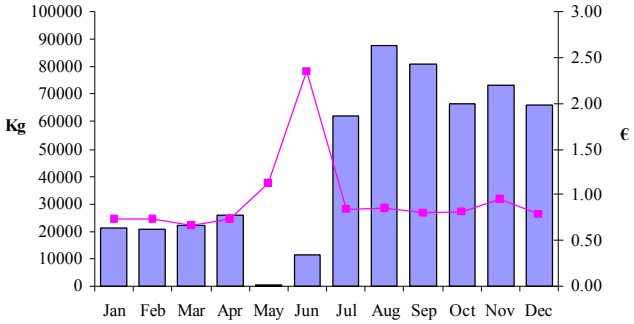
Pouting *(Trisopterus luscus)*



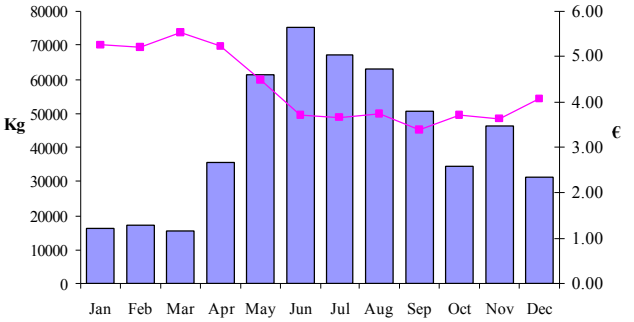
Common cuttlefish *(Sepia officinalis)*



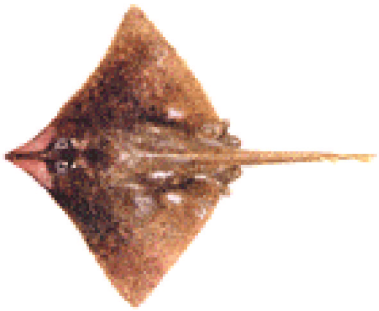
Surf clam *(Spisula solida)*



Hake *(Merluccius merluccius)*



Skates *(Raja* spp*)*



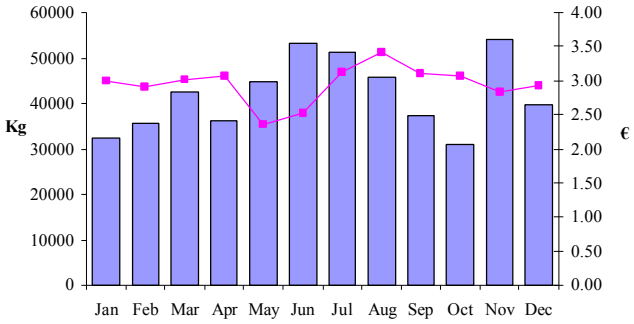


Figure 54 - The 10 more species landed in weight and respective value in average by month.

4.3 Species landed by fleet component

The following figure describes the 10 species more landed and theirs distributions by fleet component.

The most important species, octopus, is catch in great percentage by OTR, these result is expected, since this fleet component uses almost exclusively octopus pots and netpots. Through all report analysis about fishing gears or species landed, this relationship was always evident.

The pelagic species, sardine and Spanish mackerel, represent almost the totality of landings of small purse seines (SPS). Horse mackerel is another small pelagic fish catch by this component, however it is caught also by beach seine, a gear that intends to catch horse mackerel.

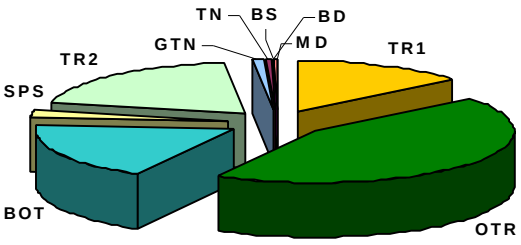
The bivalve common cockle is caught mainly with the manual dredge grouped in the fleet component MD. The other important bivalve species surf clam is the target species of boat dredge (BD).

Approximately half of the pouting landings are done by BOT. However, this species is caught in different proportion by all components.

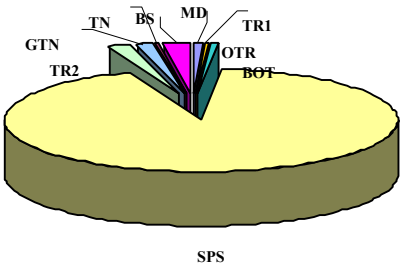
The fleet components which uses mainly trammel nets have the highest portion of common cuttlefish, a species majority caught by this fishing gear. The regions Central-South and Algarve, with the fleet components TR1, TR2 and TN, contributes largely to these catches.

Hakes are catch essentially with gillnets in the components TR1, TR2 and BOT. Skates are caught mainly by fleet components TR1, BOT, SPS, TR2 and GTN.

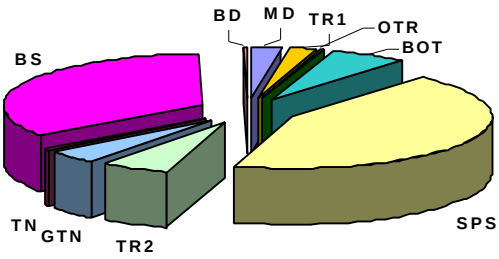
Octopus



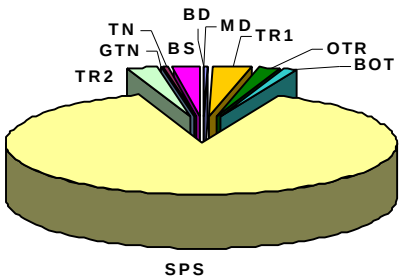
Sardina pilchardus



Trachurus trachurus



Scomber japonicus



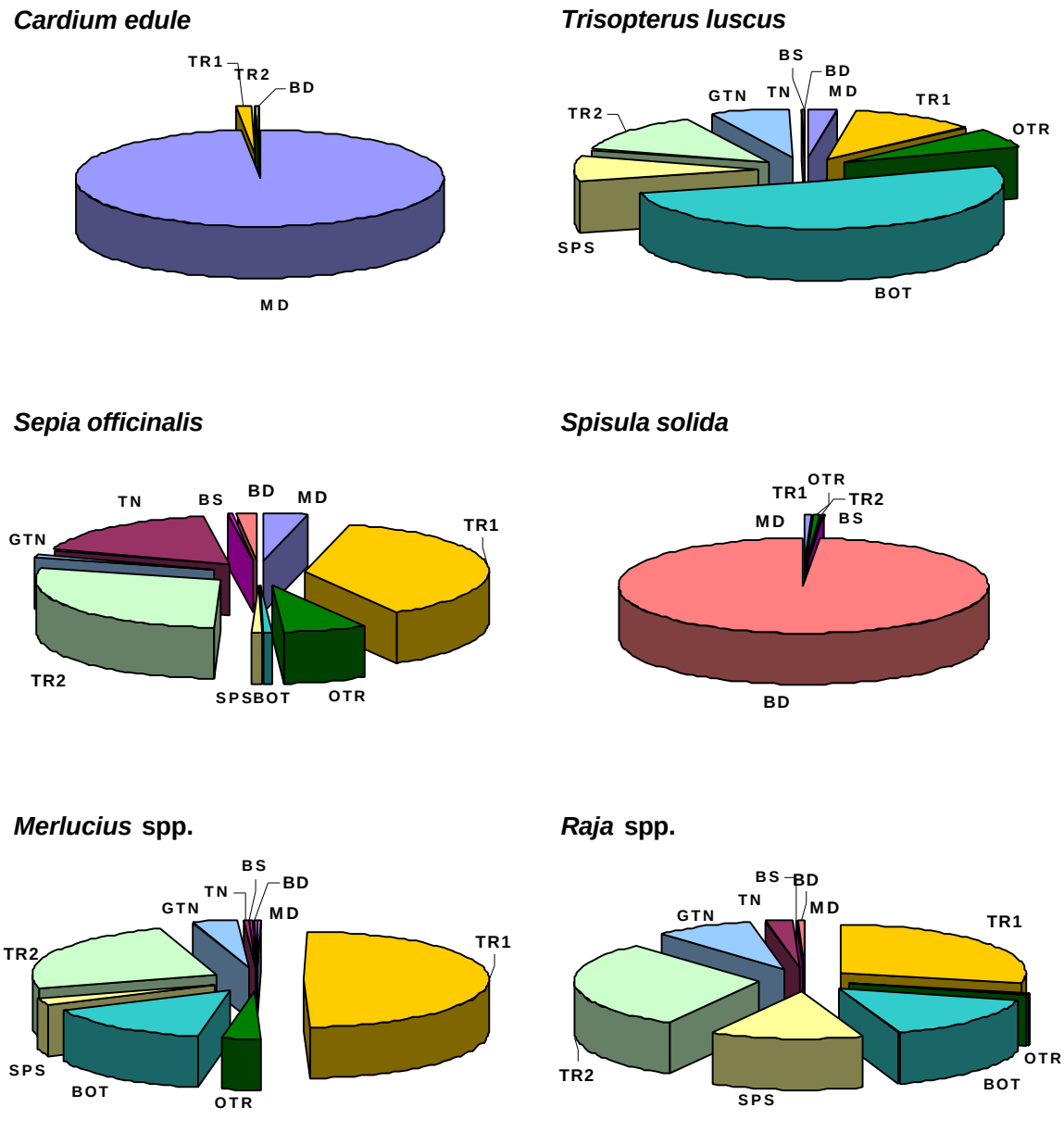


Figure 55 - Percentage of the 10 more species landed by fleet component.

5 FISHERIES INTERACTIONS

Some fleet components have the same fishing grounds. Inside the same fishing area, sometimes the conflict occurs between the fishermen that use the same or different gears. The reason is that more than one fisherman prefers the same area to set out their equipment. Moreover, sometimes fishermen place their equipment near a navigator channel or do not use sign buoys. So, some equipment is damage with the passage of other fishing boats.

The conflicts among fishermen when the target species are the same are common even if the fishing gears used are different. Another conflict occurs when the trawl fleet operates (illegally) in an inshore area. The *artisanal* fishermen think that they damage the biodiversity of the place because they have a harmful way of fishing. Sometimes the trawl fleet is accused to damage the gears of the artisanal fleet.

It is usual the fishermen criticises if an outsider fisherman uses theirs fishing grounds. They assume, as theirs owns either the areas or the fish resources near their harbour.

Part 2

Socio-economic and commercial analysis of the Portugal fishing fleet activity

The *artisanal* fishery is very important in the socio-economic point of view, mainly in the coastal fishing communities, due to the large number of employment involved and the respective guarantee of subsistence. Furthermore, this fishery constitutes a refugee for the existent unemployment and a monetary complement for the retired fishermen. The *artisanal* catches allow the consumption of high quality fresh fish due to the daily landings.

The importance of the *artisanal* fishery is unquestionable, it is a type of activity that can be done with low investments and a small consumption of energy (Garcia *et al*., 1998).

In order to analyse the socio-economic indicators, the main statistical parameters used were average ($\bar{X}$) and standard deviation (s), performed in the Microsoft® worksheet Excel (functions average and Stdev).

The coefficient of variation (CV) is a measurement of dispersion expressed by the following equation:

$$CV = \frac{s}{\bar{X}} * 100$$

The socio-economic and halieutic parts of the inquiry were surveyed at same time (Annex 1). The reference year is 1999. The time expended in the inquiries performance had varied between 45 minutes and 2 hours, depending on the approachability of the fishermen, their willingness and free time to answer the questions and the number of fishing gears used, among others.

The inquiries were surveyed in the auction places, the harbours, the local fishermen associations, on the beach and in the fishermen's houses. The first contact was done through the local fishermen associations or by a direct approach to fishermen.

6 SOCIO-ECONOMICS ANALYSIS OF FISHERY ACTIVITY

6.1 Production Factor

6.1.1 Labour productivity

The type of property indicates if the vessel belongs to one or more than one person.

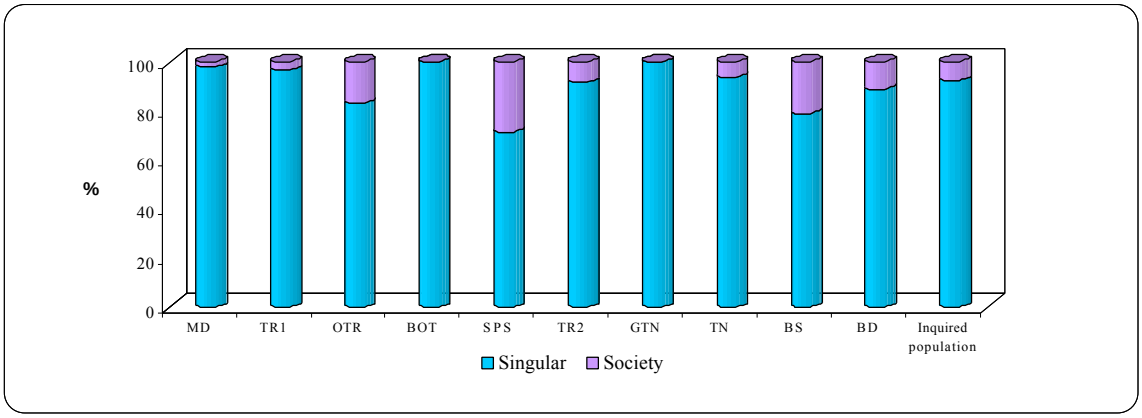


Figure 56- Fishing vessels property type by fleet component.

In general, Figure 56 shows that in the fleet components and in whole-inquired population, the vessels belong mostly to one person. In fact, in the overall inquired population only 8% of vessels belong to a society (more than one owner).

6.1.2 Skipper

6.1.2.1 Skipper's age

Skipper's age is an important factor when describing the fishing fleet, since it explains social behaviour as well as allows a demographic analysis of the population.

The age of the 249 skippers inquired has a high range; the youngest skipper had only 21 years old, while the oldest had 72 years old (table 3). In average, the skipper's ages in each fleet component varied between 42 and 53 years old, with a total average of 46 years old.

Table 3- Age of the inquired skippers by fleet component.

	MD	**TR1**	**OTR**	**BOT**	**SPS**	**TR2**	**GTN**	**TN**	**BS**	**BD**	**Inquired population**
Min	26	27	24	31	29	32	21	27	29	23	**21**
Max	72	65	64	68	57	57	66	64	59	62	**72**
Average	45	47	42	53	44	46	46	47	51	42	**46**
Stdev	10	11	11	10	8	11	12	11	8	8	**10**
CV (%)	22	22	26	18	19	23	26	22	17	19	**22**

When the skipper's age is represented in terms of age groups, it reveals a predominant age group between 46 and 50 years old.

The second most represented age group is the 36-40 years old, showing that the second predominant skipper's generation is not so young also. Indeed, less than 2.5% of skippers below 25 years old are involved in the fishing activities (Figure 57).

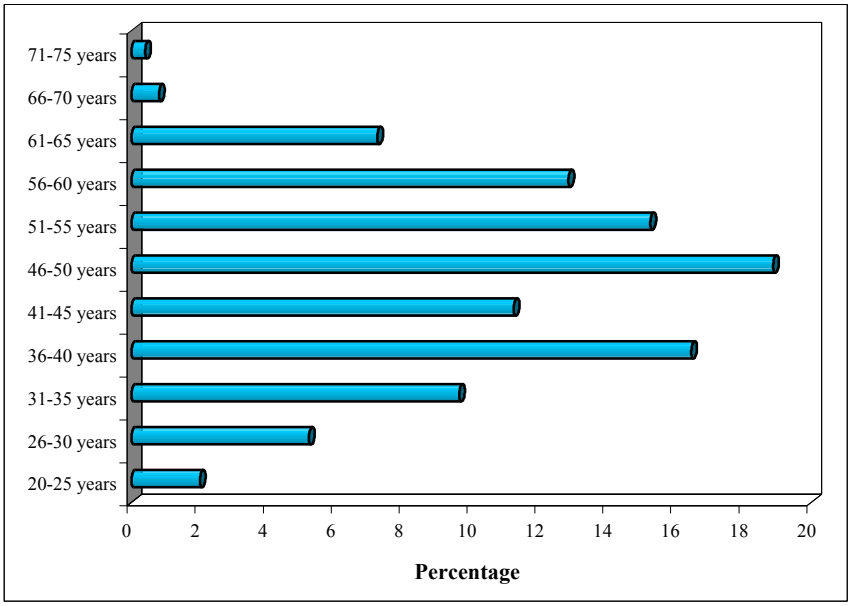


Figure 57- Histogram of the skipper's age by age groups (5 years).

6.1.2.2 Time left to retirement

The Portuguese law permits that fishermen gets their retirement when they have 55 years old (Decreto-Lei (*law*) no. 9/99 of 8th January). Nevertheless the older fishermen generally intend to work until their health allows. In fact, they normally do not set an age to end their fishing activities. On the other hand, since they belong to small communities, even if they do not work as skippers, they still participate in other fishing related activities, such as fishing gear maintenance and other boat activities.

The time to the retirement is obtained by the difference between the official age of retirement and the actual age of the skipper.

As is shown in table 4, 60 inquired skippers have already reached the retirement's age, but still work in fishing related activities.

Table 4 -Time to the retirement of the inquired skippers

	MD	TR1	OTR	BOT	SPS	TR2	GTN	TN	BS	BD	Total population
Skippers that already reached the official retirement age	8	9	3	12	2	3	8	5	8	2	60
Average	13	13	16	9	12	13	13	13	9	14	13
Stdev	8	7	8	7	8	10	11	7	8	6	8
CV (%)	57	57	49	77	62	79	83	49	93	44	63

In all fleet components there are skippers older than 55 years old. Fleet components BOT and TR1 are those where the skippers reach in major number the official retirement age (55 years old).

For the overall inquired population, the time lacking to retirement is on average 13 years.

6.1.2.3 Skipper's origin

With the purpose of comparing the skippers birthplace and workplace, were established four different categories of birthplace *vs* workplace (figure 58).

This comparison was based on the PECOSUDE zones, which consider four geographical areas corresponding to the zones of the regional IPIMAR laboratories.

The different situations were grouped in the following categories:

Category 1: Skipper's birthplace and workplace in the same zone;

Category 2: Skipper's birthplace and workplace in different zones;

Category 3: Skipper's birthplace in a internal province and workplace in the respective PECOSUDE zone;

Category 4: Skipper's birthplace in a foreign country.

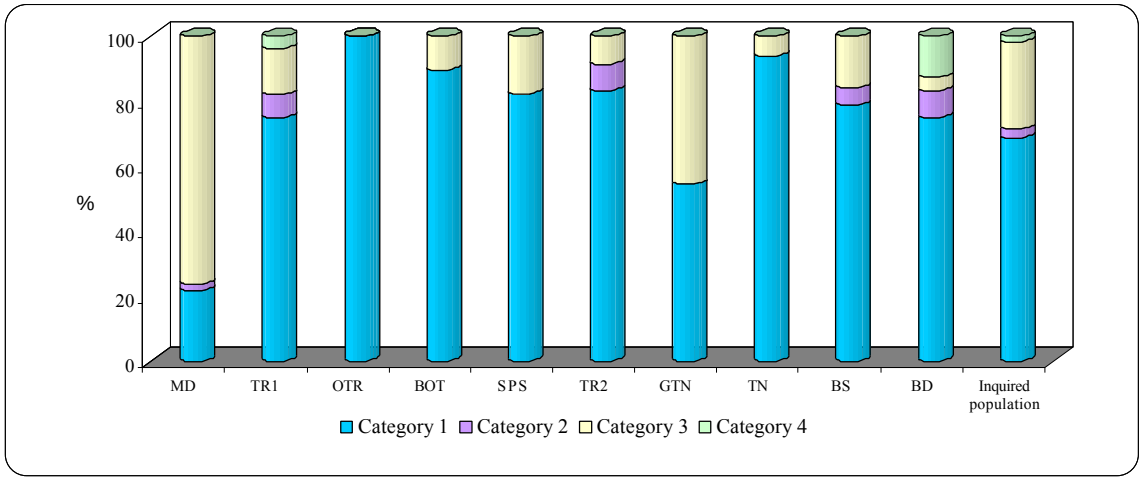


Figure 58- Comparison between skipper's birthplace and workplace, classified in four categories.

Almost 70% of the PECOSUDE skippers inquired actually work in their birthplace region actually (category 1). Skippers that were born in a different zone, that do not correspond to their littoral work zone (category 2) are only found in the fleet components MD, TR1, TR2, BS and BD. Skippers with the birthplace in a internal province and workplace in the respective PECOSUDE zone (category 3) are present in all fleet components except OTR. Skippers of category 4 have a small meaning in all fleet components.

6.1.2.4 Skipper's professional formation

The great majority of the crews are constituted by professional fishermen, not qualified, who obtained their professional knowledge exclusively with practice at the sea, i.e., without frequency of any technical or professional course (figure 59).

During the inquiries it was not possible to get information about the degree of official school, the only answer was given in terms of professional degree. The predominant category is coxswain ("*arrais de pesca*"), which only requires a previous examination, but often substitutes the skippers and boatswains ("*contramestre*"). The courses for the various fishing professional categories are given in special schools for fishermen.

In the last decade, the policy for professional formation was essentially centred for improving the ability of fishermen to increase the catches. Technological evolution of the vessels, allied to the increasing necessity to cover longer distances, given the scarcity of coastal resources, press the fishermen to attend courses in order to obtain further professional qualification and to face the new requirements of their profession.

In the final 80´s and early 90´s was made an effort to increase fishing formation in all career levels, in order to bring young people to the fishing activities. This task was facilitated by the implantation of the FORPESCAS Professional Formation Centres for fishermen. Since 1986, these centres are located in the main fishing ports along the entire continental coast.

The available data on the number of fishermen registered in Portugal shows an increasing trend up to 1994 followed by a decrease after this period, which can be explained by several reasons:

- Weak interest on the fishery activity, mainly among the youngest active population;
- Less appealing working and living conditions on board, offered to the young;

- Recession in the fishery job market.

(Ministério do Planeamento, 2000).

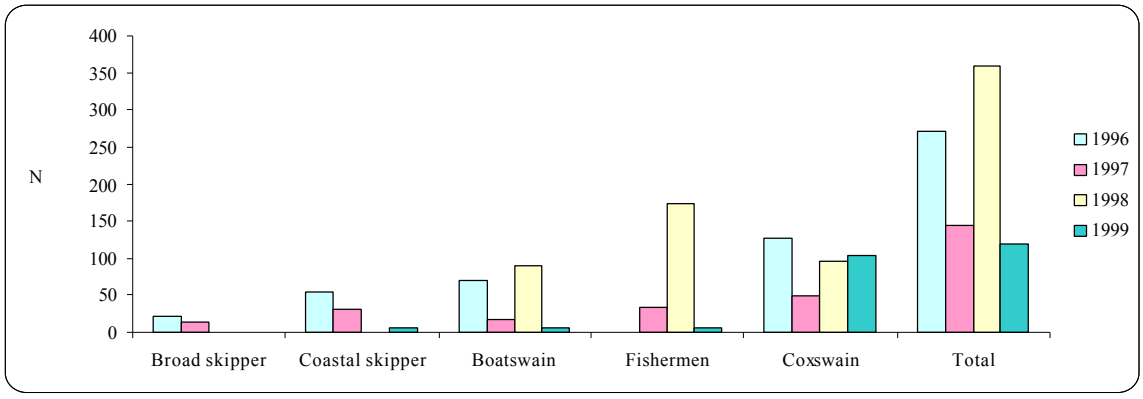


Figure 59 - Fishermen registered by professional category (*in* DGPA, 1996, 1997, 1998, 1999).
DGPA - General Directorate of Fisheries and Aquaculture

Between 1996 and 1999 occurred a reduction in the number of fishermen registered in Portugal. In fact, despite an increase in the registrations during 1998, marked decreases during 1999 that contributed to a situation of decrease in the overall period (1996-1999).

In the PECOSUDE inquiries six categories of professional formation were considered, in decreasing order:

- Broad skipper;
- Coastal skipper;
- Boatswain;
- Coxswain;
- Fishermen;
- Others.

