

Discards regulation vs Mediterranean fisheries sustainability

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Reconstructing discards profiles of unreported catches

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Summary: In Portugal it has been estimated that unreported catches represent one third of total catches. Herein, information on landings and total unreported catches (discards) by commercial métier were disaggregated into high taxonomic detail using published scientific studies. Fish accounted for 93.5% (115493 t) of overall unreported catches per year, followed by cephalopods (2345 t, 1.9%) and crustaceans (1754 t, 1.4%). Sharks accounted for 1.3% of total unreported catches in weight (1638 t/y). Unreported taxa consisted mostly of the commercial landed fish species: *Scomber colias*, *Boops boops*, *Trachurus picturatus*, *T. trachurus*, *Merluccius merluccius*, *Sardina pilchardus*, *Liza aurata* and *Micromesistius poutassou*, which together accounted for 70% of the unreported discarded catches. The number of unreported/discarded species was highest in artisanal fisheries, followed by trawl and purse seine. In artisanal fisheries, *L. aurata*, *S. colias*, *S. pilchardus*, *Trachinus draco* and *B. boops* accounted for 76.4% of the unreported discards. *B. boops*, *S. colias* and *S. pilchardus* were also among the most discarded purse seine species, together with *Belone belone* accounting for 79% of the unreported catches. In trawl fisheries, *T. picturatus* (16%), *M. merluccius* (13%), *S. colias* (13%) and *M. poutassou* (13%) accounted for 55% of the trawl discarded unreported catches. The discarded species that most contribute to overall unreported catches are those that are most frequently landed and that most contribute to overall landings in weight.

Keywords: unwanted catches; discards; commercial fisheries; trawl discards; seine discards; multispecies discards.

Reconstrucción del perfil de descartes pesqueros en capturas no declaradas

Resumen: Para Portugal se estima que las capturas no declaradas representan un tercio de las capturas pesqueras totales. Aquí se aporta información sobre las descargas y las capturas totales no declaradas (descartes) por estrategia de pesca, detalladas al máximo nivel taxonómico posible, a partir del análisis de estudios científicos publicados. Los peces óseos constituyen el 93.5% (115493 toneladas) de las capturas no declaradas anuales, seguidos por los cefalópodos (2345 toneladas, 1.9%) y los crustáceos (1754 toneladas, 1.4%). Los peces cartilaginosos representan el 1.3% de las capturas totales no declaradas, con un volumen de 1638 toneladas anuales. La composición taxonómica de las capturas no declaradas se corresponde con las especies de mayor volumen en las descargas: *Scomber colias*, *Boops boops*, *Trachurus picturatus*, *T. trachurus*, *Merluccius merluccius*, *Sardina pilchardus*, *Liza aurata* y *Micromesistius poutassou* que conforman un 70% de las capturas no declaradas descartadas. El número de especies no declaradas/descartadas es más elevado en las pesquerías artesanales, seguido del arrastre y el cerco. En las pesquerías artesanales, el 76.4% de los descartes no declarados corresponden a *L. aurata*, *S. colias*, *S. pilchardus*, *Trachinus draco* and *B. boops*. En la pesca de cerco *B. boops*, *S. colias* y *S. pilchardus*, así como *Belone belone*, representan el 79% de las capturas no declaradas. En arrastre *T. picturatus* (16%), *M. merluccius* (13%), *S. colias* (13%) y *M. poutassou* (13%) proporcionan el 55% de las capturas no declaradas/descartadas. Las especies descartadas que más contribuyen al total de las capturas no declaradas coinciden con las especies más frecuentemente presentes en las descargas y que más contribuyen al volumen total de descargas.

Palabras clave: capturas no deseadas; descartes; pesquerías comerciales; descartes de arrastre; descartes de cerco; descartes multispecíficos.

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INTRODUCTION

Coastal and maritime activities have traditionally been important for the national economy and the historical, social, and cultural identity of Portugal (Leitão and Baptista 2017). The country has long relied on fishing as a major means of subsistence and many coastal communities depend almost exclusively on small-scale coastal and estuarine fisheries and related activities. However, over time substantial technological improvements and changes have been made in the fisheries. For example, in the around 1850, steam-powered vessels were introduced to the fishing fleets, resulting in a reduction of total fishers (Alves 1991). Additionally, fishers began to deploy for the first time an industrial gear, the otter trawl, which immediately created conflicts between the small-scale sector and this newly developing industrial sector (Baldaque da Silva 1891, Alves 1991). According to Hill and Coelho (2001), there was a decrease in the number of vessels in the Portuguese fishing fleet between 1989 and 1999, but this was compensated by an increase in vessel power. By 1996, 98% of the fishing fleet was motorized—a 2% increase from 1986. Today, in mainland Portugal, a variety of gears/métiers are used in the coastal fisheries, ranging from trawls to static gears such as gill nets and traps. Therefore, a wide variety of unwanted species are captured along with the target species (Gaspar et al. 2003, Gonçalves et al. 2007, Bordalo-Machado et al. 2009). Different types of gear often compete for the same resources (Borges et al. 2001). However, as different gear types and métiers target different organisms (Watson et al. 2006 a, b), unreported catches such as discards also differ from métier to métier.