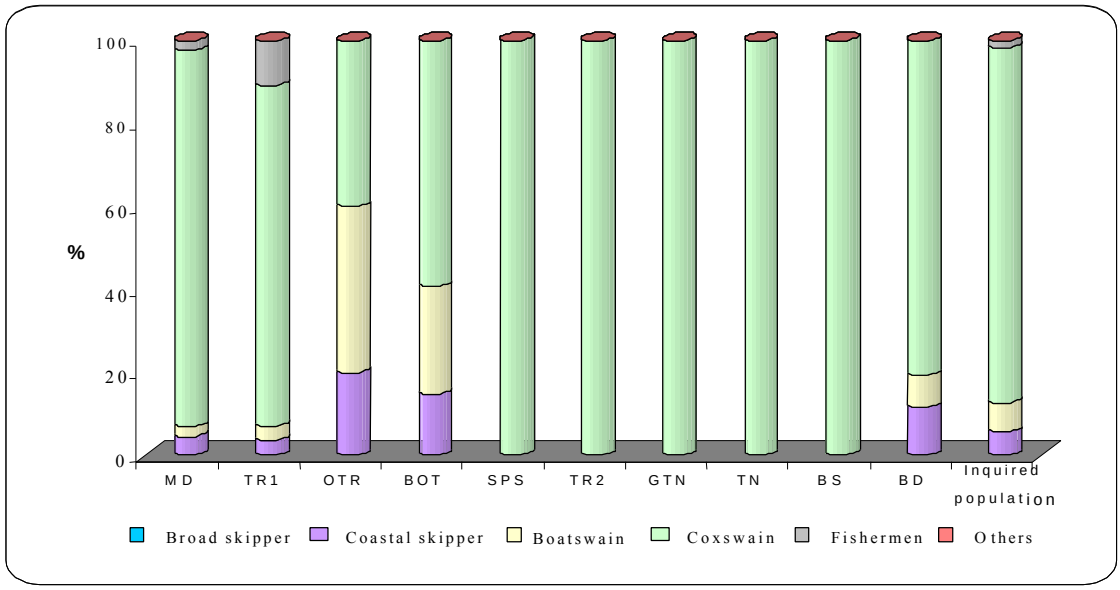


Figure 60 - Level of maritime professional qualification of the inquired skippers.

Figure 60 reveals that coxswain is the main professional category detained by skippers, with an average of 86% for the whole-inquired population. In the fleet components SPS, TR2, GTN, TN and BS all skippers possess the same formation category (coxswain).

On the other hand, none of the inquired skippers has the professional categories of broad skipper or others.

6.1.3 Mono-activity *versus* Pluri-activity

This indicator reveals that the skipper has any other activity independent of fishing related activities.

Examples of some activities besides the fishery activity are agriculture, mollusc aquaculture, tourism (some fishermen rent their houses during summer season) and others.

Mollusc aquaculture (in marine and brackish waters) is practised in all coastal zones, particularly in estuaries and lagoons. The high exploitation level of certain bivalves species have created some regional and national impacts, namely in the Algarve coast ('Formosa lagoon' and 'Alvor lagoon'), and in lesser degree, in the *Sado* estuary and *'Aveiro lagoon'*.

The target species exploited in Portugal, besides the oysters, are clams, cockles, mussels and razor clams. The majority of these species is caught and commercialised directly.

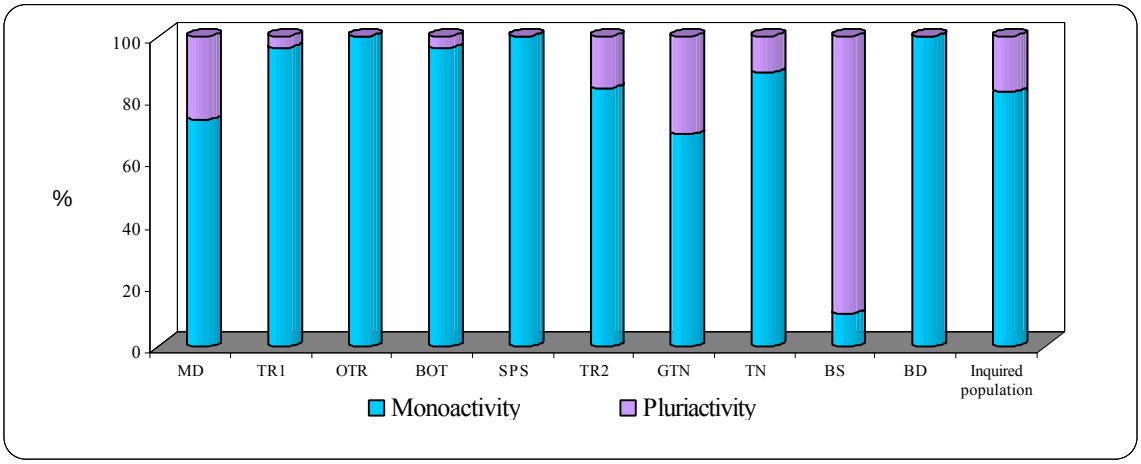


Figure 61 - Mono-activity *vs* Pluri-activity of the inquired skippers.

According to Figure 61, 82% of the inquired skippers are exclusively dedicated to the fishing activity. Nevertheless, some skippers have simultaneously more than one activity. The fleet component BS is the only group whose skippers are included in the category of other activities (89%).

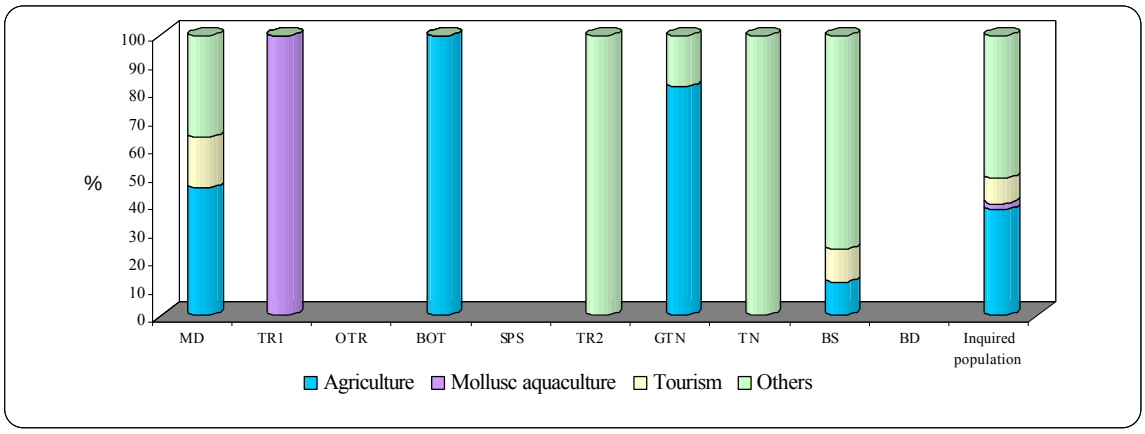


Figure 62- Description of the type of pluri-activity (other activities besides fishery).

Among the inquired skippers agriculture and others are the most practised activities (figure 62). The category others include activities such as metallurgic, mechanic, shipbuilder, manager of fish auction places, etc.

Mollusc aquaculture is the only other activity performed besides fishery in the fleet component TR1, being the Algarve the main region of this group. Components TR2 and TN only dedicate their activities in worksother than agriculture, mollusc aquaculture and tourism (category of other activities).

6.1.4 Crew

6.1.4.1 Number of crew members (crew size)

The crew size (number of crewmembers) of the inquired fishing boats is compiled in the table 5. The number of crewmembers includes also the skipper.

Table 5- Average number of crew members (crew size) *per* fleet component.

	MD	**TR1**	**OTR**	**BOT**	**SPS**	**TR2**	**GTN**	**TN**	**BS**	**BD**	**Total population**
Average	1,9	1,6	4,2	2,8	3,4	2,1	2,4	2,2	6,8	3,0	2,9
Stdev	1.4	0.8	1.3	1.4	1.9	0.9	0.5	0.8	1.7	0.9	1.8
CV (%)	75	48	31	52	55	44	23	37	24	30	62

Among all inquired *artisanal* fishing fleet, only one member (skipper) composed the crew of 48 boats.

The whole-inquired fleet has an average crew of 3 members, varying between a minimum of 2 members (fleet components MD, TR1, TR2, GTN and TN) and a maximum of 7 members (fleet component BS).

6.1.4.2 Participation and description of the inland activities

From all the inquired vessels, only 17% (45 vessels) have an inland support crew. Fleet components TR1, TN and BD have no support crew working in land, as shown in table 6.

Table 6- Percentage of the inquired boats with inland support crew by fleet component.

	MD	TR1	OTR	BOT	SPS	TR2	GTN	TN	BS	BD	Inquired population
Inland Crew	2	0	8	7	39	14	24	0	95	0	17

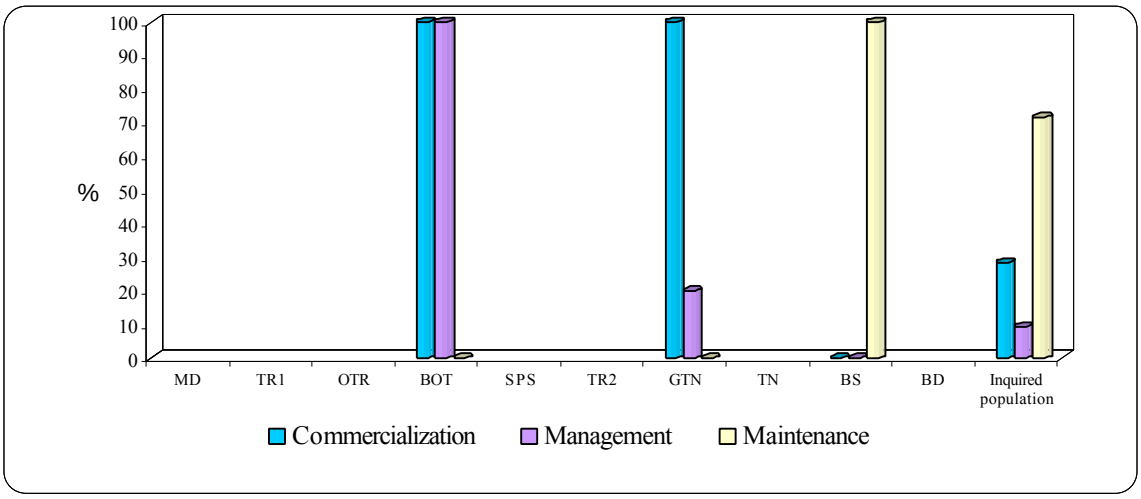


Figure 63 - Description of the activities performed by the inland support crew members.

For the fleet components TR1, TN and BD it is impossible to distinguish if the null value is due to the lack of answers or if they really do not have any inland support crew. For the others fleet components it is also hard to know if the low percentage is due the same difficulty.

For the fleet components MD, OTR, SPS and TR2 there is no information available on the description of the activities performed by the members in the inland support crew (figure 63).

In the whole inquired fleet with information available on this parameter, there are 71% of vessels whose inland support crew work in the maintenance (manufacturing and repairing fishing gears), 29% in the commercialisation and 10% in the management. Maintenance is the only activity undertaken by the inland crewmembers of fleet component BS. Some fishermen have simultaneously more than one activity.

6.1.5 Familiar participation

Fishermen live in fishing communities, reason because it is important to assess to what extent the fishermen's family is directly employed by the fishery sector.

Table 7- Percentage of familiar participation in the fishery sector by fleet component.

	MD	TR1	OTR	BOT	SPS	TR2	GTN	TN	BS	BD	Inquired population
Familiar participation %	5	100	-	15	-	0	58	18	22	-	28

Table 7 reveals that 28% of the whole skippers inquired have direct familiar participation in the fishery sector. Fleet components OTR, SPS and BD do not have any familiar occupation in fishing related activities.

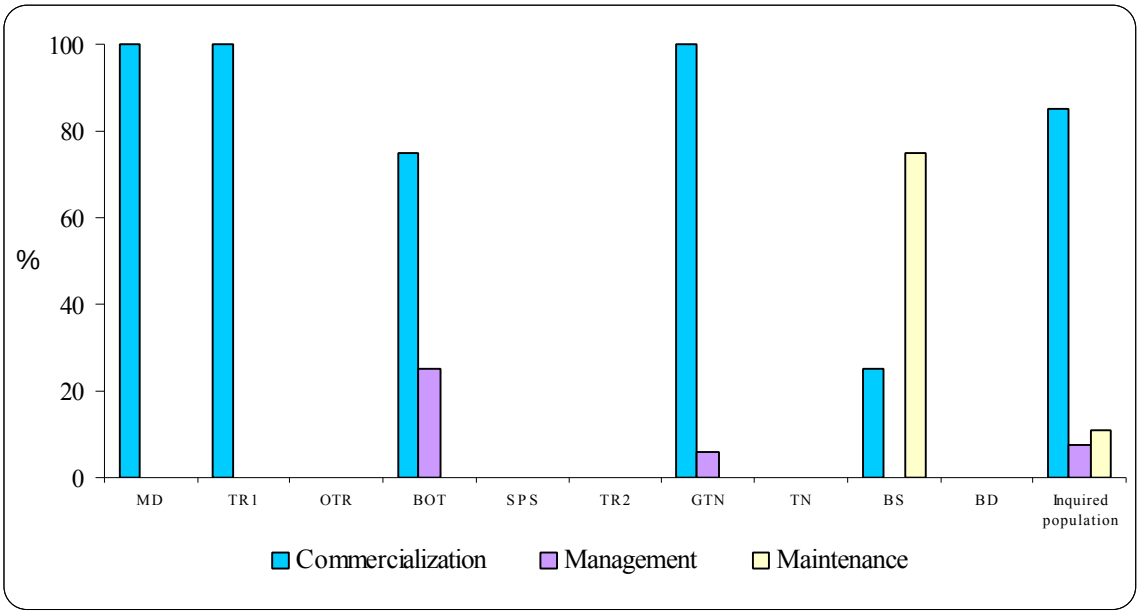


Figure 64 - Description of the inquired skippers family activities in the fishery sector.

As an illustrative example, the fishermen's family can commercialise fish and simultaneously help with the vessels maintenance.

For the overall inquired population, the most important fishery related activity undertaken by the fishermen families is the fish commercialisation.(figure 64)

In fact, the commercialisation represents 85%, maintenance 11% and management 7% of the occupations of the whole-inquired population. Maintenance is the main familiar activity for the fleet component BS.

6.1.6 Skipper's adhesion to management or accounts enterprises

Figure 65 shows that in 54% of the overall inquired population, the vessels management and accountancy are made by specialised enterprises. The skippers that have any relation with this type of specialised enterprises make their own self-accountancy, task that usually belongs to the skipper or a family member (11%, see Figure 9).

The inquiries of the fleet component TN do not possess information on this topic.

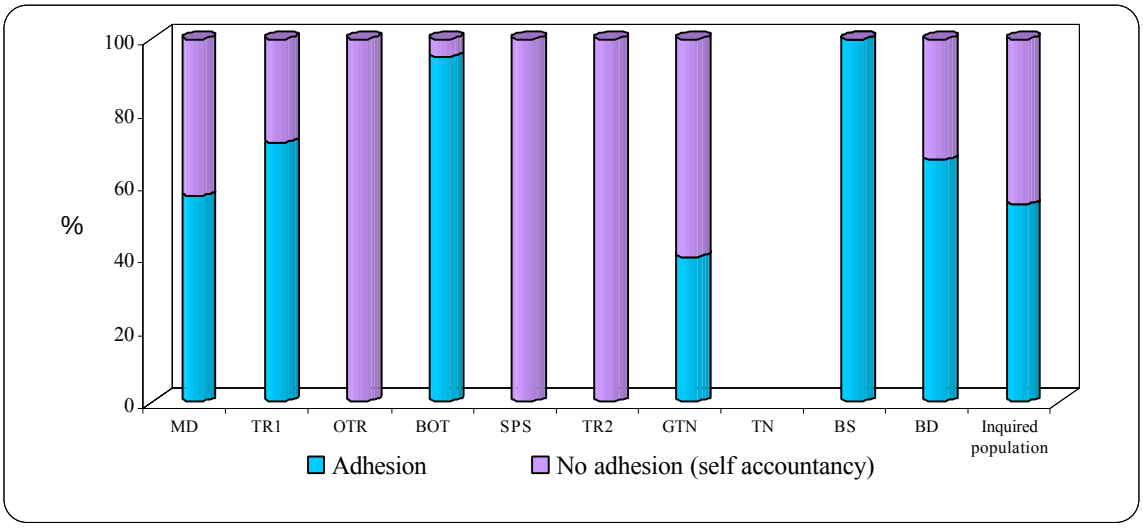


Figure 65 - Skippers adhesion to management or accounts enterprises.

6.1.7 Skipper's adhesion to syndicates

In a general way, syndicates defend the preservation of the fishing stocks and fight for better life conditions for fishermen.

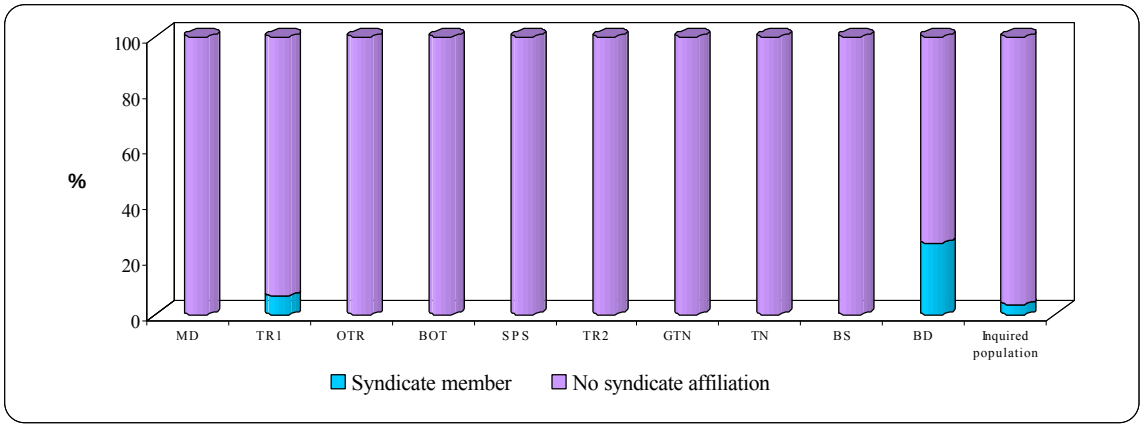


Figure 66 - Skipper's adhesion to syndicates.

The Figure 66 indicates that only 4% of the inquired skippers belong to a syndicate, while the remaining fishermen do not have any syndicate affiliation or did not answered to this item.

6.1.8 Skipper's adhesion to fishery associations

In what concerns fishery associations, Figure 67 shows that 58% of the inquired skippers belong to an association, while the remaining inquired population is not connected and/or represented by any association of the fisheries sector. The *artisanal* fishing associations belong to local and regional areas.

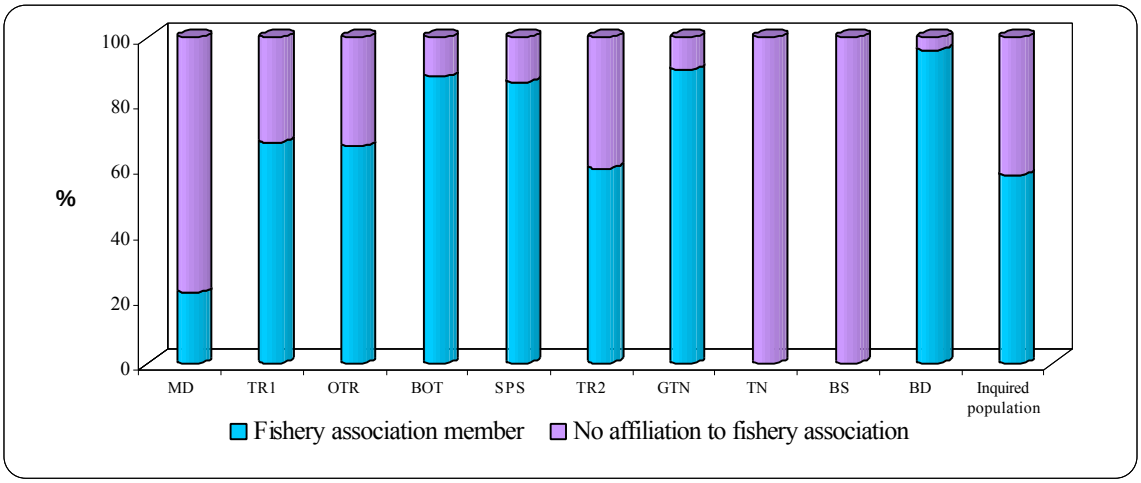


Figure 67- Skippers adhesion to fishery associations.

6.1.9 Work factor

Work factor is the relationship between total profit and the crew-number by each boat. In table 8 is possible to see the diversity of mean values among all fleet components. TR1, BS and BD are the fleets with work factors below the inquired population average.

5 fleet components had no reliable data.

Table 8- Work factor by fleet component (keuros/crew member).

	Average	**Stdev**	**CV**
MD	2 177	1 969	90
TR1	7 371	9 692	131
BOT	4 836	3 389	70
BS	8 803	5 945	68
BD	8 906	3 553	40
Inquired Population	5 921	6 183	104

6.2 Fishing fleets

6.2.1 Technical characteristics of the fishing fleet components

Some information about the main characteristics of the fishing fleet components submitted to the inquiries is presented in table 9.

Table 9- Main characteristics of the fishing boats of the different fleet components.

		MB	TR1	OTR	BOT	SPS	TR2	GTN	TN	BS	BD	Inquired population
Total length (m)	***Average***	7.5	6.3	9.6	8.1	8.8	7.3	6.3	8.0	10.0	10.2	8.1
	StDev	1.8	0.9	2.3	1.4	2.7	2.7	1.5	1.5	1.5	2.2	2.3
	CV (%)	25	14	24	17	30	37	23	18	15	21	28
	Minimum	5.1	5.0	3.2	6.1	3.3	2.7	4.5	5.1	7.8	5.8	2.7
	Maximum	12.6	9.0	14.4	11.9	14.0	12.6	10.2	11.7	12.5	13.9	14.4
Engine power (kW)	***Average***	15	23	51	33	48	35	28	22	33	59	34
	StDev	14	13	23	18	26	37	11	19	6	17	23
	CV (%)	92	55	44	55	55	106	40	88	19	29	69
	Minimum	4	6	3	10	4	3	6	3	30	30	3
	Maximum	79	51	112	78	104	149	48	66	45	83	149
GRT	***Average***	2.3	2.2	7.9	4.0	6.7	4.7	2.4	3.4	4.8	7.5	4.4
	StDev	2.3	1.0	4.6	2.0	5.3	4.7	1.1	2.5	1.8	3.4	3.8
	CV (%)	100	46	59	51	80	101	45	74	37	45	85
	Minimum	0.3	1.1	0.6	1.7	0.8	0.5	1.0	1.0	2.5	1.3	0.3
	Maximum	14.1	6.7	19.4	9.7	25.5	16.5	5.0	10.4	8.8	14.7	25.5
Construction Year	***Average***	1982	1986	1966	1974	1980	1978	1984	1968	1982	1965	1977
	StDev	11	14	22	14	15	14	13	15	7	20	16
	Minimum	1961	1956	1920	1948	1952	1956	1954	1944	1975	1926	1920
	Maximum	1999	1998	1999	1999	1999	1998	1999	1999	1996	1998	1999
Material of Construction (%)	**Wood**	79	55	81	90	94	81	79	74	100	78	82
	Steel / Aluminium	11	0	0	7	0	0	0	0	0	0	2
	Plastic	10	45	19	3	6	19	18	26	0	22	15
	Other	0	0	0	0	0	0	3	0	0	0	1

GRT (Gross registered tonnage): measures a ships internal volume, its capacity. There are several ways to measure it; for the purpose of homogeneity of measurement, the European Commission (EU) created the Council Regulation no. 3 259/94, of 22 December and the Commission Decision 95/84/CE, of 20 March. According to these documents, the tonnage for all fishing vessels should be determined in accordance with Annex I of the International Convention on Tonnage Measurement of Ships (London, 1969) (INE, 1998).

The mean overall length of the fleet components ranged between 6.3 m and 10.2 m. The fleet components that presented the biggest value was BD and the lowest were TR1 and GTN. Due to the fact that some of these boats are quite small, the majority of them operate in areas very near to the coast.

In the present, the fishing capacity can be defined either in terms of gross registered tonnage (GRT) and carrying power, among others. One can see that the fleet component that has the highest mean value of GRT is OTR (7.9), and the lowest is TR1 (2.2).

As shown in table 8, the average engine power of the motors varies between 15.2 kW and 58.9 kW (MD and BD, respectively). The construction year of the boats is comprehended between 1920 (OTR) and 1999 (in almost all fleet components).

These values reveal a relatively old fleet, but this fact is not completely correct, because sometimes fishermen rebuilt almost completely their old fishing boats.

This fact occurs with all the fleet components that operate with fishing gears considered harmful to the environment. According to the legislation the construction of new boats is not permitted (e.g. a beach seine fishing gear named Xávega).

According to INE (1998), in most fishing vessels the hull is wooden constructed (90%), while the remained are built in metal (steel / aluminium) or fibreglass. These results are similar with those obtained in the inquiries. As observed in Table 8, on average, the wooden hull type is more frequent, being the second position occupied by the fibreglass constructed hulls. Only the BS fleet component presents all fishing boats with hulls constructed in wood.

Comparing the technical characteristics of boats from data available in inquiries with those obtained from all PECOSUDE fleet (*in* Halieutic report), we can see that there are some differences. The mean total length for the sampled boats is higher than that of the whole population. Perhaps too many small boats between 2.2 m and 2.7 m are not sampled resulting in a higher average value for total length sampled. For similar reasons the engine power for the sampled boats is also higher (33.7 kW against 18.4 kW mean value in the population) since the minimum engine power sampled was 3.0 kW while in the population was 1.1 kW. Concerning the construction year and the type of construction material, the differences are almost nulls. So, this socio-economic study is based in the boats from the total population (8% of sampled boats (actives)) with the largest total length, and higher engine power in average values.

6.2.2 Type of boat acquisition

Since Portugal became a member of European Community (1986), it has been submitted to some measures of the Common Fisheries Policy. This fact was determinant in the development and improvement of the fishing activity, due to financial support both from the national government and the European community (Garcia *et al*., 1998; INE, 1998).

Figure 68 illustrates the number of new boats acquired by the Portuguese artisanal fishing fleet.

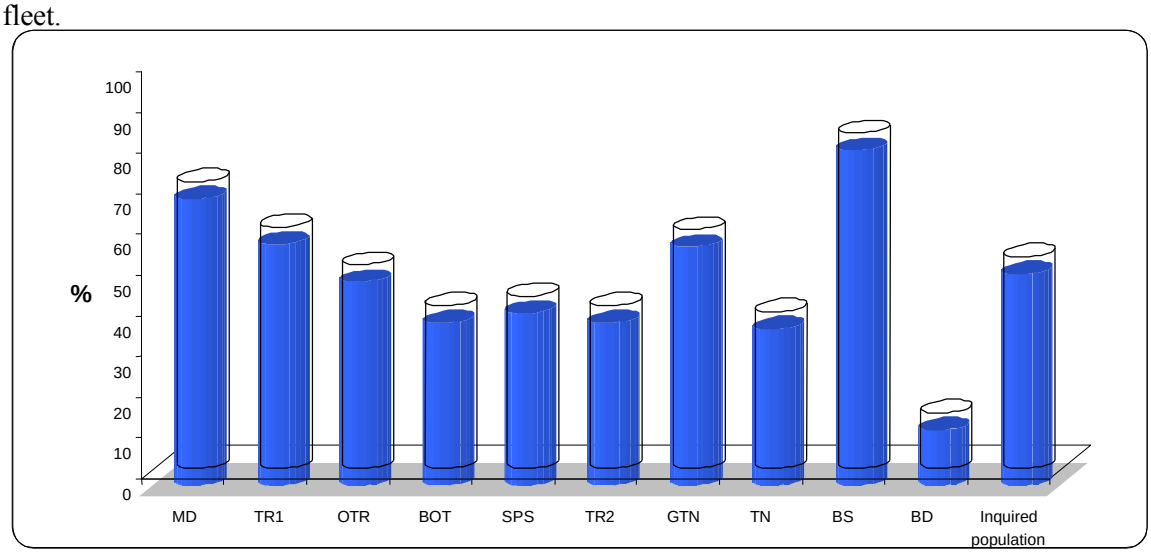


Figure 68 - Percentage of new boats by fleet component.

The beach seine (BS) component presents the highest percentage (80%) of new boats (the last acquisition was in 1996), and this component had the biggest investment, either by self-finance and by loans (see Figure 68).

The lowest percentage of new boat acquisition corresponds to boat dredges in marine waters (fleet component BD). Some fishermen have to buy the boats themselves or take out a loan, fact that constitute a non-incentive for the acquisition of new boats.

Still concerning boats acquisition, it was not possible to present the vessels mean price. The motive is that we can not compare the prices practised in the past with those nowadays, without taking into account multiple factors such as inflation.

The Figure 69 presents the mean values of boats age when acquired by the fishermen (Annex 9, present the average, Stdev and CV value).

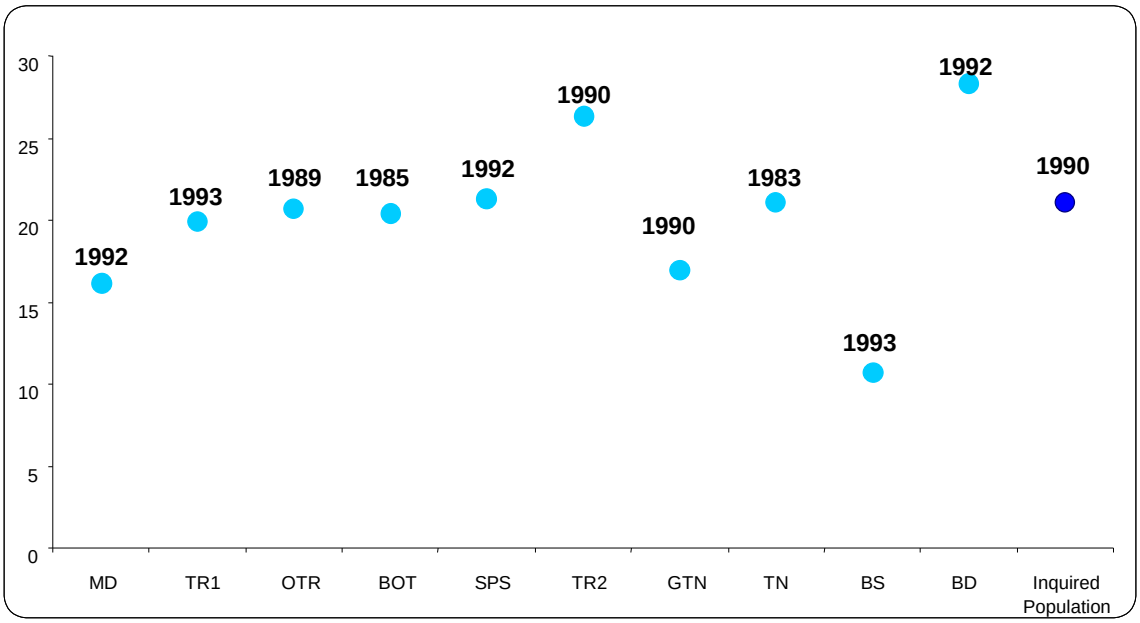


Figure 69 - Mean boat's age ● and mean acquisition year by fleet components.

The mean year of acquisition of the boats varies between 1983 and 1993, and the ages between 13 and 27 years old. In what concerns the mean age, the youngest boats belong to the beach seines component (BS) and the oldest to the boat dredges in marine waters (BD). However, the boats in the fleet component TN were the first to be acquired by the fishermen, with an average acquisition year of 1983 (Annex 9).

The evolution per year-group of the new and second hand boats acquisition is presented in the figure 70.

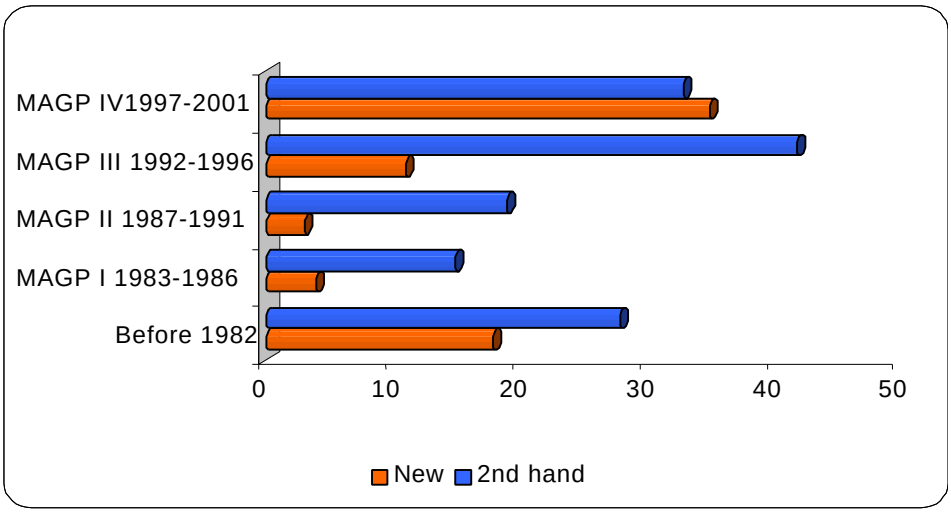


Figure 70- New / 2nd hand boats (MAGP).

Between 1987 and 2001 the number of new boats acquired by fishermen has increased.

Concerning the second hand boats, the MAGP[2] III was the period with more boat acquisitions.

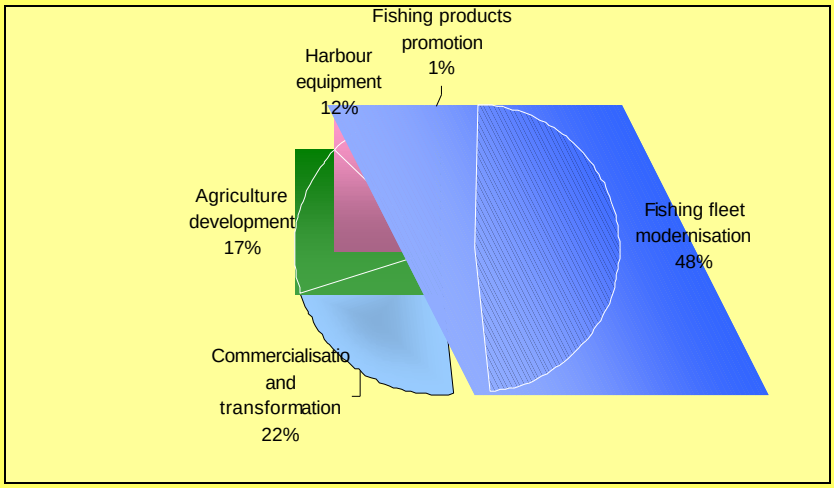
A general rise of the profitability obtained with the *artisanal* fishing activity, was one of the factors that contributed to the increase of acquisition of new boats. New boats can only be bought when an old boat is handed over. Through the years there were a development of some support initiatives that have contributed greatly for the increase of new boats. One of the initiatives was named ICPESCAS (enforce between 1994 and 1999) and intended to give social and financial support to fishermen and make a re-conversion of some fishing structures. With similar objectives other financial support were created namely PROPESCAS, and the SIPESCAS, among others. These national or European Community financial supports are in part responsible for the rise of new vessels in the last years.

During 1986 and 1996 it was approved 829 projects with financial support from the Portuguese government and the European Community. The aims of this support (1696 k €) were the construction and modernisation of the fishing fleet, among others. It is estimated that from the total investment and financial support, 81% were to the new boats construction projects and 19% for the modernisation projects.

[2] MAGP – Multiannual Guidance Programme

* The aim of **ICEPESCAS** (Community initiative for fishing activity – "Iniciativa Comunitária Pescas") was support the fishing sector in the fishing communities more dependent on this activity. It was enforced in complementation with others instruments of public intervention. This initiative was applied in 30 municipalities of Portugal mainland and in all municipalities of Madeira and Azores Islands.

The financial investment of IFADAP was divided in several components, namely fishing product promotion, harbour equipment, agriculture development, commercialisation and transformation of fishes and fishing fleet modernisation. In next figure is evident that fishing fleet modernisation has the highest investment (48% which represents about 6.3 million of escudos) (*in* http://www.ifadap.min-agricultura.pt).



* The **SIPESCAS** (System of fishery incentive) is a national financial support enforces during one part of MAGP IV. It has several objectives, namely the financial support for the modernisation and replacement of the old fishing boats.

* The **PROPESCA** (Operational fisheries intervention programme) is a governmental financial support that intents to give support to the fishing communities.

* The **MARE** (Programme for the sustainable development of the fishery sector) is supported in part by the IFOP (Community fishing initiative) and have several objectives such as the modernisation of the fleet, fishing effort adjustment, protection and development of: aquatic resources, aquaculture, harbour equipment's and transformation and commercialisation.

(*in* INE, 1998; http://www.ifadap.min-agricultura.pt).

The type of financial support obtained by fishermen for boat acquisition is described in the figure 71.

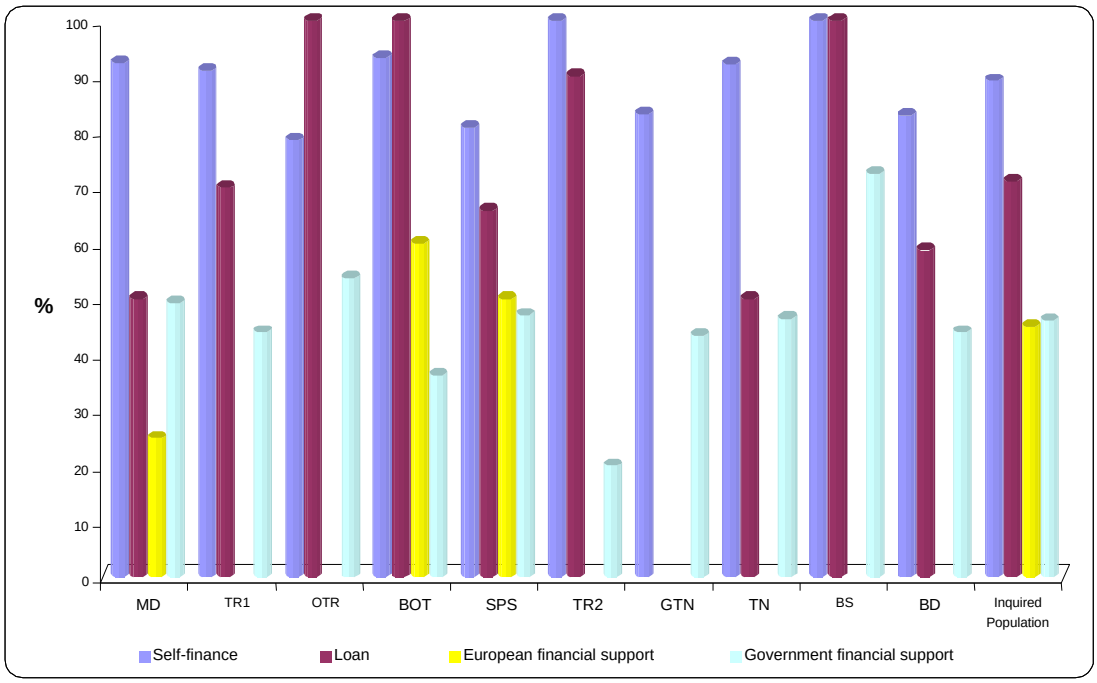


Figure 71 - Types of financial support used by fishermen for boat acquisition.

An important parameter of the fleet is the vessel's motorization. This equipment contributes for an increase in the safety conditions of fishermen, especially in the *artisanal* fleet. Information available from INE (1998) reveals that in 1996 approximately 78% of the motorised vessels belonging to the *artisanal* fleet were propelled by out board engines. The engine power, as well as the engine age is variable among the fishing fleet. From the inquired population it is possible to conclude that around 90% of boats were acquired with resort to self-finance. About 70% of fishermen had resort also to a loan to boat acquisition. European and government financial supports were used by near 50% of fishermen in both cases.

The figure 72 presents the percentage of boat engines acquired by component of the *artisanal* fleet.

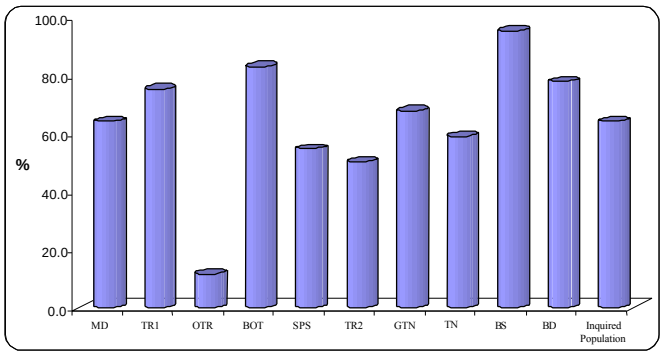
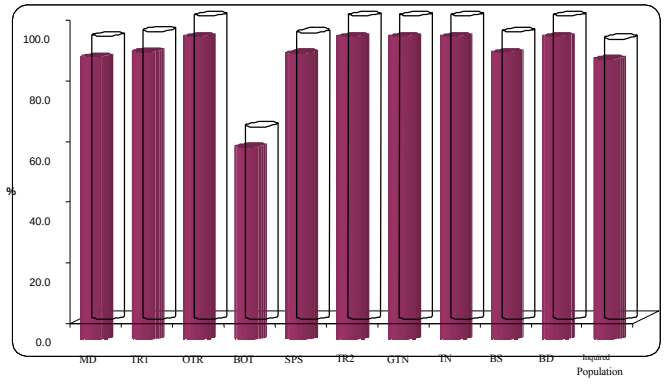


Figure 72- a): Percentage of re-engine boats, since date of acquisition.



b): Percentage of re-engine boats during the last decade.

Analysing the percentage of engines acquired it is possible to conclude that OTR (octopus fishery) is the fleet component with less re-engine boats since the date of acquisition. The few re-motorizations were all made in the last decade (figure 72b). Vessels from Central-South and Algarve regions mainly compose this component, and therefore it is possible that their few re-motorizations are due to the calm oceanic conditions and easier access to the harbours.

Beach seine (BS) is the fleet component with more re-motorizations, once again due the 'ICPESCAS' financial support program.

The lifetime of the boat engines can be very changeable. In fact, due to the high cost of the engines, fishermen prefer to repair them as often as possible. The figure 73 presents some information about this topic.

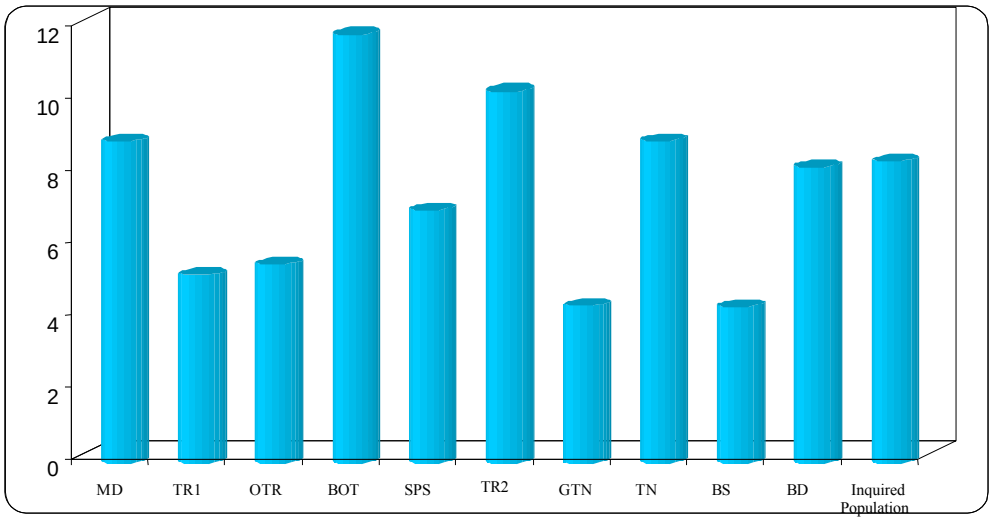


Figure 73 - Average lifetime of the boat engines by fleet component.

Sometimes, the average lifetime of the engines depends on the *modus operandi* of the fishing gears. It is necessary to take into account the distance from the coast; the effort made to leave/arrive to the harbour, and the utilisation of the engine as support for the fishing operations (Annex 10).

The mean values of each type of financial support for boat engine's acquisition are shown in the Figure 19.

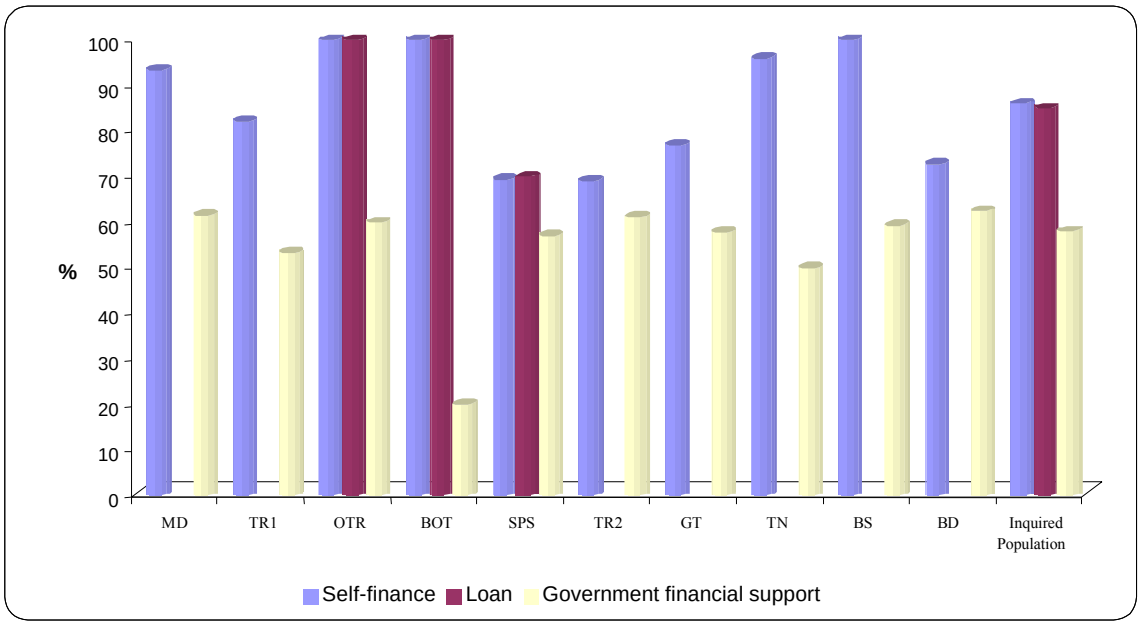


Figure 74 - Type of financial support for engine acquisition.

Figure 74 shows that the government financial support for boat engine's acquisition has the lower percentage in all fleet components (around 60% for all inquired population). Taking out a loan or making a self-investment are the financial measures preferentially adopted by most fishermen. In all inquired PECOSUDE the self-finance and the loan have also the highest percentages of financial support for engines acquisition, near 90% for the total inquired population.

6.2.3 On Board Equipment

The fishing fleet is equipped with some electronic devices, such as detection, transmission, navigation and technical equipment. The detection equipment generally used by fishermen is the echo sounder. In terms of transmission equipment, fishermen use the radio (VHF and others), and more recently the mobile phones. The navigation equipment's employed are the radar and the GPS. The technical equipment consists mainly in fishery helping devices, such as the winch and other hauling equipment.

The percentage of electronic equipment existing on board and the respective type are illustrated in figures 75 and 76, respectively.

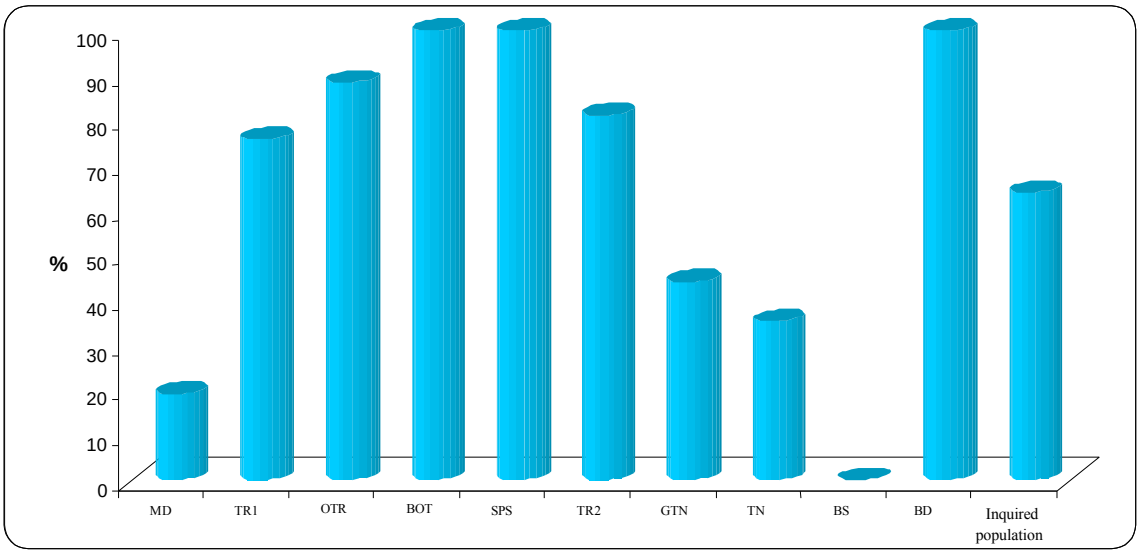


Figure 75 - Electronic equipment installed on board of the inquired artisanal fishing vessels.

In the BOT, SPS and BD fleet components, all vessels possess electronic equipment (100%). However some vessels are not equipped with all the equipment that assure communications, detection and navigation, necessary for the security of fishing trips (Figure 20). Beach seine in marine waters (BS) is a fleet component that due to its particular type of fishing operation does not have any electronic equipment installed on board.

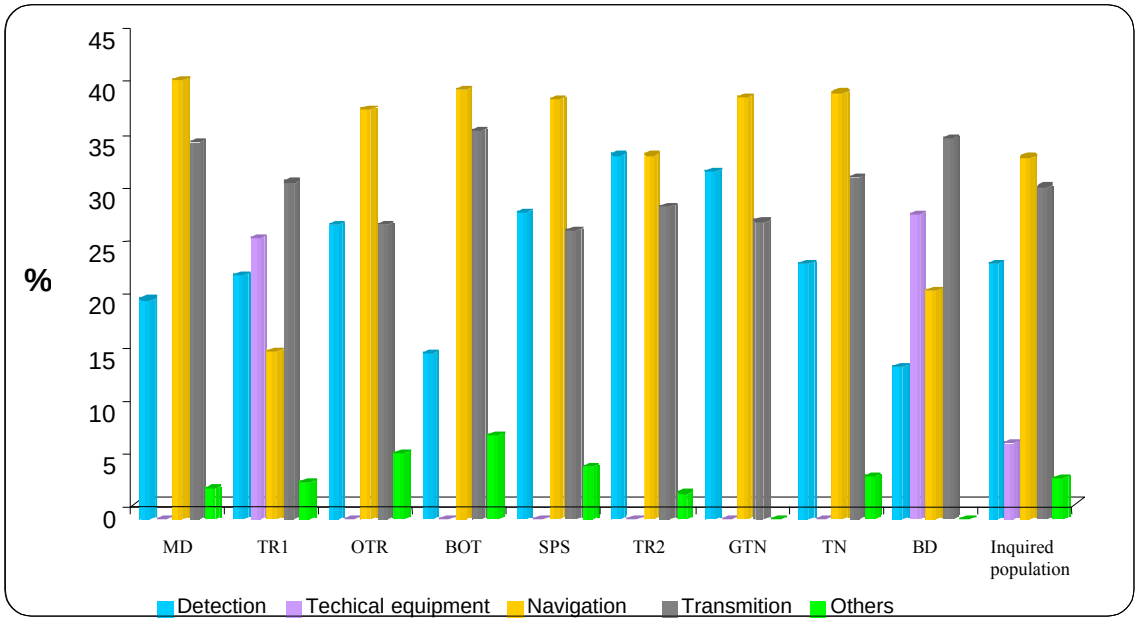


Figure 76 - Type of electronic equipment used by the inquired *artisanal* fishing fleet.

The technical equipment is used in lower percentage than the other types of on-board equipment. Analysing the Figure 21, we can conclude that the transmission and navigation equipment had the highest percentage in most fleet components.

Part of the electronic equipment used on board is fundamental fishermen safety, and some of the equipment is even obligatory by law, namely the VHF radio. However, most of the vessels operate in fishing grounds near the coast, so they rarely possess high technology communication equipment, using instead mobile phones for communicational purposes.

Concerning the average year of installation of those equipment's (table 10), it is possible to conclude that in all fleet components the equipment's were acquired between 1993 and 2000.

Table 10 - Mean installation year of the most recent electronic equipment.

Fleet component	Detection	Transmission	Navigation	Technical equipment	Others
MD	1997	1999	1999	-	2000
TR1	1996	1993	1997	1997	1999
OTR	1994	1995	1997	-	-
BOT	1997	1993	1998	-	1997
SPS	1994	1995	1998	-	1996
TR2	1995	1997	1997	-	-
GTN	2000	-	2000	-	-
TN	1997	1998	1998	-	1999
BS	-	-	-	-	-
BD	1998	1999	1999	1997	-
Inquired population	1996	1996	1998	1997	1998

According to the information available from the inquiries, the MD and GTN fleet components installed more recently the on-board equipment (mean = 2000). This is an important indicator that was biased by the adoption of year 2000 as an alternative reference year, since during the inquiries many fishermen did not remember some of the data questioned. Among the overall inquired population, the detection and transmission equipment's were the first to be acquired (mean = 1996).

6.3 Capital Evaluation

- **Insured vessels**

The insurance policy is a cost frequently referred by some ship owners. The figure 77 presents the percentage of boats with and without insurance.

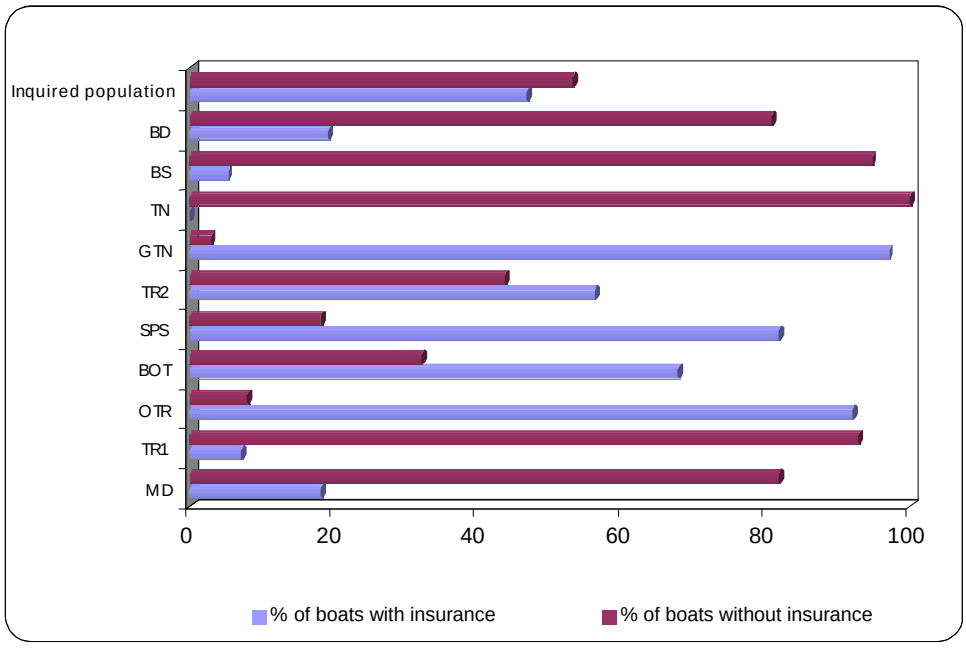


Figure 77 - Insurance policy in the inquired artisanal fishing fleet.

In MD, TR1, TN, BS and BD fleet components the percentage of vessels without boat insurance is higher than the percentage of those that possess insurance. On the other hand, some fishermen declared that certain insurance company's refused to assure their fishing boats.

➢ *** Difference between insurance value and estimated value of the boat**

In what concerns the price of the insurance policy, in the figure 78 is depicted the comparison between the mean costs of the insurance policy and the boat's values estimated by the inquired skippers.

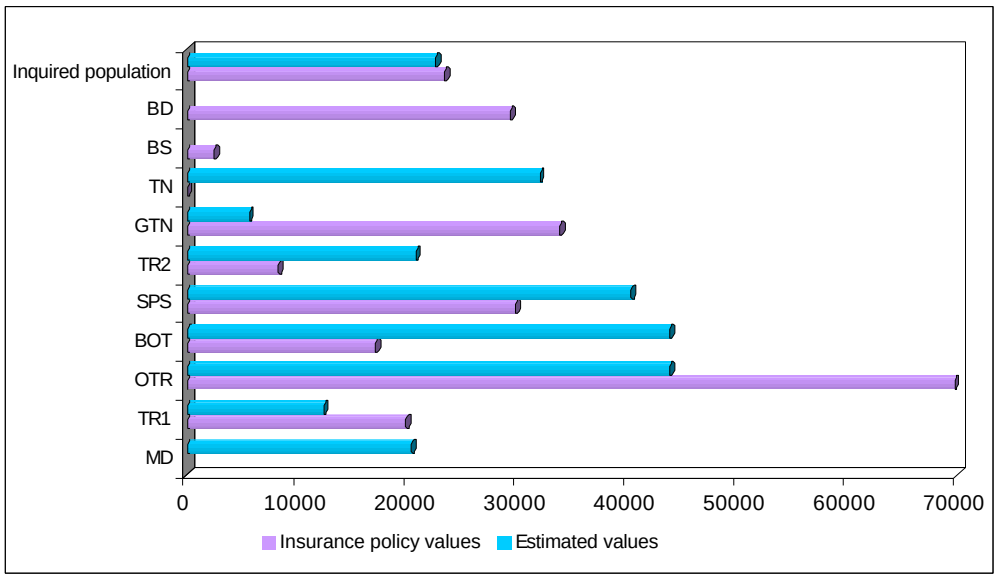


Figure 78 - Comparison between the mean insurance policy value and the mean boat values estimated by the inquired skippers.

In a general way, for total inquired population the insurance policy values and the estimated values are almost equal. In some fleet components the mean estimated values of the boats are bigger than the respective insurance policies. One reason for this difference is that when fishermen referred the value of their boats, they overestimated it with the values of fishing gears, which are not covered by the insurance. More data about this topic is described Annex 11.

Other investment made by fishermen in the fishing activity is related with the fishing gears acquisition, such as the nets, ropes, among others (figure 79).

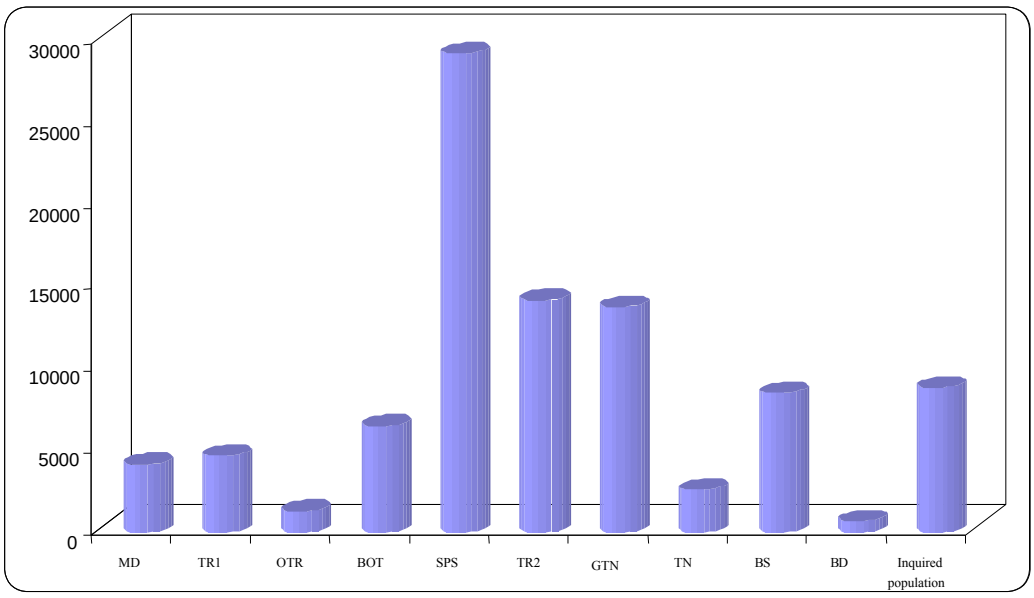


Figure 79 - Mean costs (Euro) of the fishing gears.

The small purse seine (SPS) is the fleet component that spent more money in the fishing gears acquisition, while OTR (octopus fishery) and BD (bivalves dredge) have the lowest costs for these tools.

Additional information on the costs of the fishing gears is presented in the Annex 12.

6.4 Productivity of the capital factor

Information about the profits of the fishery was very difficult to obtain during the inquiries. There are many reasons that could explain this, such as the high commercial value of some species that cause a sold outside the auction places or even the inexistence of auction places in small localities.

The capital factor productivity is the ratio between profits and the estimated value of each boat.

From a total of 10 fleet components, 4 have no reliable data to build this indicator (figure 80). In order to acquire more information about this item, the profits from the fishing activity were estimated from the DGPA database. Although this approach, the differences observed still exists, on possible reason is the difference of profits considerate, the data collected by DGPA is about auction place sales, do not takes into account the direct sales. Moreover, the DGPA do not use any typology similar with the one adopted for PECOSUDE. The fleet typology used by DGPA is refers to the Commission Regulation (EC) No. 2091/98 of 30 Sept 1998.

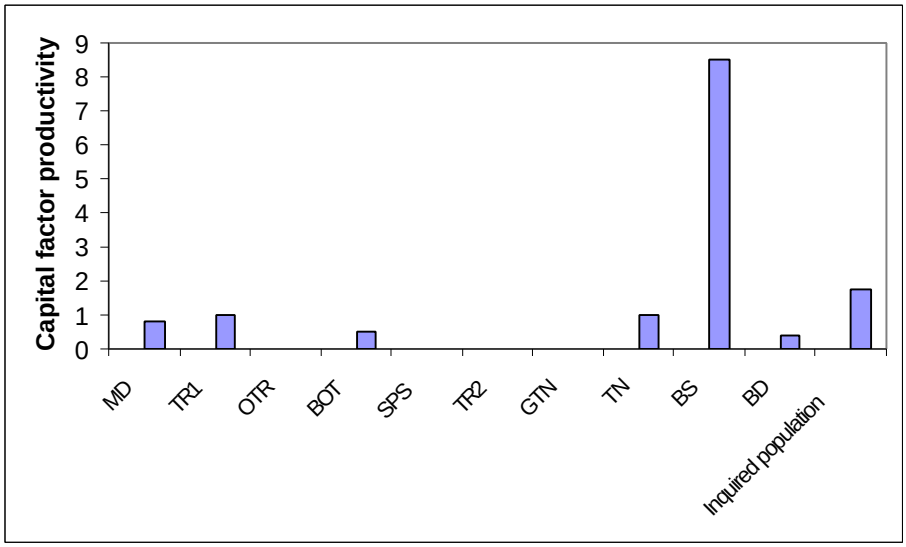


Figure 80 - Estimated mean values of the capital factor productivity obtained with the fishing activity (from the inquiries data)

In fact, when comparing both values, the fleet components with highest capital factor do not agree at all (e.g. BS or GTN). Two boats from BS component were eliminated from this indicator since the estimate boat values were not possible (when considerate the BS capital factor is near to 23).

6.5 Factor Cost

6.5.1 Compensation of employees

In fisheries sector the most frequent type of salary is the division of total profits into parts. The ship owner receives the highest amount (from 25% to 75% of total profits), followed by the skipper, while each fisherman takes one part. The division is not always the same, since each boat has a particular way to do it, being almost impossible to describe all the different types of profits division. Generally, almost half of the profits belong to the ship owner, the remaining is divided into equal parts, the skipper receives two or more parts and the remaining parts are divided among the fishermen.

The beach seine (BS) is the only component that has a different type of crew remuneration (figure 81). In this particular case, a percentage goes to the ship owner and another to fishermen. The number of employees in this specific fishing gear obliges to different salary levels, one higher to the boat crew and another lower to the inland support employees.

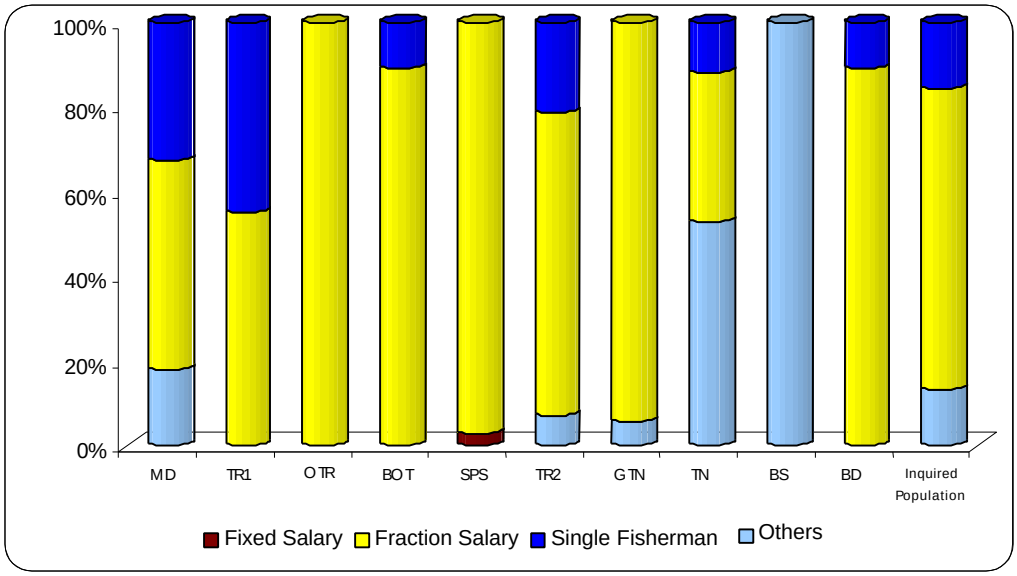


Figure 81 - Different types of remuneration performed by the artisanal fleet components.

6.5.2 Gross salary and gross salary by employee

The methodology applied to achieve the gross salary is schematically represented in Figure 82. It was made taking into account the presence of only one fisherman on board or a crew composed by 2 or more fishermen.

The number of boats considerate for this indicator was low (near to 80 boats). This is mainly due to the high number of items that were necessary to get by boat in order to calculate the gross salary.

With the aim of confirming the information about salaries, this methodology was also performed with profit data available from DGPA. However, results were not reliable. Nevertheless, the results presented are not split by fleet component because data were not sufficient to show most of the components.

The average annual gross salary for the overall inquired population is 12 385 € (varying between 276€ and 73 573€), while with the DGPA profits the average annual salary decreased to 5 074 € (between 24€ and 37 998€). The average value for the annual gross salary was calculated ignoring the negative values obtained, when the methodology was applied for each boat.

The annual gross salary by employee is (taking into account the crew's number) 4 027 € in average [185€ ; 40 857€] for inquiries data and for DGPA data of 1 291 € in average [3€ ; 15 256€].

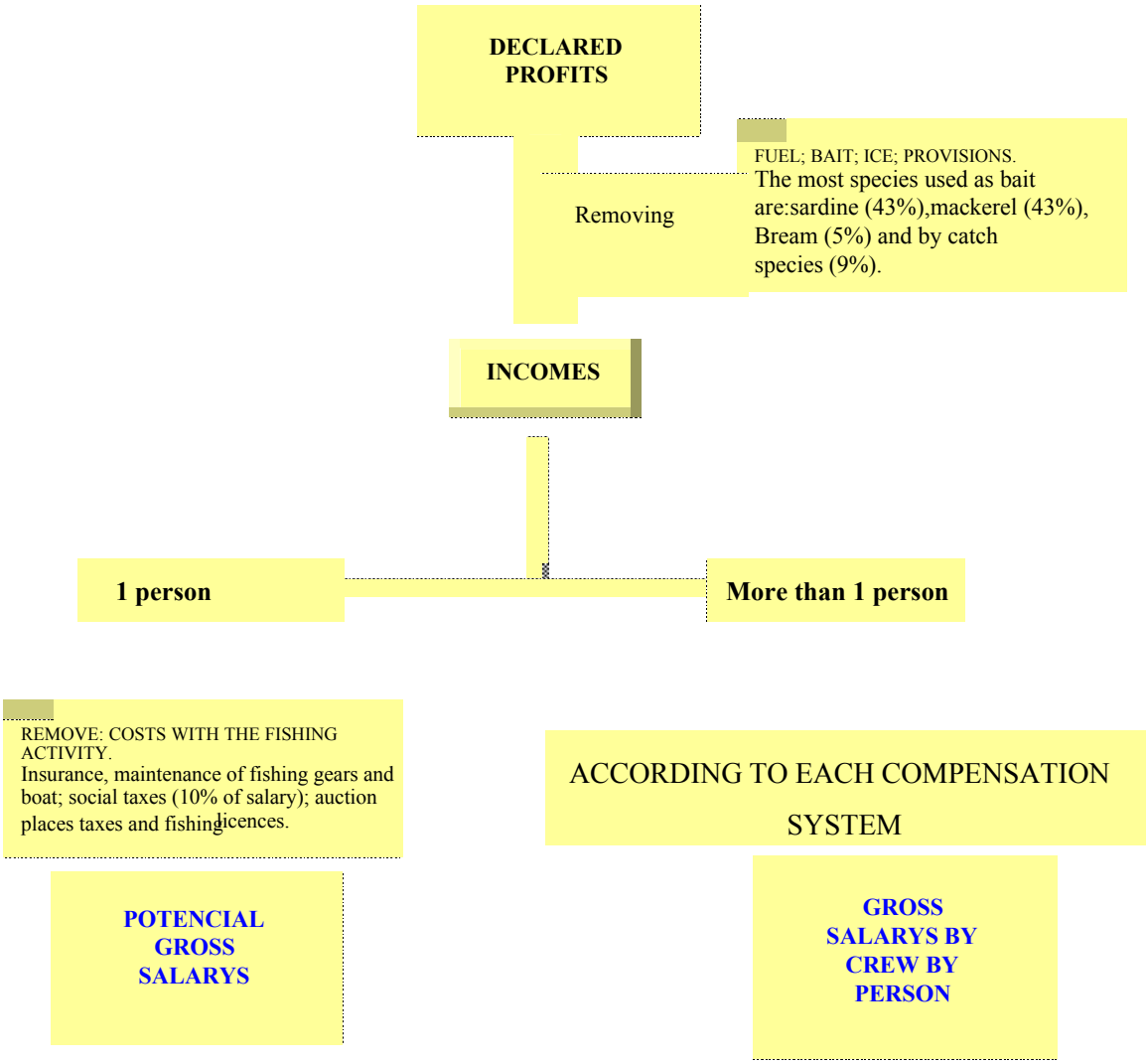


Figure 82 - Schematic representation of the procedure to estimate the gross salary.

In order to validate the estimated salaries, a contact was made with the president of a fishermen syndicate (Sindicato Livre dos Pescadores). This syndicate gave the information that the annual gross compensation of employees in the artisanal fleet is rarely below 4.190 € (very close to the National Minimum Salary).

Although both data are not reliable, the information obtain by inquiries can be a good skill to improve the official data, since, the values obtained were superior to those obtained to DGPA, and very close to the indicative value given by the syndicate. So, inquiries can be a good skill, however it is necessary to call attention for the importance of them near fishing communities.

6.5.3 Social charges

The Portuguese Social system has two types of social charges. One of these systems is specific for the *artisanal* fishery sector, in which exists one fixed percentage of social charges that is 10% took off from the sales (directly in auction places). In the other system, the social

charges are paid by the employer and by employee each one in different percentages that varies from activity to activity.

Comparing to other sectors (such as agriculture, and other workers), *artisanal* fisherman has the lowest taxes. The average social charges are 2 233 € in the range from 60€ to 17 728€.

6.6 Intermediate consumables

Assuming several data limitations, it was decided to present in this sub-chapter the values of the intermediate consumables, such as ice, bait, fuel and oil, boat repairs, fishing gears maintenance, insurance and provisions (table 11).

Table 11 - Values of the intermediate consumables by fleet component (average and stdev in Euro).

	MD	TR1	OTR	BOT	SPS	TR2	GTN	TN	BS	BD	Inquired Population
ICE											
average (€)	64	200		51	674						**269**
stdev (€)	40	414		69	1.174						**622**
CV (%)	61	207		135	174						**231**
BAIT											
average (€)		1 372	1 654	1 142	2 084	1 298	998				**1 204**
stdev (€)		1 793	1 148	958	1 978	1 095	863				**1 171**
CV (%)		131	69	84	95	84	86				**97**
FUEL AND OIL											
average (€)	1 201	2 811	2 827	1 186	2 377	960	2 424	3 727	3 927	4 117	**2 361**
stdev (€)	1 083	1 821	3 321	1 297	2 211	566	1 430	6 177	2 317	2 307	**2 377**
CV (%)	90	65	117	109	93	59	59	166	59	56	**101**
BOAT REPAIRS											
average (€)	1 633	783	5 204	3 327	1 890	468	698	1 114	13 764	4 034	**3 476**
stdev (€)	1 953	863	6 250	6 122	1 382	514	1 025	1 627	8 274	5 970	**5 923**
CV (%)	120	110	120	184	73	110	147	146	60	148	**170**
FISHING ENGINE MAINTENANCE											
average (€)	3 225	6 329	3 826	9 379	15 499	6 590	10 230	7 598	6 211	1 686	**7 163**
stdev (€)	5 035	9 848	4 381	22 561	27 255	9 577	20 354	12 402	3 884	1 723	**15 468**
CV (%)	156	156	115	241	176	145	199	163	63	102	**216**
INSURANCE											
average (€)		535		682	728	368				744	**659**
stdev (€)		251		415	292	145				226	**335**
CV (%)		46,86		61	40	39				30	**51**
PROVISIONS											
	not enough data to provide this parameter										
TOTAL OF INTERMEDIATE CONSUMPTIONS											
average (€)	2 005	2 662	3 926	4 041	7309	3 453	4 083	4 777	8 475	3 072	**4 071**
stdev (€)	3 467	5 660	4 822	13 050	18 711	7 023	12 101	9 218	7 099	3 778	**10 093**
CV (%)	173	213	123	323	256	203	296	193	84	123	**248**

By transformation of the intermediate consumables value into percentage (Figure 83), we can conclude that fishing gears maintenance is the more expensive item declared by fishermen. It is possible that fishermen really spend a lot of money with equipment and gears maintenance. However, we have to notice that in their answers they usually include the labour force as a cost, even if they do it themselves.

The three main intermediate consumables are always fishing gear maintenance, boat repairs, fuel and oil.

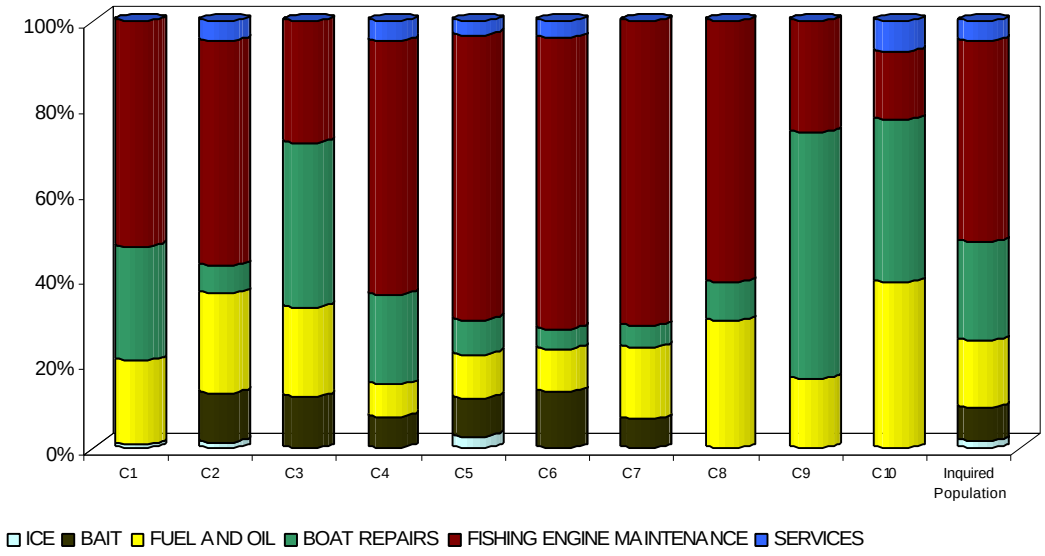


Figure 83 - Relative percentage of the value of each intermediate consumable, by fleet component.

6.7 Economic performance

6.7.1 Profits declared

Table 12 shows the profits by fleet component. Due the very low number of inquires with answers in this question, only for five components it was possible to establish this indicator.

The high standard deviation reveals that profits declared have a large range of values.

Table 12 - Profits declared by skippers (in euros).

Profit declared	MD	TR1	BOT	BS	BD	Inquired population
Average	€ 4 266	€ 9 857	€ 14 247	€ 59 113	€ 22 784	€ 18 536
stdev	€ 7 501	€ 12 986	€ 20 800	€ 42 053	€ 13 240	€ 27 344
CV (%)	176	132	146	71	58	148

6.7.2 Species proportion in profits

The proportions of each species in the profits are presented in table 13.

Table 13- Percentage of caught species categories in fishermen profits, by fleet component

Fleet Component		CEPHALOPODS	OCTOPUS	FLAT FISHES	DEMERSAL FISHES	SMALL PELAGIC FISHES	BIVALVES
TR1	*Average*	41	18	31	16		
	Stdev	17	5	16	10		
	CV	40	29	52	64		
SPS	*Average*		100				
	Stdev		0				
	CV		0				
BS	*Average*	8				41	
	Stdev	4				36	
	CV	54				89	
BD	*Average*						36
	Stdev						29
	CV						82
Total	*Average*	30	86	32	16	41	36
	Stdev	22	32	16	15	36	29
	CV	74	37	51	89	89	82

Table 13 and figure 84 show the direct relationship between the fleet components (fishing gears) and the target species. It is possible to detect two highly specific fleet components, namely OTR and BD. In relation to OTR, the main fishing gears (pots and traps) are directed to catch octopus species, while boat dredges in marine waters (BD) only catch bivalves.

Concerning to beach seine fleet component (BS), the small pelagic fishes represent the main part of the profits.

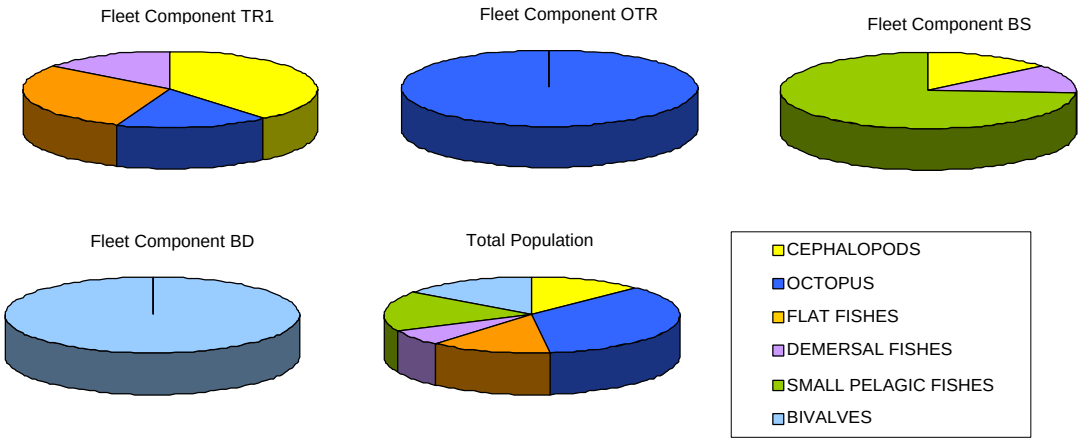


Figure 84- Representation of target species categories/groups by fleet component.

6.7.3 Profits / Engine power

As shown in figure 85, there is no linear relationship between these two variables, profit and engine power. In fact, a powerful engine does not correspond to a value added for profits. For *artisanal* fleet, and due the inshore fishing areas, engine power is used mainly to give the

necessary power to operate some fishing gear. Moreover, several harbours have a difficult access, and thus the boat way in and out depends on engine power to cross the turbulence waters.

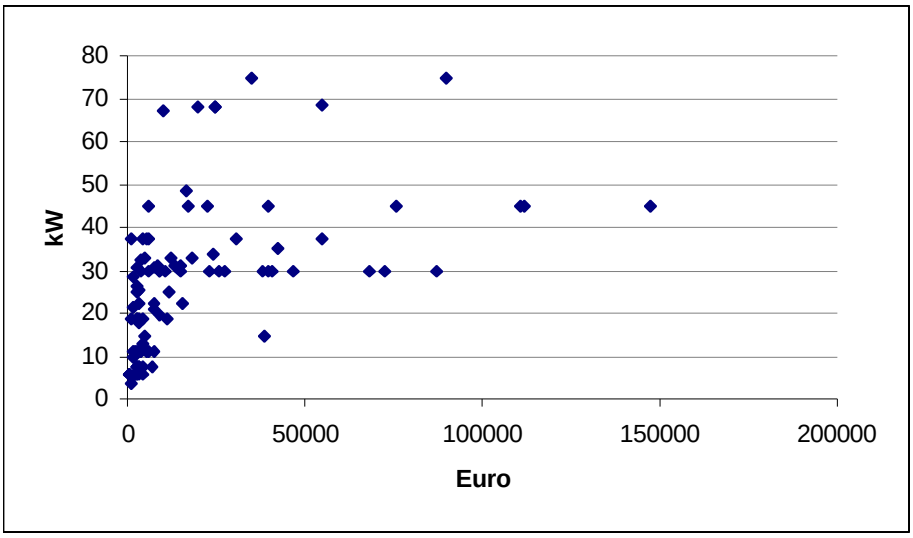


Figure 85– Relationship between Profits and engine power.

In what concerns to the profits/Engine power by fleet component the MD have the lowest mean value, as described in table 14.

Table 14- Profits / engine power

	MD	**TR1**	**BOT**	**BS**	**BD**	**Inquired population**
Average (€/kW)	297	456	497	1649	472	605
Stdev (€/kW)	234	346	588	974	310	678
CV(%)	79	76	118	59	66	112

6.7.4 Added value (VA)

Added value is the remaining portion of profits when intermediates consumables are taken (VA= Profits – Intermediate consumables).

This indicator is also depending on profit evaluation of each boat. Following the previous approaches, there is not enough information to establish this indicator by fleet component, on this way only some indicative parameters will be shown.

For the total number of boats with available data, the Added Value varies between 74 € and 130 336 € with a mean value of 17 332 €.

The added value rate is the ratio between the VA and the profits. This rate varies between 0.02 and 0.94 with a mean value of 0.5.

6.7.5 Profitability Rate

The profitability rate is calculated by the expression:

(VA - Compensation of employees - Social charges - taxes) / Profits * 100

It was difficult gathering the information about these 5 parameters for one boat (only possible for 22 boats). So, any analysis was made by fleet component. Taking into account the data limitations, the profitability rate varies between 0, 7 and 39.4 with a mean value of 20.2.

6.7.6 "Net à partager"/ crew

This indicator is calculated as the proportion of the difference between Profits and common costs and the crew number. The common costs considered were fuel, bait, ice and provisions. Removing the negative values, the mean value was 4 379 € in a range between 249 € and 42 198 €.

7 PRODUCTS COMMERCIALISATION

7.1 Inland equipment

Inland equipment is necessary to assure conservation, durability, better quality as well as some consumption requirements. In order to accomplish these purposes, several different processes can be used, such as frozen cameras, plastic boxes with ice to transport fish to auction places, fishponds, bags in the river, etc..

Table 15 - Percentage of inland equipment used by fleet component.

	MD	TR1	OTR	BOT	SPS	TR2	GTN	TN	BS	BD	Inquired population
Inland equipment usage	40	3	0	100	5	7	0	5	-	0	10

It can be observed in table 15 that only 10% of the inquired vessels pay for the use of inland equipment.

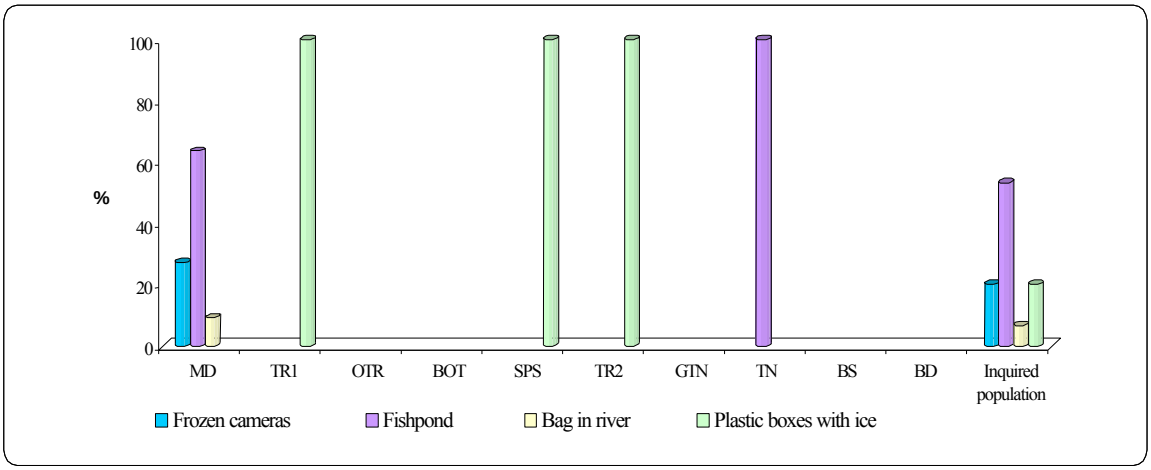


Figure 86 - Description of the inland equipment (% of answers)

Sometimes species are conditioned in plastic boxes with ice, to assure the transportation in good conditions to the auction places.

Frozen cameras are used in land mainly to conserve species as seabass, common seabream, shrimps, turbot and pouting.

Fishponds are compartments of the saltpans destined to the water admission. These compartments are artificially delimited by walls and doors, allowing to the water renewal by the tides and input of fishes, which are kept there for growth and fattening, during 1 or 2 years, until reaching a commercial dimension.

The fishponds are mostly used to conserve lamprey, but also European plaice and sole.

Some other uncommon cases were declared by fishermen, as the case of fish kept inside bags on the river, which are mainly used in the North region for the maintenance of lamprey, European plaice, sole and seabass.

7.2 Fish processing

The main fish processing activities inland or onboard are beheading, disembowelling, freezing, packing, canning, filleting, and reducing to flour and oil.

Among the vessels that process their catches, 19 boats (42% of the vessels with fish processing) make it inland and all of them refer to bivalves depuration (namely: striped venus, surf clams, donax clams and razor clams).

Other 26 vessels execute fish processing onboard (58% of the vessels with fish processing), mainly the disembowelling of hake, conger, black scabbardfish, monkfish and sharks, and the disembowelling and beheading of some sharks.

In the case of bivalve dredging, onboard processing relates with individuals sorting onboard (donax clams and surf clams). In the North region only one vessel declared making fish processing on board, while in the Central region none of the inquired fishermen referred fish processing on-board of his fishing vessel.

7.3 Fishing products distribution

None of the inquired vessels participates in the fishing activity just for family consumption, and the highest percentage obtain on the inquiries of fish retained for familiar consumption was 30%.

Most percentages of fish retention for familiar consumption were low, since the vast majority of the vessels (73.8%) only retain an amount of fish less or equal than 5% of the total catches. Nevertheless, on average, all fleet components retain less or equal than 10% of the fish catches for family consumption. Thus, according to the inquiries performed, the fish retention for familiar consumption does not seem to impose great restrictions or limitations in the fishermen annual incomes (profits). As shown in the table 16, 64% of the overall inquired vessels retain part of the catches for familiar consumption.

Table 16-Percentage of vessels with fish consumption by the families and average percentage of the fish retention.

	MD	TR1	OTR	BOT	SPS	TR2	GTN	TN	BS	BD	Inquired population
% of boats with familiar consumption	50	91	100	11	62	92	100	89	53	62	64
Average % of fish retention	6	8	1	10	2	5	1	4	4	5	5

According to table 17, the sales in auction places do not necessarily correspond to the vessels catches, because they depend on the fish commercial value. Sometimes when the fish has a great commercial value is not sold in auction places, being preferentially sold directly to particulars and restaurants that pay higher prices (and without taxes), that's why in some fleet components the average percentage is lower than 100%.

Table 17 - Average of the percentage of fish sales in auction places, declared in inquiries.

	MD	TR1	OTR	BOT	SPS	TR2	GTN	TN	BS	BD	Inquired population
Average	74	85	100	100	99	92	-	93	94	91	91
Stdev	27	23	0	0	2	14	-	10	18	15	19
CV (%)	36	28	0	0	2	15	-	11	19	16	21

For the fishermen that declared what percentage of catches they had sold in auction place in 1999, the average percentage was 91%. All the inquired vessels present a high percentage, above 70% on average, of fish sales in auction places (figure 87).

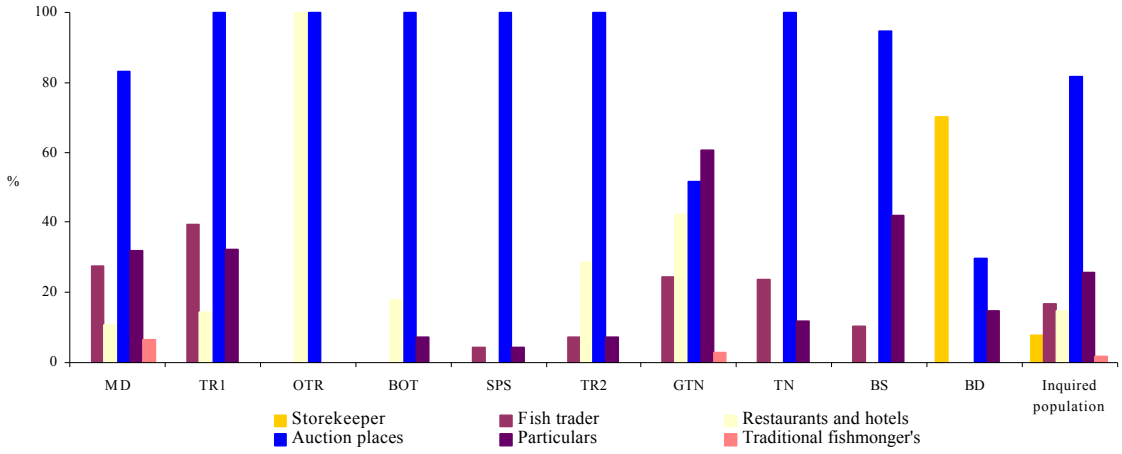


Figure 87 - Fish sales in auction places and other destinations (% of answers).

Some vessels sell their total daily catches in auction places, but in some cases, fishermen only sell the minimum weight necessary to keep the annual fishing licenses to legally operate next year. This restrictions are imposed and controlled by the DGPA, the entity that confer the fishing licenses.

Concerning the older skippers, they preferentially sell all the catches in auction places, because by increasing the sales volume in the last 10 years of their active life, after retirement they can increase the value of their pension (retirement income).

Some more valuable fish species are rarely sold in auction places, namely the lobster and spinous spider crab. By legal reasons, sometimes the horse mackerel under the minimum legal landing size is directly sold to particulars and fish traders.

On the other hand, some fishermen do not have access to auction places, for example in Apúlia (North region) and Cortegaça (Central region), because these are very small localities. Most auction places are closed during the weekend, reason why most fish caught during these days is sold to particulars, restaurants and fish traders (e.g. Aveiro).

In the particular case of the bivalves, the storekeeper's have the responsibility to carry them for depuration.

The bivalve's sales directly to particular buyers are more frequent during the summer season.

CONCLUSION

Halieutic study

The Portuguese PECOSUDE fleet was defined as the *artisanal* local fleet that includes vessels with overall length equal or less than 15 meters. This fleet consisting of a total of 6360 vessels involves about 13,600 fishermen. The mean number of fishermen per vessel varies with the PECOSUDE region. North of Portugal is the region with more fishermen per vessel, 3 in average, followed by the Central region and Algarve (both with 2 in average) and by the Central-South (with 1).

In 1999, 3 535 of those vessels landed in 154 ports (122 very small ports and 32 main ports) along the continental coast, about 17 700 t of fish with a value of 45,5 K€. The main species caught are Octopodidae with 24 % and 27 % in weight and value respectively, followed by sardine 11 %, horse mackerel 7% and Spanish mackerel 6 % in weight and sole, in second place in value, with 6 %.

In average the total fleet (6 360 vessels) is roughly characterised by 6.4 meters of overall length, 18.4 kW of engine power, 2.6 GRT, around 24 years old and 70 % have outboard engines. The majority of the hull boats are constructed in wood (about 80 %), and a small percentage in steel/aluminium or plastic.

The main characteristic of the *artisanal* fishing activity is the use of a large diversity of fishing gears and fishing methods.

To identify the different typologies of this fleet it was performed inquiries and used, in first approach the information on landings, fleet characteristics and fishing licenses available from the national fisheries database. The methodologies used to define the typology of the fleet were the Discriminant Analysis (to classify the daily landings unknown into the fishing gears groups) and the K – Means clustering (to distribute the fleet vessels by different groups).

From the analysis of optimal number of groups resulted 10 different fleet components by main fishing gears and target species. The seasonal character of several fisheries can explain the great variety of fishing gears presented in some fleet components. The dominant gear inside any component named each fleet component. So, the fleet components are : Manual dredge in lagoon, multi-specific, pots and traps, gillnets, small purse seine, trammel nets, bottom gillnet, bottom trammel, beach seine and boat dredge in marine waters.

Some fleet components are a distinctive mark for certain regions, such as: vessels from manual dredge fleet component operate mainly in central region, more specifically in Aveiro Lagoon. Vessels from fleet component operate mainly in central-south region (TR2) and in the south region (TR1). Also characteristic from South region is the Octopus fleet component. The BOT and GTN fleet components are the most important components in the North and also characterise this region.

Manual dredge fleet component has as most landed species common cockle and common cuttlefish that are the target species of manual dredge and bottom trammel nets, respectively. July is the month with more landings of common cockle.

The fleet component TR1 is characterised by the utilisation of more than 1 fishing gear (3 licenses *per* boat in average) witch results in a large diversity of species caught. However, octopus is the species with more catches, because most of these vessels have licenses to use octopus pots and common octopus netpots.

The octopus fleet component is very mono-specific in terms of fishing gears (octopus netpots and octopus pots) and mono-specific in terms of species.

The fleet component BOT has the youngest boats. Otter trawl, bottom gillnets, trammel nets and iron pots are used during all the year, and have as target species octopus and pouting, the two most landed species. In the North region exist two specific fishing gears named 'Sombreira' and 'Bombos' used to catch shrimp.

In Small purse seine fleet the catches of sardine, horse mackerel and Spanish mackerel are higher during the summer season, from June to September.

TR2 have also (as TR1) octopus as a more landed species. However, these vessels use other fishing gears as bottom trammel nets and bottom longline, this last one used often to catch black scabbardfish.

The component GTN is a typical multi-specific fleet for the North region and has no target species.

In the TN component, Bottom trammel nets and common cuttlefish as a direct relationship, being the fishing gear more used and also the more landed species. The more productive period to this species is from March to June.

Beach seine fleet, (*named 'Xávega'*) is very specific in terms of fishing gears. The mean number of licenses is 1 by vessel. The target species are small pelagic, horse mackerel specifically. From December to February there are no activity. The most productives months are May, June and July.

Boat dredge is the component with largest boats. The target species are bivalve, like, surf clam, smooth mactra, wedge shell and striped venus.

Socio-economic analysis

The Portuguese socio-economic report is based on 277 inquiries, done along the continental coast. The reference year was 1999. During the inquiries implementation several problems took place, and the consecutive analysis was limited. The problems were mainly the refuses by fishermen to cooperate, and also the refuses to answer to some specific questions that involved cost and benefits from the fishery activity. A higher level of data confidence was difficult to gather, due the fishermen suspicious nature, and to there misunderstand between the research work and Fishery Inspection.

The main results achieved are concerned with the social factor.

The average skipper age varied between 42 and 53 years old. The oldest skipper inquired was a Manual Dredge worker with 72 years old. Portuguese fishermen have higher mean ages when compared with the Spanish or French fishermen. It is usual to work up to the official age of retirement. Indeed, 24% of fishermen are working besides 55 years old. Even they do not assume the skipper position, they never left for complete the fishery activity (they cooperate in land with the youngest fishermen, repairing and preparing the fishing gears).

In this specific sector, 82% of fishermen are working exclusively in the fisheries. The fleet component with more percentage of pluri-activity is Beach Seines, were 89% of fishermen have agriculture, tourism and others diverse activities at the same time (for ex. metallurgic, mechanical, shipbuilders…). In Algarve region, all the fishermen from the multi-specific component (TR1) with a second activity are mollusc aquaculture workers.

Near to 18 % of vessels operate only with the skipper on board. The others have crews composed by 3 fishermen in average. Only Beach seine needs a higher number of fishermen to operate (7 or more members). Crew for the inland work is not very usual to find. The principal in

land activities such as, commercialisation, management and maintenance assumed in part by families (28%).

The percentage of skippers adherent to management or accountancy enterprises is 54%, however, the variation among fleet components is high. Octopus fishermen, purse seines and multi-specific component in Central-South region are not adherent to this enterprises, the fishermen are responsible by their own accountancy. Almost the same total percentage (58%) of fishermen belongs to a fishery association. The trawlers components (BOT and GTN), Purse Seines and Boat Dredges are connected and are represented by one fishery association of their sector.

The start the fishing activity or to buy a new boat, fishermen usually take out a loan or they support their own costs. Few fishermen appeal to governmental or European support. Manual Dredges, Otter Trawlers and Purse Seines are the fleet components where fishermen had bough their boats their boats with support of 50% of the total cost in average. Most of the Portuguese boats have been re-engined during the last decade.

Some fleet components have their boats with equipment on board (like, Detection, Navigation or Transmission). Only Beach Seines have no equipment at all. The most recent equipment acquired was the Navigation one (Radar or GPS).

The capital evaluation estimated by fishermen is sometimes higher than the respective insurance policy. The boat value is overestimated by the fishing gear value and also by the licence values, things that the insurance companies do not assure.

The economic performance expected to by done was not achieved with the present data that result from this inquiries. Once more, the lower degree of confidence was the principal factor. The most important data needed to this chapter was the incomes (profits) but probably this value was under estimated. Nevertheless, the highest costs were identified associated with fishing gear maintenance, boat repairs and fuel (near to 80% of total costs).

About the commercialisation of products, we can say that 91 % of the inquiried population sell their daily catches in auction places, but in some cases, fishermen only sell the minimum weight necessary to keep the annual fishing licenses to legally operate next year. Sometimes when the fish has a great commercial value is not sold in auction places, being preferentially sold directly to particulars and restaurants that pay higher prices (and without taxes), On average, all fleet components retain less or equal than 10% of the fish catches for family consumption.

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ANNEXES

ANNEX 1

Portuguese codes for the 32 main harbours.

Codes	Region PECOSUDE	Registered Harbour name	No of boats	Total
C	**North**	**Caminha**	521	**1519**
AN		**Ancora**	63	
V		**Viana do Castelo**	270	
ES		**Esposende**	125	
PV		**Povoa do varzim**	106	
VC		**Vila do Conde**	90	
P		**Douro**	275	
L		**Leixoes**	69	
A	**Central**	**Aveiro**	778	**1014**
FF		**Figueira da Foz**	236	
N	**Central-South**	**Nazare**	99	**1981**
SM		**S. Martinho do Porto**	19	
PE		**Peniche**	413	
E		**Ericeira**	25	
CS		**Cascais**	61	
LX		**Lisboa**	32	
TR		**Trafaria**	196	
VX		**Vila Franca de Xira**	103	
B		**Barreiro**	82	
S		**Setubal**	485	
SB		**Sesimbra**	255	
SN		**Sines**	211	
SA	**Algarve**	**Sagres**	144	**1846**
LG		**Lagos**	147	
PM		**Portimao**	277	
AL		**Albufeira**	94	
Q		**Quarteira**	172	
F		**Faro**	180	
O		**Olhao**	308	
FZ		**Fuzeta**	138	
T		**Tavira**	196	
VR		**Vila Real S. Antonio**	190	
Total				***6360***

ANNEX 2

Average, Standard deviation, CV, minimum and maximum, for the fleet technical characteristics.

	PECOSUDE Vessels	MD	TR1	OTR	BOT	SPS	TR2	GTN	TN	BS	BD
Overall Length (m)											
Average	6.39	6.39	6.85	6.51	8.10	8.16	6.29	7.02	7.05	8.57	9.77
StDev	2.18	1.21	2.51	2.38	2.93	3.07	2.52	1.87	1.53	2.05	2.71
C V	34.12	18.91	36.67	36.65	36.15	37.63	40.10	26.62	21.73	23.90	27.71
Minimum	2.22	2.23	3.27	2.62	3.80	3.30	2.39	4.00	2.75	5.50	5.09
Maximum	15.00	12.60	15.00	14.96	14.87	14.77	15.00	14.53	13.85	12.50	14.68
Engine power (kW)											
Average	18.4	8.57	29.14	26.20	45.28	43.04	25.06	21.15	16.92	31.43	57.72
StDev	21.62	8.83	26.24	21.24	30.23	37.01	24.39	17.71	13.42	8.32	24.30
C V	117.50	103.00	90.06	81.05	66.78	86.00	97.32	83.73	79.32	26.46	42.09
Minimum	1.119	2.61	2.98	2.61	4.48	3.73	1.49	2.98	2.61	5.97	20.14
Maximum	149.20	79.08	146.96	119.36	148.45	145.47	149.20	116.38	82.81	44.76	111.90
GRT											
Average	2.57	1.39	3.80	3.30	5.83	6.14	3.19	2.69	2.50	4.04	7.37
StDev	3.46	1.03	5.04	3.62	6.07	6.21	3.73	3.01	1.73	1.88	4.89
C V	134.63	73.84	132.70	109.76	104.10	101.15	117.05	111.85	69.20	46.55	66.36
Minimum	0.14	0.19	0.55	0.40	0.75	0.80	0.32	0.73	0.46	1.55	1.18
Maximum	40.69	14.09	40.69	22.43	24.55	26.39	25.23	24.82	13.82	9.20	23.64
Construction Year											
Average	1977	1977	1980	1978	1984	1980	1978	1977	1971	1982	1969
StDev	14.49	14.38	15.58	16.23	12.86	13.79	14.67	13.85	15.10	7.01	18.19
C V	0.73	0.73	0.79	0.82	0.65	0.70	0.74	0.70	0.77	0.35	0.92
Minimum	1901	1915	1920	1920	1947	1951	1915	1904	1916	1967	1926
Maximum	1999	1999	1999	1999	1999	1999	1999	1999	1999	1998	1999
Material of construction (%)											
Wood	84	13	12	9	6	3	19	9	6	1	2
Steel / Aluminium	14	0.2	0.3	0.1	0.5		0.1	0.1			
Plastic/Other	2	0.6	6.5	4.8	0.1	0.3	3.6	0.8	0.7		0.7
Type of propulsion (%)											
Outboard engines	80	14	14	8	4	2	15	8	5	1	
Diesel	20	0.5	4.9	5.4	3.0	1.4	8.5	2.1	2.4	0.0	1.1

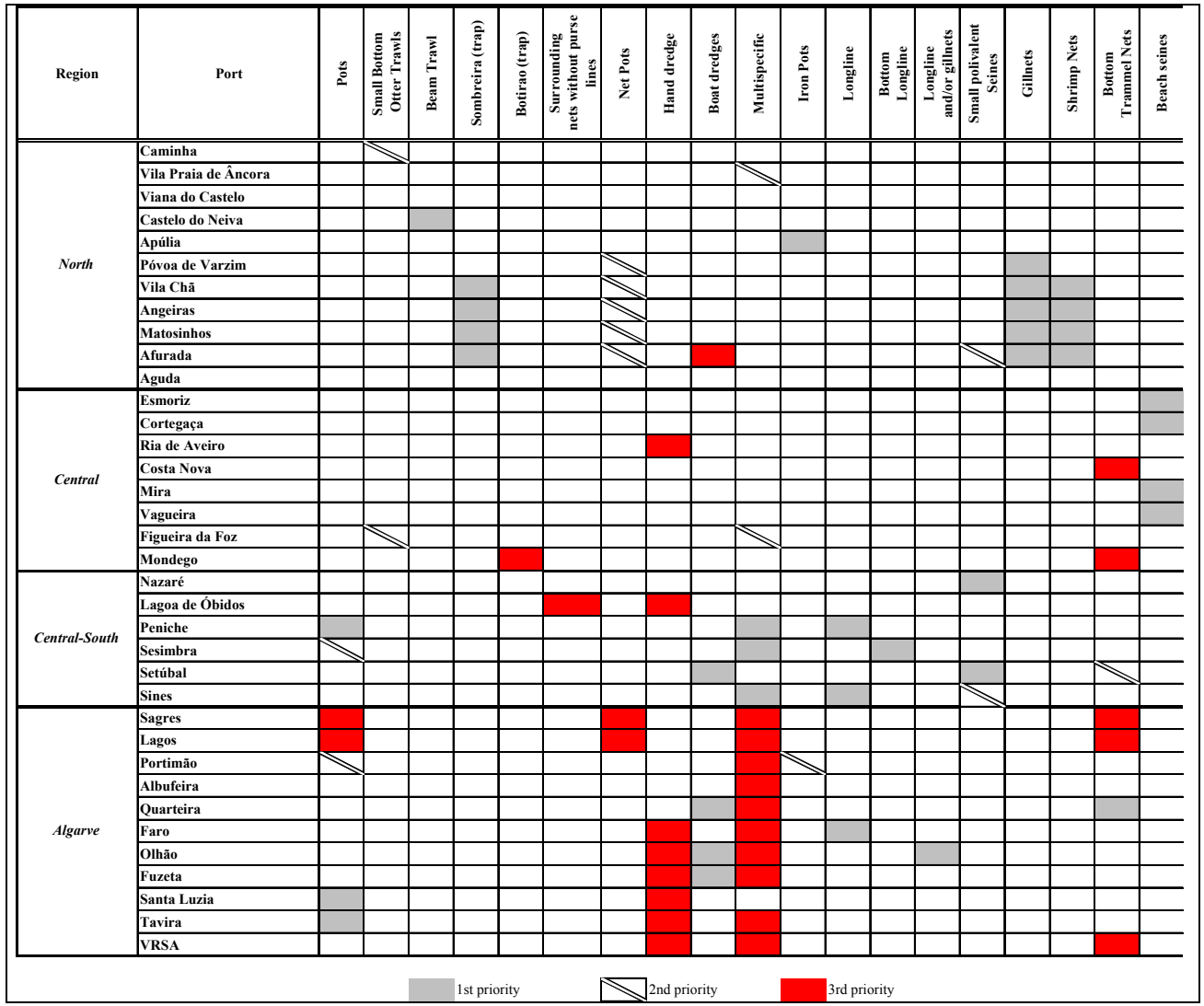
ANNEX 3

FAO codes, scientific names and English names, for the 30 species used in PECOSUDE.

Fao Code	Cientific name	Portuguese name	English name
BSF	*Aphanopus carbo*	Peixe espada preto	Black scabbardfish
BLT	*Auxis rochei*	Judeu	Bullet tuna
COC	*Cardium edule*	Berbigão vulgar	Common cockle
COE	*Conger conger*	Congro	European conger
BSE	*Dicentrarchus* spp.	Robalos nep.	Seabasses
SRG	*Diplodus* spp.	Sargos nep.	Sargo breams
CTB	*Diplodus vulgaris*	Sargo safia	Common two-banded seabream
DON	*Donax* spp.	Cadelinhas nep.	Wedge shell
ANE	*Engraulis encrasicolus*	Biqueirão	European anchovy
ANF	*Lophius* spp.	Tamboris nep	Anglerfish
MAG	*Mactra* spp.	Ameijolas	Hen clam / Smooth mactra
HKX	*Merluccius* spp.	Pescadas nep.	Hakes
THS	*Microchirus* spp.	Azevias nep	Bastard sole
MUL	Mugilidae	Tainhas	Mullets
MUX	*Mullus* spp.	Salmonetes nep.	Surmullets
OCT	Octopodidae	Polvos nep.	Octopuses
SBA	*Pagellus acarne*	Besugo	Axillary sea bream
FOX	*Physis* spp.	Abróteas	Forkbeards
SKA	*Raja* spp.	Raias nep.	Skates
PIL	*Sardina pilchardus*	Sardinha	European sardine
SLM	*Sarpa salpa*	Salema	Bambo fish
MAS	*Scomber japonicus*	Cavala	Chub mackerel
SCL	*Scyliorhinus* spp.	Pata roxa	Spotted dogfish
CTC	*Sepia officinalis*	Choco vulgar	Common cuttlefish
SOX	*Solea* spp.	Linguados nep.	Sole
CLX	*Spisula solida*	Ameijoa branca	Surf clam
HOM	*Trachurus trachurus*	Carapau	Horse mackerels
BIB	*Trisopterus luscus*	Faneca	Bib
CTS	*Venerupis pullastra*	Ameijoa macha	Carpet shell
SVE	*Venus* spp.	Pés de burro nep.	Striped venus

ANNEX 4

Fisheries priorities definition scheme



ANNEX 5

PERCENTAGE OF LANDINGS IN VALUE (EUROS) BY HARBOURS

CodFAO	A	CodFAO	CS	CodFAO	FF	CodFAO	L	CodFAO	LG	CodFAO	LX	CodFAO	N	CodFAO	O	CodFAO	PE	CodFAO	PM
HOM	**46.0**	**OCT**	**43.9**	**OCT**	**31.9**	XXX	20.3	**OCT**	**27.0**	**OCT**	**34.0**	**OCT**	**30.9**	**OCT**	**19.2**	**OCT**	**26.0**	**OCT**	**46.8**
XXX	24.2	XXX	20.0	**BIB**	**22.1**	**OCT**	**15.0**	XXX	22.9	XXX	18.8	XXX	14.0	**HKX**	**14.2**	XXX	16.7	XXX	14.7
COC	**9.3**	**SOX**	**9.2**	XXX	14.1	**SOX**	**12.8**	**ANF**	**6.3**	**ANE**	**13.3**	**SOX**	**10.8**	XXX	12.1	**SKA**	**9.6**	**SBA**	**7.6**
CTC	4.3	SKA	6.2	**SOX**	**11.5**	**BIB**	**9.5**	**THS**	**6.0**	**HOM**	**11.7**	**HOM**	**8.8**	**CTC**	**9.7**	**BIB**	**9.4**	CTC	6.0
CTS	4.2	BSE	5.9	BSE	8.2	**CLX**	**7.8**	**SBA**	**6.0**	PIL	7.8	BSE	7.7	**THS**	**6.7**	**BSE**	**9.3**	CTB	5.2
CLX	3.2	CTC	2.3	SKA	3.7	**BSE**	**7.4**	**CTC**	**5.0**	SOX	7.3	PIL	5.9	**SBA**	**6.4**	COE	5.8	MUX	4.5
BSE	2.5	HKX	2.2	HKX	3.5	PIL	7.2	MUX	4.0	COE	2.2	SKA	5.7	DON	4.5	SBA	3.7	THS	3.4
SOX	2.4	SRG	1.8	COE	1.8	THS	5.3	BSE	3.9	CTC	1.3	BIB	5.2	CTB	4.5	CTS	3.3	SOX	2.5
PIL	0.9	COE	1.6	SRG	0.9	HOM	3.7	HKX	2.8	SKA	1.1	SRG	4.4	SOX	4.4	SOX	3.2	COE	2.2
OCT	0.8	ANF	1.4	MUX	0.5	COE	3.6	CTB	2.4	HKX	0.8	COE	2.4	CLX	4.3	COC	3.0	PIL	1.7
ANE	0.6	BIB	1.2	SCL	0.5	ANE	1.8	SOX	2.1	DON	0.6	HKX	1.7	MUX	2.9	FOX	2.3	SRG	1.5
SRG	0.5	CTB	1.1	SBA	0.4	SKA	1.7	SKA	2.1	BIB	0.3	SLM	0.5	BLT	2.0	MUX	1.6	HKX	1.1
BIB	0.3	FOX	0.9	CTC	0.4	HKX	1.3	COE	2.1	BSE	0.3	FOX	0.5	ANF	1.4	ANF	1.4	BSE	0.8
CTB	0.1	MUX	0.8	ANF	0.1	CTB	0.7	FOX	1.7	SRG	0.2	ANF	0.5	SVE	1.4	CTB	1.3	FOX	0.7
SKA	0.1	DON	0.5	HOM	0.1	MUX	0.4	PIL	1.7	MUL	0.1	CTC	0.3	SKA	1.4	HKX	1.2	SKA	0.7
COE	0.1	SLM	0.2	FOX	0.1	MUL	0.4	SRG	1.5	THS	0.1	SBA	0.2	BSE	1.4	CTC	0.6	SCL	0.3
MAS	0.1	SBA	0.2	SLM	0.1	SRG	0.3	HOM	0.8	SCL	0.1	SCL	0.1	SRG	1.3	SRG	0.6	HOM	0.1
SBA	0.1	HOM	0.2			ANF	0.3	BIB	0.4	FOX	0.0	MUX	0.1	COE	0.8	THS	0.3	BIB	0.1
HKX	0.1	SCL	0.1			SBA	0.2	DON	0.4	MUX	0.0	MUL	0.1	HOM	0.4	HOM	0.2	ANF	0.1
MUX	0.0	THS	0.1			MAS	0.2	SCL	0.4			MAS	0.1	SCL	0.2	SCL	0.2	SLM	0.1
DON	0.0	MUL	0.1			CTC	0.2	MAS	0.2			THS	0.0	MUL	0.2	CLX	0.1	MUL	0.0
THS	0.0					SCL	0.1	MUL	0.2			CTB	0.0	SLM	0.2	SLM	0.1	MAS	0.0
MUL	0.0							SVE	0.1					FOX	0.2	MUL	0.1	DON	0.0
SCL	0.0							SLM	0.0					MAS	0.1	MAS	0.0	CLX	0.0
SLM	0.0													COC	0.1	BLT	0.0		
ANF	0.0													PIL	0.0	BSF	0.0		
														BIB	0.0	PIL	0.0		
																DON	0.0		
total	100.0	total	100	total	100	total	100	total	100	total	100	total	100	total	100	total	100	total	100

PERCENTAGE OF LANDINGS IN WEIGHT (TONNES) BY HARBOURS

CodFAO	A	CodFAO	CS	CodFAO	FF	CodFAO	L	CodFAO	LG	CodFAO	LX	CodFAO	N	CodFAO	O	CodFAO	PE	CodFAO	PM
COC	**42.2**	**OCT**	**57.4**	**OCT**	**33.6**	**PIL**	**25.9**	**OCT**	**34.8**	**OCT**	**26.2**	**OCT**	**26.6**	**OCT**	**17.6**	**OCT**	**25.6**	**OCT**	**54.7**
HOM	**25.6**	**SKA**	**10.6**	**BIB**	**31.8**	**OCT**	**11.7**	XXX	15.1	**HOM**	**21.9**	**PIL**	**26.5**	**CLX**	**17.6**	**COC**	**17.1**	**PIL**	**10.0**
XXX	20.5	XXX	8.6	XXX	10.7	**CLX**	**11.6**	**PIL**	**7.9**	**PIL**	**19.4**	**HOM**	**11.1**	**DON**	**9.8**	**BIB**	**12.1**	XXX	8.6
CTS	2.3	SOX	3.1	SKA	4.8	XXX	10.2	**CTC**	**5.1**	**ANE**	**18.8**	XXX	10.5	**HKX**	**8.8**	**SKA**	**10.3**	CTC	5.2
CTC	2.3	HKX	2.7	SCL	4.2	**BIB**	**9.7**	**ANF**	**4.5**	XXX	6.1	BIB	6.0	XXX	8.7	XXX	10.0	CTB	4.7
CLX	2.1	CTC	2.7	SOX	3.6	**HOM**	**7.6**	SBA	4.4	COE	2.0	SKA	5.6	BLT	8.7	COE	7.6	SBA	4.6
PIL	1.9	BIB	2.4	HKX	3.3	MUL	4.4	COE	3.4	SOX	1.9	SOX	2.7	CTC	6.7	CTS	3.9	COE	3.7
ANE	0.6	COE	2.1	BSE	2.6	SOX	3.2	HKX	3.1	CTC	0.8	COE	2.3	SVE	3.7	BSE	2.4	THS	1.3
MAS	0.5	BSE	2.1	COE	2.4	COE	3.0	CTB	2.9	SKA	0.8	BSE	1.8	CTB	3.6	FOX	2.2	SCL	1.3
SOX	0.4	SLM	1.2	HOM	0.7	ANE	2.8	SKA	2.8	HKX	0.6	SRG	1.5	SBA	2.9	SBA	2.1	MUX	1.1
BSE	0.4	FOX	1.1	MAS	0.4	THS	2.6	MAS	2.6	DON	0.4	SCL	1.2	THS	2.7	HKX	0.9	HKX	1.0
OCT	0.3	SCL	1.1	SRG	0.4	BSE	1.6	THS	2.6	BIB	0.3	SLM	1.1	SKA	1.1	SOX	0.9	SKA	0.7
BIB	0.2	CTB	1.0	SBA	0.4	CTB	1.4	FOX	2.2	MUL	0.3	HKX	1.0	COE	1.0	CTB	0.8	FOX	0.7
SRG	0.1	SRG	1.0	CTC	0.3	SKA	1.4	SCL	1.7	SCL	0.2	MAS	0.9	SOX	0.9	SCL	0.8	SRG	0.5
MUL	0.1	ANF	0.9	SLM	0.2	MAS	1.1	HOM	1.3	SRG	0.1	MUL	0.3	MAS	0.9	ANF	0.7	SOX	0.5
CTB	0.1	DON	0.6	MUX	0.2	HKX	0.7	BSE	1.2	BSE	0.1	FOX	0.3	ANF	0.7	CTC	0.5	MAS	0.4
SKA	0.1	HOM	0.6	MUL	0.2	SCL	0.4	MUX	1.2	FOX	0.0	ANF	0.2	MUX	0.6	HOM	0.5	SLM	0.2
SCL	0.1	MUL	0.3	FOX	0.1	SRG	0.2	DON	0.9	THS	0.0	CTC	0.2	MUL	0.6	MUX	0.4	BSE	0.2
COE	0.0	MUX	0.2	PIL	0.1	ANF	0.2	SOX	0.7	MUX	0.0	SBA	0.1	SLM	0.6	MUL	0.2	HOM	0.2
DON	0.0	SBA	0.1	ANF	0.1	SBA	0.1	SRG	0.6	SBA	0.0	THS	0.0	BSE	0.6	SRG	0.2	MUL	0.1
SLM	0.0	MAS	0.1	THS	0.0	CTC	0.1	MUL	0.5			MUX	0.0	HOM	0.5	CLX	0.2	BIB	0.1
SBA	0.0	THS	0.1			MUX	0.1	BIB	0.4			CTB	0.0	SRG	0.5	MAS	0.1	CLX	0.0
HKX	0.0	PIL	0.1			SLM	0.0	SLM	0.1			BLT	0.007	COC	0.5	SLM	0.1	ANF	0.0
THS	0.0	MAG	0.0			FOX	0.0	SVE	0.1			SVE	0.002	SCL	0.4	THS	0.1	DON	0.0
MUX	0.0	CTS	0.0					CLX	0.0					PIL	0.2	PIL	0.0		
ANF	0.0	SVE	0.0											FOX	0.1	BLT	0.0		
BLT	0.0													BIB	0.0	BSF	0.0		
														ANE		DON	0.0		
														MAG					
														CTS					
														BSF					
total	100.0	total	100.0	total	100.0	total	100.0	total	100.0	total	100.0	total	100.0	total	100.0	total	100.0	total	100.0

ANNEX 6

Discriminant Analysis (DA) methodology

Discriminant Analysis (DA) is a multivariate statistical method that allows the study of differences between two or more groups of individuals with respect to several variables simultaneously. Fundamentally DA has two major groups of procedures, the ones used for interpreting differences between groups and those employed to classify individuals into the groups. The first group of procedures is used when it is aimed to study the way in which groups differ (i.e., are discriminated) on the basis of some set of characteristics, and how well do they discriminate and which characteristics are the most powerful discriminators. The second group of applications is used to derive one or more mathematical equations for the purpose of classifications. These equations, called discriminant functions, combine the group characteristics in a way that allows a case to be linked to the group that it most closely resembles (Hair et al., 1995; Klecka, 1980). The characteristics used to distinguish between the groups are called discriminating variables. These variables must be measured at the interval or ratio level of measurement, which allows the calculation of means and variances.

The assumptions of the DA are summarized by the following requirements:
The variance and covariance matrices for each group must be approximately equal;
Each group must be drawn from a population with a multivariate normal distribution of the discriminating variables;
Two or more groups;
Two or more cases by group;
Any number of discriminating variables, provided that it is less than the total number of cases minus two;
Discriminating variables measured at the interval-level;
No discriminating variables may be linear combinations of other discriminating variables;
Any observations to each number of groups must be highest than the number of discriminating variables.

Classification Method

The classification method (described *in* Reis, 2001) is therefore the process for deciding the particular group in which a specific individual belongs. This decision is based on the information contained in the discriminating variables. There are several ways of using DA as a multivariate classification method, provided that the number **g** of groups is known *a priori*.
The criterion of the Fisher classification for more than two groups is to assign additional observations to the correct one. It involves one classified equation for each group. For each case and from the referring equations it is estimated a classified score. The cases are classified in the group in which had the highest classified score.
In a simple way, the classified equations to j $_{(j = 1, 2, \ldots, k)}$ group are:

$$C_j = c_{j0} + c_{j1}X_1 + c_{j2}X_2 + \ldots + c_{jp}X_p = c_{j0} + \underset{\sim j}{c'}\ \underset{\sim}{X}$$

where: c_{ji} is the classified coefficient to the group j, for variable $X_{I;}$ c_{j0} is a constant;
The total matrix of the sample variance and covariance estimates the coefficients (S) and the centroid of the group j ($\underset{\sim}{\bar{X}}$), more precisely:

$$\underset{\sim j}{c} = S^{-1}.\underset{\sim j}{X} \qquad and \qquad \underset{\sim j0}{c} = -\frac{1}{2}\underset{j}{c'}.\underset{\sim j}{\bar{X}}$$

where: $\underset{\sim}{X}_i$ is the group j which has the highest valor of the classified equation C_j.

Classification Matrix

When applied the DA to groups removed from a population with a multivariate normal distribution with known parameters, the probabilities of wrong classification will be estimated, and the algorithms used guarantee that probabilities are as little as possible.

But in practice in most of the cases, this theoretical situation is far form happen, in this situation it is used sample estimators.

There is a process that evaluates the DA performance and do not depend on the distribution by the groups considerate. It is creating a classification matrix, which compares the initial classifications (Original group) with a posterior classification (Predicted group), DA provides those results.

Table 1- Classification matrix.

Original Group	**N**	Predicted group			
		1	**2**	**…**	**k**
1	n_1	$\mathbf{n_{11}}$	n_{12}	…	n_{1k}
2	n_2	n_{21}	$\mathbf{n_{22}}$	…	n_{2k}
…	…	…	…	…	…
k	n_k	n_{k1}	n_{k2}	…	$\mathbf{n_{kk}}$
Unknown	n_0	n_{01}	n_{02}	…	n_{0k}

The table 1 illustrates the classification matrix, where the general term of this matrix is n_{ij}, i.e., the number of the initially classified individuals is group *i* and each predicted group is *j*. This matrix also include the unknown group.

All data, even those classified previously in the unknown group are divided by group sample size. Thus all cases became a membership of one known group excluding the unknown group.

A classification matrix that relates the predicted group membership with the original group membership may also be used to assess the performance of DA classification procedure. If this matrix is presented as percentages, the diagonal with a high percentage demonstrates the accurate of each predict group classification (Reis, 2001).

Indicators from the estimated matrix:
Percentage of the correctly classified cases

$$PCC = \frac{\sum_{i=1}^{k} n_{ii}}{n} * 100$$

Percentage of the incorrectly classified cases

$$PIC = \frac{\sum_{i=1}^{k}\sum_{\substack{j=1 \\ j\neq i}}^{k} n_{ij}}{n} * 100$$

or PIC = 100 - PCC

SPLUS® 2000 was the statistical software used for the Discriminant Analysis.

Homoscedastic model was used on our study. This model assumes that the group covariance matrices are equal to $\sum_j = \sum$, for all *j* = 1,…,K. Here p(p+1)/2 variance-covariances are estimated and the assumption of p- variate normality (p – number of variables).

It is possible fit a homoscedastic model using either the classical or canonical families.

Results

Traditionally, the Portuguese coast is divided in four region: North, Central, Central-South and Algarve (South). Based on this regional division and in the fact that the inquiry was performed by region, also inquiry Data Base was implemented by four regions. It was decided to implement the Discriminant Analysis in a regional basis.

The input data to classify the vessels with unknown gears, are 31 variables-species (30 species and one variable "others species"), one variable-date, one variable-gears and *n* rows (daily landings), the *n* is different in each region.

For each region DA was applied to each initial matrix. The dependent variables was 'fishing gears'. 'Species landed' and 'date' were the independent variables. Each resultant matrix was analysed with the empirical knowledge and some changes were made on the dependent variable. The new matrix was renamed as examined matrix.

Table 2- Number of groups and variables considerate to the original and examined matrix for the four regions from inquiries.

Region	Initial matrix			Examined matrix		
	Variables Species N	**Gears groups N**	**Gears groups N***	**Variables Species N**	**Gears groups N**	**Gears groups N***
Algarve	**30**	14	**13**	**30**	17	**9**
Central	**30**	21	**16**	**30**	28	**9**
Central-South	**29**	36	**36**	**29**	46	**32**
North	**25**	40	**39**	**25**	106	**32**

Notes: * applied one of the requirements of the DA (8th assumption).

The variable 'Species' dimension is not always 30, due to analysed vessels did not landed some species.

Table 3- Percentage of correct classification for the four regions from inquiries.

Region	**Initial matrix**	**Examined matrix**
Algarve	67	**70**
Central	57	**74**
Central-South	36	**52**
North	20	**44**

For all regions examined matrices had the best classifications.

The statistical analysis performed is presented in the following scheme (Figure 1).

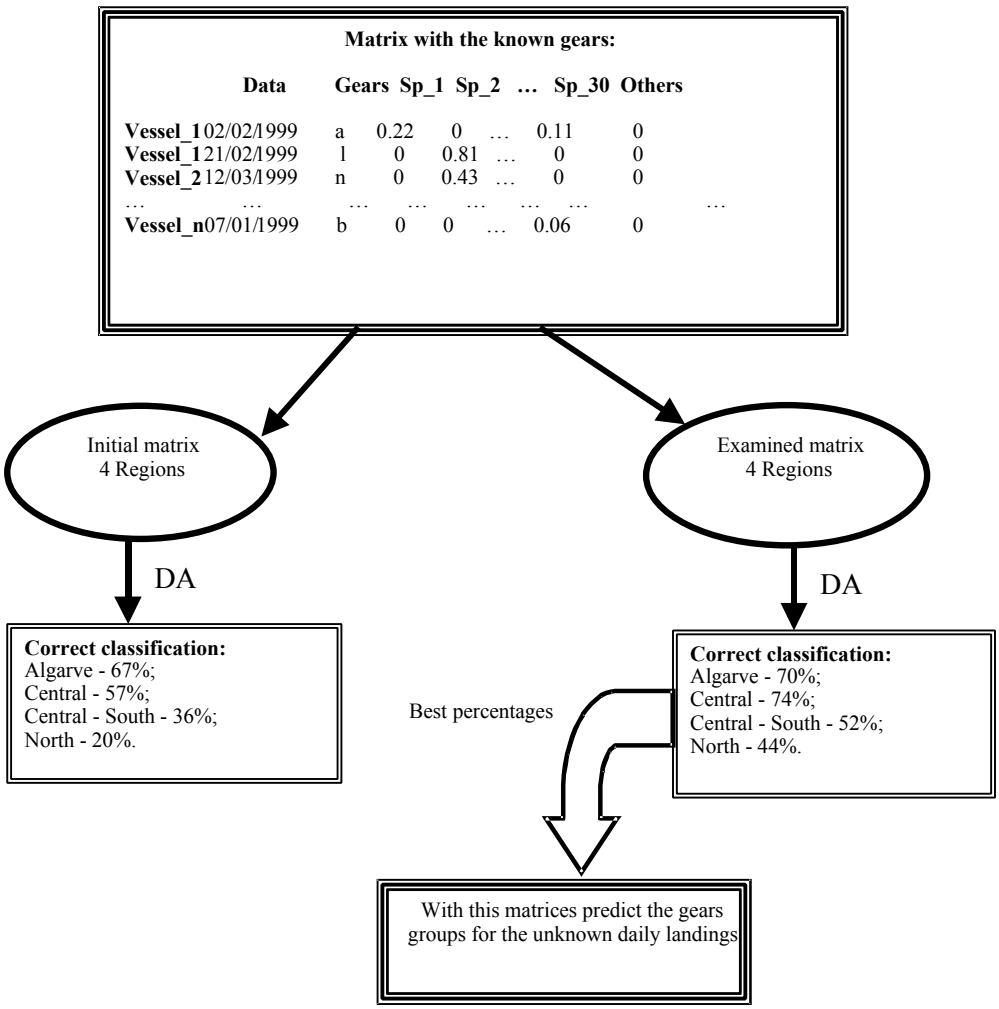


Figure 1- Flowchart of the DA performance

Classification Matrix – application

To illustrate the classification matrix methodology it is present the Algarve results. In order to test the performance of the model, the known observations were re-classified. The numbers of observation in each group are present in Table 4, and the percentages in table 5.

Table 4- Number of observations of daily landings of the classification Algarve region (to gears codes *see* Annex 7).

Fishing gears	**a**	**at**	**atz**	**au**	**j**	**l**	**lz**	**n**	**z**	**Total**
a	**168**	30	6	52	0	99	0	0	8	363
at	92	**184**	16	115	0	111	0	0	33	551
atz	13	1	**28**	4	0	25	0	0	2	73
au	19	16	0	**180**	0	65	0	0	1	281
j	0	0	0	0	**23**	187	0	0	0	210
l	0	0	0	1	85	**2051**	1	0	1	2139
lz	0	6	0	0	23	682	**2**	0	21	734
n	0	2	2	0	0	96	0	**2646**	0	2746
z	0	2	0	0	8	411	0	0	**33**	454
Unknown	5338	12625	9559	3733	325	33308	2152	3592	3472	74104
Total	5630	12866	9611	4085	464	37035	2155	6238	3571	81655

Table 5- Percentage of daily landings of the classification Algarve region.

Fishing gears	a	at	atz	au	j	l	lz	n	z	Total
a	**46**	8	2	14	0	27	0	0	2	100
at	17	**33**	3	21	0	20	0	0	6	100
atz	18	1	**38**	5	0	34	0	0	3	100
au	7	6	0	**64**	0	23	0	0	0	100
j	0	0	0	0	**11**	89	0	0	0	100
l	0	0	0	0	4	**96**	0	0	0	100
lz	0	1	0	0	3	93	**0**	0	3	100
n	0	0	0	0	0	3	0	**96**	0	100
z	0	0	0	0	2	91	0	0	**7**	100
Unknown	7	17	13	5	0	45	3	5	5	100
Total	7	16	12	5	1	45	3	8	4	100

In Algarve, the 7550 know original observations were re-classified with a precision of 70%. The remaining 74104 unknown observations where classified in the 9 groups.

The highest probability of incorrectly classification were in group ‘lz’ and ‘z’ (Traps and others). Groups ‘l’ (Traps) and ‘n’ (Trawl) had a precision above 90%.

The following classifications tables represent the remaining regions.

Table 6- Number of daily landings of the classification North.

Fishing gears	biqrtv	birtu	birtv	bv	cfqtv	cfrtv	du	duv	duvz	duz	e	f	fil	filt	fqrt	fqrtv	ft	i	iq	it	lqtv	prt	prtu	qt	rt	rtv	ru	t	tv	uv	v	x	Total
biqrtv	**1**	3	1	5	0	9	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	2	0	0	5	0	0	0	0	27
birtu	2	**12**	1	1	0	20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	3	0	0	0	0	3	1	0	1	0	45
birtv	2	8	**11**	7	0	18	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	4	1	0	7	0	0	0	0	61
bv	0	0	1	**25**	0	0	0	5	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	33
cfqtv	0	3	0	0	**0**	35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	20	0	0	0	0	58
cfrtv	0	1	0	0	0	**85**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	32	0	0	0	0	118
du	0	0	0	0	0	0	**0**	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	38	0	0	0	0	39
duv	0	0	2	4	0	0	0	**48**	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	81	0	0	3	0	143
duvz	0	1	1	5	0	3	0	33	**11**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	83	0	0	6	0	143
duz	0	0	0	0	0	0	0	2	0	**0**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	34	0	0	1	0	37
e	0	0	0	0	0	0	0	0	0	0	**11**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	31	46
f	0	0	0	0	0	0	0	0	0	0	0	**44**	6	0	0	0	12	20	2	0	0	0	0	0	0	0	0	149	0	0	0	0	233
fil	0	0	0	0	0	0	0	0	0	0	0	10	**15**	0	0	0	1	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	28
filt	0	0	0	0	0	0	0	0	0	0	0	0	0	**22**	0	0	1	0	0	8	0	0	0	0	0	0	0	5	0	0	0	0	36
fqrt	0	2	0	0	0	32	0	0	0	0	0	0	0	0	**0**	0	0	0	0	0	0	0	0	0	0	0	0	14	0	0	0	0	48
fqrtv	0	0	0	0	0	35	0	0	0	0	0	0	0	0	0	**0**	0	0	0	0	0	0	0	0	0	0	0	14	0	0	0	0	49
ft	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	**78**	0	0	0	0	0	0	0	0	0	0	44	0	0	0	0	123
i	0	0	0	0	0	0	0	0	0	0	0	88	1	3	0	0	0	**9**	22	8	0	0	0	0	0	0	0	82	0	0	0	0	213
iq	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	**23**	0	0	0	0	0	0	0	0	0	0	0	0	0	27
it	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	**49**	0	0	0	0	0	0	0	84	0	0	0	0	135
lqtv	0	1	0	6	0	0	0	12	1	0	0	5	1	0	0	0	0	9	0	0	**15**	0	0	0	0	0	0	13	0	0	0	0	63
prt	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**	4	0	26	0	0	11	0	0	0	0	41
prtu	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**26**	0	33	7	0	30	0	0	1	0	98
qt	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**	0	0	0	667	0	0	0	0	667
rt	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	25	0	**223**	1	0	70	0	0	0	0	320
rtv	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	0	26	**14**	0	9	0	0	6	0	62
ru	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	17	0	**0**	6	0	0	0	0	27
t	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	20	0	0	49	12	0	1	0	24	0	0	**896**	7	0	0	0	1010
tv	1	44	0	7	0	13	0	0	1	0	0	0	7	8	0	0	6	0	0	18	12	0	0	0	0	2	0	12	**69**	0	28	0	228
uv	0	0	1	5	0	0	0	22	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	91	0	**0**	0	0	126
v	0	0	0	2	0	0	0	3	0	0	0	25	44	0	0	0	7	0	0	0	0	0	0	1	0	0	0	97	9	0	**187**	0	375
x	0	0	0	0	0	0	0	0	0	0	78	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	151	0	0	0	**498**	727
Unknown	17	1007	417	636	1	3855	0	1149	91	0	330	2190	3383	959	0	0	506	1458	1968	1429	1232	0	580	121	1515	92	0	14831	4395	8	4067	1197	47434
Total	23	1084	435	703	1	4107	0	1276	116	0	420	2363	3457	992	0	0	632	1500	2015	1562	1272	0	652	122	1870	117	0	17586	4481	8	4300	1726	52820

Table 7- Percentage of daily landings of the classification North.

Fishing gears	biqrtv	birtu	birtv	bv	cfqtv	cfrtv	du	duv	duvz	duz	e	f	fil	filt	fqrt	fqrtv	ft	i	iq	it	lqtv	prt	prtu	qt	rt	rtv	ru	t	tv	uv	v	x	Total
biqrtv	**4**	11	4	19	0	33	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	7	0	0	19	0	0	0	0	100
birtu	4	**27**	2	2	0	44	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	7	0	0	0	0	7	2	0	2	0	100
birtv	3	13	**18**	11	0	30	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	7	2	0	11	0	0	0	0	100
bv	0	0	3	**76**	0	0	0	15	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	100
cfqtv	0	5	0	0	**0**	60	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	34	0	0	0	0	100
cfrtv	0	1	0	0	0	**72**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	27	0	0	0	0	100
du	0	0	0	0	0	0	**0**	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	97	0	0	0	0	100
duv	0	0	1	3	0	0	0	**34**	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	57	0	0	2	0	100
duvz	0	1	1	3	0	2	0	23	**8**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	58	0	0	4	0	100
duz	0	0	0	0	0	0	0	5	0	**0**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	92	0	0	3	0	100
e	0	0	0	0	0	0	0	0	0	0	**24**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9	0	0	0	67	100
f	0	0	0	0	0	0	0	0	0	0	0	**19**	3	0	0	0	5	9	1	0	0	0	0	0	0	0	0	64	0	0	0	0	100
fil	0	0	0	0	0	0	0	0	0	0	0	36	**54**	0	0	0	4	0	0	0	0	0	0	0	0	0	0	7	0	0	0	0	100
filt	0	0	0	0	0	0	0	0	0	0	0	0	0	**61**	0	0	3	0	0	22	0	0	0	0	0	0	0	14	0	0	0	0	100
fqrt	0	4	0	0	0	67	0	0	0	0	0	0	0	0	**0**	0	0	0	0	0	0	0	0	0	0	0	0	29	0	0	0	0	100
fqrtv	0	0	0	0	0	71	0	0	0	0	0	0	0	0	0	**0**	0	0	0	0	0	0	0	0	0	0	0	29	0	0	0	0	100
ft	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	**63**	0	0	0	0	0	0	0	0	0	0	36	0	0	0	0	100
i	0	0	0	0	0	0	0	0	0	0	0	41	0	1	0	0	0	**4**	10	4	0	0	0	0	0	0	0	38	0	0	0	0	100
iq	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	15	**85**	0	0	0	0	0	0	0	0	0	0	0	0	0	100
it	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	**36**	0	0	0	0	0	0	0	62	0	0	0	0	100
lqtv	0	2	0	10	0	0	0	19	2	0	0	8	2	0	0	0	0	14	0	0	**24**	0	0	0	0	0	0	21	0	0	0	0	100
prt	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**	10	0	63	0	0	27	0	0	0	0	100
prtu	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**27**	0	34	7	0	31	0	0	1	0	100
qt	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**	0	0	0	100	0	0	0	0	100
rt	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8	0	**70**	0	0	22	0	0	0	0	100
rtv	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	11	0	42	**23**	0	15	0	0	10	0	100
ru	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	15	0	63	0	**0**	22	0	0	0	0	100
t	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	5	1	0	0	0	2	0	0	**89**	1	0	0	0	100
tv	0	19	0	3	0	6	0	0	0	0	0	0	3	4	0	0	3	0	0	8	5	0	0	0	0	1	0	5	**30**	0	12	0	100
uv	0	0	1	4	0	0	0	17	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	72	0	**0**	0	0	100
v	0	0	0	1	0	0	0	1	0	0	0	7	12	0	0	0	2	0	0	0	0	0	0	0	0	0	0	26	2	0	**50**	0	100
x	0	0	0	0	0	0	0	0	0	0	11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	21	0	0	0	**69**	100
Unknown	0	2	1	1	0	8	0	2	0	0	1	5	7	2	0	0	1	3	4	3	3	0	1	0	3	0	0	31	9	0	9	3	100
Total	0	2	1	1	0	8	0	2	0	0	1	4	7	2	0	0	1	3	4	3	2	0	1	0	4	0	0	33	8	0	8	3	100

Table 8- Number of daily landings of the classification Central-South.

Fishing gears	a	aqt	atv	h	i	iqt	iqv	it	iw	j	jlv	kl	klq	kq	kqtv	l	lotv	lqv	lv	n	o	oq	otv	q	qt	qtv	qv	t	tv	v	w	y	Total
a	**169**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	70	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	239
aqt	0	**19**	0	0	0	0	0	0	0	1	0	0	0	0	0	1	1	0	0	0	14	0	0	1	0	17	0	0	0	33	0	0	87
atv	0	0	**0**	0	0	0	0	0	0	0	0	0	0	0	0	31	0	0	0	0	1	0	0	0	0	0	1	0	2	64	0	0	99
h	0	0	0	**87**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	3	1	40	0	0	132
i	49	0	0	0	**230**	0	0	25	71	2	0	5	1	3	0	174	0	0	0	0	0	0	0	1	0	0	0	0	0	7	0	0	568
iqt	0	0	0	0	8	**6**	0	5	0	0	0	0	0	0	0	21	0	0	0	0	0	0	0	0	0	0	0	0	0	20	0	0	60
iqv	1	0	0	0	0	0	**0**	0	0	0	0	0	0	0	0	7	0	0	0	0	0	0	0	0	2	0	0	0	5	24	0	0	39
it	12	2	0	0	118	0	0	**20**	67	0	6	1	0	0	0	65	0	0	0	0	11	0	0	2	0	2	0	0	0	19	8	0	333
iw	0	0	2	0	42	0	0	23	**115**	0	2	0	0	0	0	3	0	0	0	0	8	0	0	0	1	0	0	0	0	8	7	0	211
j	0	0	0	0	0	0	0	0	0	**4**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	225	0	0	229
jlv	0	0	0	0	0	0	0	0	0	0	**23**	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	60	0	0	86
kl	15	0	0	0	0	0	0	0	0	0	0	**69**	0	23	0	87	0	0	0	0	0	0	0	2	0	0	0	0	0	9	0	0	205
klq	0	0	0	0	0	0	0	0	0	1	0	3	**0**	7	0	13	0	0	0	0	0	0	0	3	0	0	0	0	0	10	0	0	37
kq	0	0	0	0	0	0	0	0	0	1	0	0	0	**77**	0	0	0	0	0	0	0	0	0	26	2	6	0	0	0	21	0	0	133
kqtv	0	6	0	0	0	0	0	0	0	0	0	0	0	0	**0**	0	0	0	0	0	1	0	0	3	0	17	0	0	0	21	0	0	48
l	43	0	0	0	0	0	0	0	0	0	0	1	0	0	0	**940**	1	0	0	0	0	0	0	0	0	0	0	0	0	28	0	0	1013
lotv	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	19	**4**	0	0	0	0	0	0	0	2	0	0	0	0	26	0	0	51
lqv	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	14	0	**0**	0	0	0	0	0	0	0	0	1	0	0	17	0	0	35
lv	0	0	0	0	0	0	0	0	0	0	3	1	0	1	0	24	1	0	**0**	0	0	0	0	2	0	1	3	0	4	46	0	0	86
n	0	0	0	0	0	0	0	1	0	1	0	1	0	8	0	5	0	0	0	**726**	0	1	0	0	0	0	1	0	0	79	2	0	825
o	0	0	0	0	0	0	0	0	0	19	0	0	0	0	0	0	0	0	0	0	**89**	5	0	20	0	0	0	0	0	69	0	0	202
oq	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8	0	0	0	0	4	**0**	0	6	0	0	0	0	0	27	0	0	45
otv	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	**0**	1	1	0	0	0	0	36	0	0	39
q	10	64	1	0	0	1	0	12	3	5	0	0	2	81	0	48	0	0	0	0	39	12	0	**556**	22	41	0	0	4	307	83	0	1291
qt	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	**6**	0	0	0	0	4	0	0	12
qtv	13	47	1	0	0	0	0	2	0	0	0	0	0	5	0	34	0	0	0	0	12	0	0	16	23	**67**	0	0	14	113	3	0	350
qv	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	1	0	0	0	0	3	0	0	8	0	2	**5**	0	6	118	1	0	148
t	0	0	0	0	0	1	0	12	10	0	0	0	0	0	0	1	0	0	0	0	1	0	0	5	1	0	0	**27**	0	31	25	0	114
tv	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	4	4	20	0	2	**6**	184	2	0	226
v	0	2	0	0	0	0	0	0	0	1	33	0	0	0	0	24	0	0	0	0	0	0	0	6	1	15	35	0	23	**1100**	8	0	1248
w	0	3	0	0	0	0	0	7	15	0	2	0	0	0	0	0	0	0	0	0	14	0	0	5	1	5	0	0	0	44	**49**	0	145
y	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	19	0	0	0	0	0	0	0	0	0	0	0	0	0	24	0	**0**	43
Unknown	1630	212	74	1280	954	7	0	416	485	452	403	197	35	967	5	19497	165	0	1	1223	1014	162	0	2489	447	486	696	483	539	55684	1731	0	91734
Total	1942	358	78	1367	1352	15	0	523	766	487	476	278	38	1176	5	21111	172	0	1	1949	1212	180	0	3156	513	680	742	515	604	58498	1919	0	100113

Table 9- Percentage of daily landings of the classification Central-South.

Fishing gears	a	aqt	atv	h	i	iqt	iqv	it	iw	j	jlv	kl	klq	kq	kqtv	l	lotv	lqv	lv	n	o	oq	otv	q	qt	qtv	qv	t	tv	v	w	y	Total
a	**71**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100
aqt	0	**22**	0	0	0	0	0	0	0	1	0	0	0	0	0	1	1	0	0	0	16	0	0	1	0	20	0	0	0	38	0	0	100
atv	0	0	**0**	0	0	0	0	0	0	0	0	0	0	0	0	31	0	0	0	0	1	0	0	0	0	0	1	0	2	65	0	0	100
h	0	0	0	**66**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	2	1	30	0	0	100
i	9	0	0	0	**40**	0	0	4	13	0	0	1	0	1	0	31	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	100
iqt	0	0	0	0	13	**10**	0	8	0	0	0	0	0	0	0	35	0	0	0	0	0	0	0	0	0	0	0	0	0	33	0	0	100
iqv	3	0	0	0	0	0	**0**	0	0	0	0	0	0	0	0	18	0	0	0	0	0	0	0	0	5	0	0	0	13	62	0	0	100
it	4	1	0	0	35	0	0	**6**	20	0	2	0	0	0	0	20	0	0	0	0	3	0	0	1	0	1	0	0	0	6	2	0	100
iw	0	0	1	0	20	0	0	11	**55**	0	1	0	0	0	0	1	0	0	0	0	4	0	0	0	0	0	0	0	0	4	3	0	100
j	0	0	0	0	0	0	0	0	0	**2**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	98	0	0	100
jlv	0	0	0	0	0	0	0	0	0	0	**27**	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	70	0	0	100
kl	7	0	0	0	0	0	0	0	0	0	0	**34**	0	11	0	42	0	0	0	0	0	0	0	1	0	0	0	0	0	4	0	0	100
klq	0	0	0	0	0	0	0	0	0	3	0	8	**0**	19	0	35	0	0	0	0	0	0	0	8	0	0	0	0	0	27	0	0	100
kq	0	0	0	0	0	0	0	0	0	1	0	0	0	**58**	0	0	0	0	0	0	0	0	0	20	2	5	0	0	0	16	0	0	100
kqtv	0	13	0	0	0	0	0	0	0	0	0	0	0	0	**0**	0	0	0	0	0	2	0	0	6	0	35	0	0	0	44	0	0	100
l	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**93**	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	100
lotv	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	37	**8**	0	0	0	0	0	0	4	0	0	0	0	0	51	0	0	100
lqv	0	0	0	0	0	0	0	0	0	0	9	0	0	0	0	40	0	**0**	0	0	0	0	0	0	0	0	3	0	0	49	0	0	100
lv	0	0	0	0	0	0	0	0	0	0	3	1	0	1	0	28	1	0	**0**	0	0	0	0	2	0	1	3	0	5	53	0	0	100
n	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	**88**	0	0	0	0	0	0	0	0	0	10	0	0	100
o	0	0	0	0	0	0	0	0	0	9	0	0	0	0	0	0	0	0	0	0	**44**	2	0	10	0	0	0	0	0	34	0	0	100
oq	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	18	0	0	0	0	9	**0**	0	13	0	0	0	0	0	60	0	0	100
otv	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	**0**	3	3	0	0	0	0	92	0	0	100
q	1	5	0	0	0	0	0	1	0	0	0	0	0	6	0	4	0	0	0	0	3	1	0	**43**	2	3	0	0	0	24	6	0	100
qt	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	17	0	0	0	0	0	0	0	0	**50**	0	0	0	0	33	0	0	100
qtv	4	13	0	0	0	0	0	1	0	0	0	0	0	1	0	10	0	0	0	0	3	0	0	5	7	**19**	0	0	4	32	1	0	100
qv	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	1	0	0	0	0	2	0	0	5	0	1	**3**	0	4	80	1	0	100
t	0	0	0	0	0	1	0	11	9	0	0	0	0	0	0	1	0	0	0	0	1	0	0	4	1	0	0	**24**	0	27	22	0	100
tv	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	9	0	1	**3**	81	1	0	100
v	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	2	0	0	0	0	0	0	0	0	0	1	3	0	2	**88**	1	0	100
w	0	2	0	0	0	0	0	5	10	0	1	0	0	0	0	0	0	0	0	0	10	0	0	3	1	3	0	0	0	30	**34**	0	100
y	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	44	0	0	0	0	0	0	0	0	0	0	0	0	0	56	0	**0**	100
Unknown	2	0	0	1	1	0	0	0	1	0	0	0	0	1	0	21	0	0	0	1	1	0	0	3	0	1	1	1	1	61	2	0	100
Total	2	0	0	1	1	0	0	1	1	0	0	0	0	1	0	21	0	0	0	2	1	0	0	3	1	1	1	1	1	58	2	0	100

Table 10- Number of observations of the daily landings of the classification Central region.

Fishing gears	**abkqtv**	**b**	**bqtv**	**btv**	**d**	**kqtv**	**m**	**tv**	**v**	**Total**
abkqtv	**74**		4	2		1	5			86
b		**830**					144			974
bqtv	3	1	**3**	13		1	65			86
btv	7	8	2	**107**			70			194
d					**34**		130			164
kqtv			2	1		**25**	34	11		73
m			1			1	**1290**	1	12	1305
tv			4	1		16	104	**78**	11	214
v							181	9	**17**	207
Unknown	341	230	81	109	985	32	2496	96	169	4539
Total	425	1069	97	233	1019	76	4519	195	209	7842

Table 11- Percentage of the daily landings of the classification Central region.

Fishing gears	**abkqtv**	**b**	**bqtv**	**btv**	**d**	**kqtv**	**m**	**tv**	**v**	**Total**
abkqtv	**86**	0	5	2	0	1	6	0	0	100
b	0	**85**	0	0	0	0	15	0	0	100
bqtv	3	1	**3**	15	0	1	76	0	0	100
btv	4	4	1	**55**	0	0	36	0	0	100
d	0	0	0	0	**21**	0	79	0	0	100
kqtv	0	0	3	1	0	**34**	47	15	0	100
m	0	0	0	0	0	0	**99**	0	1	100
tv	0	0	2	0	0	7	49	**36**	5	100
v	0	0	0	0	0	0	87	4	**8**	100
Unknown	8	5	2	2	22	1	55	2	4	100
Total	5	14	1	3	13	1	58	2	3	100

Cluster Analysis (CA)

After DA the multivariate statistical method, was Cluster Analysis (CA). To identify homogeneous cases groups based on selected characteristics, it was used an algorithm *(K-means clustering)* that can handle large numbers of cases.

There are two major groups of methods in CA, the hierarchical and the non-hierarchical methods.

A hierarchical method describes a method yielding an entire hierarchy of clustering for the given data set. *Agglomerate methods* start with the situation where each object in the data set forms its own little cluster, and then successively merges clusters until only one large cluster remains which is the whole data set. *Divisive methods* start by considering the whole data set as one cluster, and then splits up clusters until each object is separate.

A non-hierarchical method, also named *K-means clustering* (especially in the CA software), *Partitioning methods* describes a method that divides the data set into k homogenous groups however, the algorithm requires you to specify the number of clusters. Typically, the user runs the algorithm for a range of k-values. For each k, the algorithm carries out the clustering and also yields a "quality index," which allows the user to select the "best" value of k afterwards.

In this methodology there are no hierarchic structures in the classification and seek for the best grouping structure of the data.

Each group (set of vessels) is a population well defined.

'Iterate and classify' method was used to determine the Cluster centroids, for classifying cases.

K-means algorithm iterates until convergence criterion is satisfied (between 1 and 999). The convergence criterion represents a proportion of the minimum distance of initial cluster centroids. The k-means clustering analysis is efficient mainly because it does not compute the distances between all pairs of cases as do many clustering methods do (including the hierarchical clustering).

This fact makes the procedure faster. On the other hand, the hierarchical procedure allows much more flexibility in your cluster analysis: you can use any of a number of distance or similarity measures, including options for binary and count data, and you do not need to specify the number of clusters a priori.

The distances were computed using Euclidean Distance (ED). This is the most commonly used distance and corresponds to the usual geometric distance between points of co-ordinates $(x_{i1},\ldots,x_{ip})$ and $(x_{j1},\ldots,x_{jp})$ and is given by

$$ED= \sqrt{\sum_{K=1}^{p}(x_{ik}-x_{jk})^2}$$

where: p is the number of variables, and i and j are observations (i.e., rows) of the matrix data.

As scale variables are similar, it was not necessary standardise them before perform k-means clustering analysis.

It's necessary select the appropriate number of clusters and include all relevant variables. If it is chosen an inappropriate number of clusters or omitted important variables, the results may be misleading.

The statistical software used for the K-Means Clustering analysis was SPSS® 9.0. The input data to identify the fleet components were 31 variables-species (30 species and one variable "others species"), 59 variables-gears (single or group gears) and 3535 rows (vessels) (*see* Annexes 3 and 9).

It was considerate the following criteria for fishing gears and species to construct the matrix:

Criteria for Gears:
Indices 1: 0 months of gear utilization by vessel;
Indices 2: 1 months of gear utilization by vessel;
Indices 3: 2 or 3 months of gear utilization by vessel;
Indices 4: 4 to 8 months of gear utilization by vessel;
Indices 5: 9 to 12 months of gear utilization by vessel;

Criteria for Species:
Indices 1: 0% landed species by vessel in 1999;
Indices 2:]0%, 10%] landed species by vessel in 1999;
Indices 3:]10%, 50%] landed species by vessel in 1999;
Indices 4:]50%, 100%] landed species by vessel in 1999.

The *K-means clustering* performed is presented in the following scheme (Figure 2).

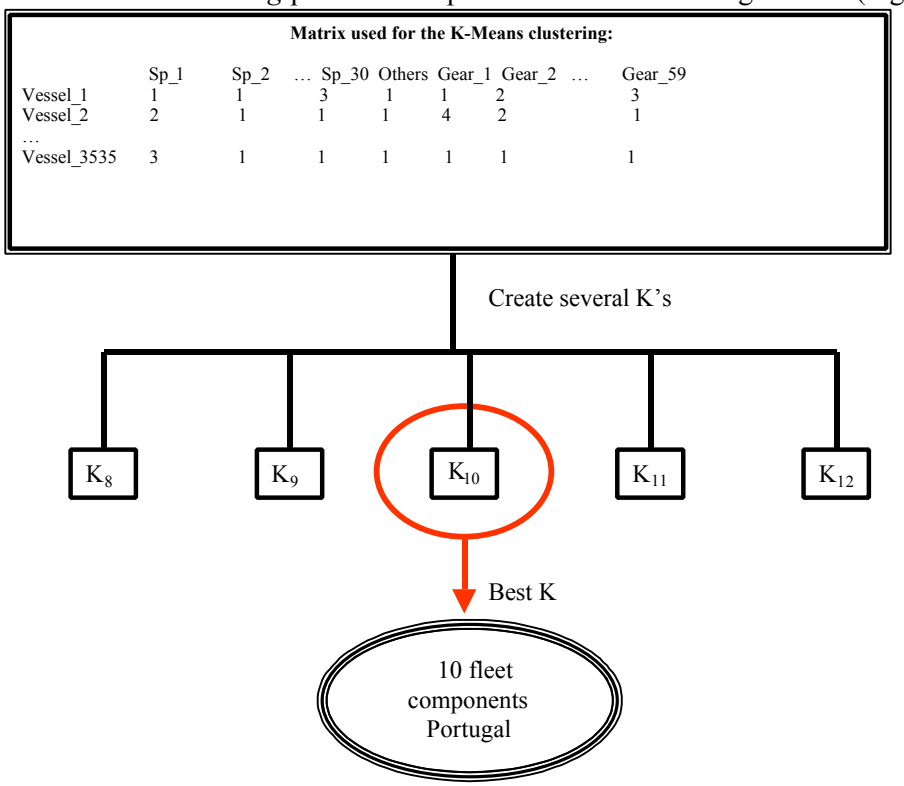


Figure 2- Flowchart of the *K-means clustering* procedure.

ANNEX 7

Gears fishing used to the study

Code	Fishing gears	Family fishing gears
a	Octopus pots	Traps
b	Bottom otter trawl	Trawl
c	Beam trawl	Trawl
d	Manual dredge	Dredges
e	Bombos	Traps
f	Iron pots	Traps
g	Fishing rod	Hooks and lines
h	Purse seine	Purse Seine
I	Mix netpots	Traps
j	Crustaceans netpots	Traps
k	Fishs netpots	Traps
l	Octopus netpots	Traps
m	Beach seines	Beach seines
n	Boat dredges	Dredges
o	Handline	Hooks and lines
p	Others lines	Hooks and lines
q	Bottom longline	Hooks and lines
r	Floating bottom longline	Hooks and lines
s	Drifting gillnet	Nets
t	Bottom gillnet	Nets
u	Drifting trammel nets	Nets
v	Bottom trammel nets	Nets
w	Mix nets	Nets (*)
x	Sombreira	Lift nets
y	Squid jig	Hooks and lines
z	Others	

*Gillnets and/or Trammelnets

ANNEX 8 - Socio-economic inquiries

PESCA ARTESANAL
INQUÉRITO SÓCIO-ECONÓMICO

I. Características da(s) embarcação(ões)

Primeira embarcação

Nome da embarcação: _____ N° matrícula: _____
Porto de armamento: _____ Nº PRT: _____

Tipo de embarcação
(lancha, cabinado, ..) : _____ Propriedade/co-propriedade: _____

Material do casco: _____ Estrutura jurídica: _____

Comprimento: _____ Arqueação da embarcação: _____

Potência: _____ Ano de construção: _____

Ano de compra : _____ Preço de compra (com/sem aparelhos incluídos): _____

Modo de financiamento (%):
Empréstimo: _____ Auto-financiamento: _____ Subsídio: _____

Número de remotorizações efectuadas desde a compra: _____
Data da última remotorização : _____
Motor actual adquirido novo ou em 2ª mão?: _____

Modo de financiamento da última remotorização (%) :
Empréstimo: _____ Auto-financiamento:_____ Subsídio (Comparticipação): _____

Número de marés/horas motor (1999/2000): _____

Consumo gasóleo + óleo (1999/2000) : _____ Incluído nos custos exploração?_____
Custo da manutenção/reparação
da embarcação (1999/2000): _____ Incluído nos custos exploração?_____

Valor actual da embarcação* (estimado): _____ Valor segurado: _____

Custo do seguro (1999/2000) : _____ Incluído nos custos de exploração?_____

Equipamentos da ponte:

	Transmissão	**Navegação**	**Detecção**	**Informática a bordo**	**Outros (controlos dos aparelhos de pesca)**
Descrição					
Ano de instalação					
Preço de compra					

* casco, motor, aparelhos electrónicos e mecânicos (sem aparelhos de pesca)

Segunda embarcação

Nome da embarcação _____ N° matrícula: _____

Porto de armamento: _____ Nº PRT: _____

Tipo de embarcação
(lancha, cabinado, ...) : _____ Propriedade/co-propriedade: _____

Material do casco: _____ Estrutura jurídica: _____

Comprimento: _____ Arqueação da embarcação _____

Potência: _____ Ano de construção: _____

Ano de compra : _____ Preço de compra (aparelhos incluídos?): _____

Modo de financiamento (%):
Empréstimo: _____ Auto-financiamento: _____ Subsídio: _____

Número de remotorizações efectuadas desde a compra: _____
Data da última remotorização : _____
Motor actual adquirido novo ou em 2ª mão?: _____

Modo de financiamento da última remotorização (%) :
Empréstimo: _____ Auto-financiamento:_____ Subsídio (Comparticipação): _____

Número de marés/horas motor (1999/2000): _____
Consumo gasóleo + óleo (1999/2000) : _____ Incluído nos custos exploração?_____
Custo da manutenção/reparação
da embarcação (1999/2000) : _____ Incluído nos custos exploração?_____

Valor actual da embarcação* (estimado): _____Valor segurado: _____

Custo do seguro (1999/2000) : _____incluído nos custos comuns?_____

Equipamento da ponte :

	Transmissão	**Navegação**	**Detecção**	**Informática a bordo**	**Outros (controlos dos aparelhos de pesca)**
Descrição					
Ano de instalação					
Preço de compra					

***** casco, motor, aparelhos electrónicos e mecânicos (sem aparelhos de pesca)

II. Descrição dos aparelhos de pesca por embarcação (1999 ou 2000*)

A compra e a manutenção/reparação do material de pesca pertence aos custos comuns (custos de exploração)? _____

Codigo FAO	Aparelho e material associado	Número de unidades	Descritivo sucinto	Custo unitário	Data de início da actividade	Tempo de vida (duração em anos)	Custo de manutenção e pequenas reparações
FPO	Covos para crustáceos		Nº de teias: Nº de covos/teia:				
	Covos para peixe		Nº de teias: Nº de covos/teia:				
	Outros covos, especificar (polvo, navalheira)		Nº de teias: Nº de covos/teia:				
	Alador para covos						
LLS	Palangre de fundo		Nº de celhas/lance: Nº de anzóis/celha: Montagem[3] :			Estralho: Madre:	
	Alador de linhas						
	Enrolador (tambor de linha)						
DRH	Draga de mão (berbigoeira)						
	Draga com saco (ganchorra)						

II. Descrição dos aparelhos de pesca por embarcação - *Continuação*

[3] Tripulação, artesão ou fábrica.

* Sublinhar o ano considerado

	Aparelho e material associado	Número de unidades	Descritivo sucinto	Custo unitário	Data de início da actividade	Tempo de vida (duração em anos)	Custo de manutenção e pequenas reparações
GNS GTR GTR	Rede de emalhar fundeada		Nº de caçadas: Nº panos/caçada:	Rede:		Rede:	
	Rede de tresmalho fundeada		Nº de caçadas: Nº panos/caçada:	Rede:		Rede:	
	Rede de tresmalho derivante		Nº de caçadas: Nº panos/caçada:	Rede:		Rede:	
	Alador de redes						
PS	Rede de cerco com retenida						
	Alador da rede de cerco (mecânico)						
	Guincho						
SSC	Envolvente arrastante (xávega, chinchorro)		Malhagem(s):				
TBB	Arrasto de fundo de vara		Malhagem(s):				
OTB	Arrasto de fundo com portas		Malhagem(s):				
	Portas/dimensão da vara						
	Tambor de rede						
	Cabos						
	Guinchos						
	Outro – especificar: (sombreira, etc…)						

Mudou/perdeu aparelhos em 1999/2000? _____ Se sim, especificar: _____

III. Volume de negócios (rendimento) por embarcação, por arte de pesca (métier) e por espécies (dados 1999 ou 2000)

Rendimento total:

Rendimento (contos) por arte (métier):

	Artes	Tempo total	Tempo de viagem	Tempo de pesca	Rendimento (em contos)	Rendimento (forte, fraco)
A	Redes (emalhar/tresmalho)					
B	Linha/palangre					
C	Cerco/dragas					
D	Armadilhas/covos					
E	Envolvente arrastante					
F	Dragas					
G	Outros (especificar)					

% do Rendimento por mês

Jan	Fev	Mar	Abr	Mai	Jun	Jul	Ago	Set	Out	Nov	Dez

Espécies principais em termos de rendimentos:

	Espécie 1	**Espécie 2**	**Espécie 3**	**Espécie 4**	**Espécie 5**
Nome da espécie					
% do rendimento total					
Quantidade (em Kg)					
Preço médio (por Kg)					
Preço máximo (por Kg)					
Preço mínimo (por Kg)					
Preço médio na lota					
% de captura por modalidade de pesca	A : B : C : D : E : F : G :	A : B : C : D : E : F : G:	A : B : C : D : E : F : G:	A : B : C : D : E : F : G:	A : B : C : D : E : F : G:

Variações sazonais dos ganhos por modalidade de pesca:

	Jan	Fev	Mar	Abr	Mai	Jun	Jul	Ago	Set	Out	Nov	Dez
A												
B												
C												
D												
E												
F												
G												

IV. Conflitos

Acha que se encontra submetido a conflitos de uso aquando da prática da sua actividade? _____

Se sim:

Com	**Conflitos quanto aos direitos de pesca (entre artes)**	**Conflitos quanto ao acesso à zona de pesca (espaço)**	**Conflitos na comercialização**	**Outros (especificar)**
Pescadores profissionais				
Outros pescadores				
Pesca de recreio				
Outros (especificar)				

Em quanto avalia (em toneladas, escudos ou %) o que, a seu ver, deveria ter ganho?:
_____

V. Processamento do pescado e comercialização

Destino do produto da pesca durante o ano, em %:

Venda: _____ Consumo familiar: _____

Processamento do pescado:

A bordo

Descrição do material usado (mesas, ...): _____
Espécies processadas: _____

Em terra

Descrição do material: _____

Espécies processadas: _____
A actividade da transformação dos produtos (além de evisceração e descabeçamento) representa que parte do seu volume de negócios global (em %)? _____

Acondicionamento e armazenamento:

A bordo	**Espécies**	**Embalagem (caso se verifique)**
Porão		
Tipo de armazenamento (caixas, a granel,…)		
Frio (se sim, tipo utilizado)		

Em terra	**Espécies**	**Embalagem (caso se verifique)**
Congelador		
Câmara fria		
Viveiros		
Outros		

Pensa que será possível vender a sua produção por um valor mais elevado?_____

Se sim, de que forma(s)?
Marcas comerciais: _____ Certificados de qualidade: _____ Outra:_____

Métodos de venda: a quem vende o pescado?

Distribuição das vendas ao longo do ano	Em valor	Em peso	Em %	Espécies consideradas
Grandes superfícies				
Peixaria tradicional				
Hotelaria / Restaurantes				
Comerciantes de pescado				
Particular				
Lota				
Pescador				
Outros (especificar)				

Principais variações sazonais das vendas:

_____

(valor, peso, %)

Recorre a uma associação de produtores para o escoamento dos seus produtos? (sim/não): _____

Se sim,

Qual (Organizações de Produtores, Associações, etc ..) _____

Número de aderentes?_____

Participa activamente no seu funcionamento? _____

Espécies escoadas: _____

VI. Características da tripulação, participação familiar na exploração e actividade(s) do mestre

Nº PRT: _____

Sistema de remuneração (assalariado, *por partes*, outros...) :_____
Remuneração por partes: Especificar a parte para a tripulação/ a parte para o armamento/
a parte para o pessoal de terra: _____

Nº de homens da tripulação: _____

Variações sazonais do pessoal:

Jan	Fev	Mar	Abr	Mai	Jun	Jul	Ago	Set	Out	Nov	Dez

Datas de nascimento da tripulação: _____
Data de nascimento do mestre embarcado:_____ Local de nascimento:_____
Tipo de carta do mestre:_____ Data prevista de reforma:_____

Participação do mestre/tripulação/família na exploração (em nº de dias/mês):

Número de dias/mês	**Mestre**	**Tripulação**	**Família**
Embarque			
Manutenção			
Comercialização			
Gestão			
Outro (especificar)			

Filiação/dependência de Organismos (especificar):

- Associações de Pescadores/Organizações de Produtores:_____
- Gestão contabilística: _____
- Abastecimento: _____
- Comercialização:_____
- Outros: _____
- Sindicatos:_____

Monoactividade de pesca (sim/não): _____
Se não,

- Outra(s) actividade(s) económica(s) a que se dedica o mestre/tripulação (hotelaria, aluguer
  turístico, moluscicultura, agricultura): _____/_____
- Percentagem do tempo dedicado à pesca por ano pelo mestre/tripulação:_____
  _____/_____
- Rendimento da família proveniente da pesca, em relação ao seu rendimento total, para o
  mestre/tripulação (em %):_____/_____

Para um pescador a tempo inteiro: Existem períodos de inactividade de pesca para o conjunto das suas embarcações (sim/não): _____

	Descanso	Imobilização para reparação	Condições climatéricas	Regulamentos de pesca	Rendimentos insuficientes
Nºdias/ano					

VII. Dados contabilísticos sobre a actividade de pesca (1999 ou 2000)

Modo de gestão (cooperativas, contabilidade individual, …): _____

	Montante (em contos)	Observações	Incluídos nos custos de exploração? (sim/não)
Material de pesca:			
- Isco			
- Combustíveis			
- Gelo			
- Outro			
Víveres:			
Reparações:			
Serviços:			
Taxas ligadas à produção: • Taxas de lota • Outras taxas			
Licenças			
Salários			
Encargos sociais			
Empréstimos em curso 1º empréstimo: 2º empréstimo:		 Objecto[1]:____Nºanos:___ Objecto[1]:____Nºanos:___	
Impostos e outras taxas			/
Dotação das amortizações			/

[1] - motor, embarcação, etc

_____

Apreciação ao desenrolar do inquérito

Relacionamento com os profissionais (bom, mau,…):

_____

Qualidade da informação recolhida (boa, má,…) :

_____

Outra informação que considere útil:

_____

Data, / /

Amostrador(es): _____

_____

ANNEX 9

Percentage of new boats and acquisition year of boats.

	MD	TR1	OTR	BOT	SPS	TR2	GTN	TN	BS	BD	Inquired population
New boats											
%	70	59	50	40	42	40	59	38	82	14	**52**
Aquisition year of 2nd hand boats											
Average	1992	1993	1989	1985	1992	1990	1990	1983	1993	1992	**1990**
StDev	9	8	8	7	4	4	7	14	10	8	**8**
CV	0	0	0	0	0	0	0	1	1	0	**0**
Age of 2nd hand boats											
Average	16	20	21	20	21	26	17	21	11	28	**21**
StDev	9	13	7	10	13	7	12	18	9	18	**13**
CV	54	65	36	49	61	26	72	83	85	63	**63**

ANNEX 10

Data relation to lifetime of the engines (years).

Fleet component	Average	StDev	CV
MD	9	7	73.3
TR1	5	4	72.1
OTR	6	1	12.9
BOT	12	9	78.2
SPS	7	4	58.2
TR2	10	8	74.3
GTN	4	4	99.3
TN	9	7	78.3
BS	4	3	75.3
BD	8	6	77.4
Inquired population	**8**	**7**	**81.0**

ANNEX 11

Insurance policy values of the boats (euros).

Fleet component	Average	StDev	CV
MD			
TR1	€ 19 952	€ 7 054	35
OTR			
BOT	€ 17 181	€ 24 194	141
SPS	€ 29 872	€ 20 430	68
TR2	€ 8 355	€ 4 524	54
GTN			
TN			
BS			
BD	€ 29 429	€ 14370	49
Inquired population	**€ 23 444**	**€ 20 867**	**89**

Estimate values of the boats (euros)

Fleet component	Average	StDev	CV
MD	€ 20 421	€ 24 458	120
TR1	€ 12 430	€ 9 108	73
OTR	€ 43 894	€ 28 084	64
BOT	€ 43 894	€ 28 084	64
SPS	€ 40 438	€ 26 560	66
TR2	€ 20 825	€ 18 364	88
GTN	€ 5 657	€ 8 337	147
TN	€ 32 110	€ 32 816	102
BS			
BD			
Inquired population	**€ 22 609**	**€ 24 977**	**110**

ANNEX 12

Fishing tackler values (euros).

Fleet Components		Average		StDev	CV
C1	€	4 171	€	8 023	192
C2	€	4 692	€	5 186	111
C3	€	1 313	€	3 404	259
C4	€	6 516	€	8 197	126
C5	€	29 338	€	73 198	249
C6	€	14 210	€	35 409	249
C7	€	13 781	€	38 794	282
C8	€	2 619	€	3 128	119
C9	€	8 538	€	2 720	32
C10	€	662	€	363	55
Inquired population	**€**	**8 844**	**€**	**31 207**	**353**

Nom du document: PORTUGAL_rapport_1-1
Dossier: Q:\Jpleaute\pecosude\Prep_rapport_final\Impression_rapports
Modèle: D:\Office 97\Office\Normal.dot
Titre: Introduction
Sujet:
Auteur: SGodinho
Mots clés:
Commentaires:
Date de création: 29/07/02 16:12
N° de révision: 3
Dernier enregistr. le: 30/07/02 09:06
Dernier enregistrement par: IFREMER
Temps total d'édition: 21 Minutes
Dernière impression sur: 26/03/03 15:18
Tel qu'à la dernière impression
Nombre de pages: 122
Nombre de mots: 21 608 (approx.)
Nombre de caractères: 123 170 (approx.)