Discards refer to the part of the catch that is not retained on board during commercial fishing operations but is returned to the sea. Discarding of marine organisms is a widespread feature of commercial fishing operations. Discard patterns are affected initially by catch compositions, which are determined by environmental factors, the fishing gear and fishing tactics used, and ultimately by fishermen themselves when they decide which parts of the catch to retain. This decision is influenced by both market and regulatory conditions, and is constrained by space and time: storage space on board the vessel and sorting time (Catchpole et al. 2014). None of the historical accounts published between 1800 and 1950 on Portuguese fisheries address unreported catches, by-catch or discards. The first study for the purse seine was published by Borges et al. (2001) in 1997. The lack of information on by-catch and discards from this period might suggest that either most of the nearshore, artisanal catches were consumed or used and not discarded, or that discarding may have been low and utterly ignored. Brandão et al. (2000) describes how all fish were processed, salted, and dried by Portuguese women, indicating that fish discards may have been minimal between 1800 and 1950.

The way different gears operate suggests that long-term monitoring is required to improve our understanding of the factors affecting discarding and of the implications of the levels of discarding on the marine

community structure (Hollingworth 2000, Kaiser and de Groot 2000). The knowledge of the overall quantity of species caught in coastal marine systems (including unreported catches) is key to understanding the indirect effects of removal of particular taxa from the system. In fact, over the past three decades, renewed interest in a more ecological approach to fisheries (an ecosystem-based management approach) has emerged.

The new European Union Common Fisheries Policy, which started to be implemented in 2014, sets out a gradual elimination of discards by reducing unwanted catches and ensuring that all catches are landed. Illegal, unreported and unregulated catches (IUU) are one of the most important topics in fisheries from both an economic and an environmental point of view (Alverson and Hughes 1996, Kelleher 2005, FAO 2010). The quantification and composition of the unreported catches and the understanding of the fate and impact of these unreported actions are key issues in fisheries (Zeller et al. 2007, 2011).

In Portugal it was estimated that an average of 123495 t/y (35.5% of the total catch) was unreported between 1938 and 2009 (Leitão et al. 2014). Overall, reconstructed total catches in Portugal amounted to just under 21.6 million t in 1950–2010, which is slightly more than twice the 10592310 t of landings officially reported by Portugal for the same time period. Discards contributed the most to the unreported catches, accounting for 7.6 million (i.e. 35%) t of total catches.

Many fisheries around the world have reached unsustainable levels and therefore deliver poor income to fishers. An effective fisheries management is urgently needed to improve the economic situation of fishing communities. Part of the solution is to reduce discards by finding market-based approaches that will increase the value for all by-catch fish (Leitão and Baptista 2017). The necessity of each country to manage all fisheries within their Exclusive Economic Zones (EEZ), a consequence of the United Nations Convention on the Law of the Sea (UNCLOS), led to attempts to find sustainable indicators for marine fisheries and ecosystems at the national level, including economic effects. However, information about unreported discard ban species that can comprise additional alternative value to the fishery sector is still scarce. Prohibited for the first time in some EU fisheries in 2009, economic-led high-grading is today illegal for all quota species, under amendments to fisheries technical measures enacted by the European Parliament and Council in March 2013 (Regulation (EU) No 227/2013). This means that fish that were discarded before should now have an economic value independently of their final use. Furthermore, sales of this fish will have to be accounted for and included in the country's economy (Leitão and Baptista 2017). However, so far the amount of information regarding total volumes and species discarded is lacking. Underestimation of catches is especially important in countries where fishing fleets are highly diversified, the enforcement of fishery management is low, data availability is poor, and there is high demand for fish products in local markets (Coll et al. 2014). Estimation of unreported catches for Portuguese fishery

was based on a fishery-by-fishery approach by Leitão et al. (2014). Herein we used information of unreported catches, for each commercial métier (from Leitão et al. 2014) and we reconstructed taxonomic profiles of unreported catches, namely discards by commercial fishing sector.

MATERIALS AND METHODS

Taxonomic rebuilding of unreported discards

Details on the estimation of the amount of unreported catch per métier and for the recreational/subsistence sector are provided elsewhere (Leitão et al. 2014). Briefly, Leitão et al. (2014) used two data sources from the INE (Portuguese National Statistical office: https://www.ine.pt/xportal/xmain?xpgid=ine_main&xpid=INE) to acquire data: the digital data series starting in 2000, and the data from manuscripts (<http://inenetw02.ine.pt:8080/biblioteca/logon.do?jsessionid=6D32727EEDCD9F2223353F2D3D81DB70>; last accessed in April 2012) for the years 1934-1999. Many species were described by the fishing sector during the time series (e.g. sardine, European hake, horse mackerel, mackerel and octopus, which together accounted for most of the landed catches). As of the 1970s, data were available by fishing gear and many species were reported by fishing sector (trawl, seine and multi-gear). Since the gear-specific data were less complete, and taxon-specific landings before the 1970s were usually higher than gear-specific data, probable actual catches by gear-type were derived from taxonomic landings. In summary:

– First the amount of landings was estimated for each major métier (seine, trawl and multi-gear, corresponding to small-scale artisanal fishery) to allow estimation of unreported discards, using available information on gear- and sometimes target-specific discard ratios. Overall, the authors used this gear-specific data period to assign catches to major gear types for the earlier period/years when data per gear were not available. Considering that the three segments of the Portuguese fleet kept their relative proportions (Baeta 2009), no significant changes were assumed between 1938 and 1968. This approach is supported by the long time series of landings of sardine, the dominant species in Portuguese landings, which is caught mainly by purse seine. Moreover, the multi-gear sector fishery has been the main component of coastal fisheries (numbers of boats), with few technological changes. The assign-

ment of several periods was carried out by subtracting different reported sectors from total landings (the simplest procedure). In other cases, for instance purse seine, landings estimates were based on sardine data, considering purse seine catchability and selectivity to be constant over time.

– Multi-gear estimates were straightforward, as reported landings for 1979-1982 were only available as ‘total’, ‘trawl’ and ‘purse seine’ categories. Thus, multi-gear reported landings for this period were estimated by subtracting trawl and purse seine landings from total landings.

– Trawl estimates (based on total and seine results) were assigned for 1938-1968. As both trawl components have similar discard rates (see Leitão et al. 2014), unreported estimates would not be biased by estimation of unreported landings from combined crustacean and finfish trawl statistics. Therefore, the percentage contribution of each gear to total landings was estimated for years with gear-specific data and used to reconstruct those trawl years where data were missing.

– Multi-gear landings were further disaggregated into more specific métiers. Therefore, the average percentage contribution of a single multi-gear fishery was estimated in relation to the overall multi-gear catches and used for years with no gear-specific data. The following multi-gear target fisheries were identified and differentiated and unreported discards in them were estimated: i) sardine (demersal coastal nearshore purse seine), ii) cephalopods using pots (e.g. octopus) or traps (e.g. octopus and cuttlefish); iii) bivalves; iv) crustaceans (lobster); v) other fishes (scabbardfish and large pelagics); and vi) recreational/subsistence and big-game sport fishing.

Based on the yearly total amounts of unreported catches, namely discards, per métier (and in several circumstances per species due to available information in the INE (see Leitão et al. 2014), the amounts of discards by commercial fisheries per taxa/species are estimated herein. Literature with high taxonomic detail regarding discards (covering the period 1996 to 2007) was used for this purpose (Table 1). Thus, for the commercial fishery (trawl, seine and multi-gear or small-scale artisanal fisheries) the percentage of discards per métier per taxa was compiled and total discards per taxa for each métier were estimated per year. Whenever more than one study was available for the same métier and taxa, the average value was used.

Table 1. – Studies with discard rates used to estimate the discards (unreported catches) per métier and per taxa.

Métier	Scientific source	Time frame	Regional scale
Black scabbardfish longline	Bordalo-Machado et al. 2009	2005 to 2007	Portuguese mainland and Madeira Island
Demersal seine (<i>rapa</i>)	Borges et al. 2001	March 1996 to June 1997	Algarve (southern Portugal)
Dredge	Leitão et al. 2009	May 2006	Southwestern Portugal (Sines)
Gill net and longline	Santos et al. 2002	February to March 1998	Algarve (southern Portugal)
Trammel net	Batista et al. 2009	October 2004 to August 2005	Central coast of Portugal (Setúbal and Sesimbra)
	Borges et al. 2001	March 1996 to June 1997	Algarve (southern Portugal)
	Gonçalves et al. 2007	1999-2000	Algarve (southern Portugal)
Trap	Saldanha 2001		Algarve (southern Portugal)
Purse seine (pelagic)	Borges et al. 2001	March 1996 to June 1997	Algarve (southern Portugal)
Trawl	Borges et al. 2001	March 1996 to June 1997	Algarve (southern Portugal)
	Costa et al. 2008	February 1999 to March 2001	Algarve (southern Portugal)

The discard rates of unreported catches per sector are presented in Supplementary Material Table S1.

In addition to the INE data, we used the detailed database of the Direção Geral das Pescas e Aquicultura (DGPA), available for the years 1989 to 2009. The DGPA database comprises information of landing per fishing sector and by species (or groups, e.g. *Diplodus* spp). Based on the landings of each taxonomic group (and gear) from the DGPA, we estimated the number of species and proportion in catches for the INE data, to group the following categories.

The amount of shrimps, prawns and *Nephrops norvegicus* since 1969 depends mostly on trawl crustacean fisheries that specifically target these groups. Before 1969 little was known about the crustacean fishery in Portugal. Therefore, for these groups catches before 1969 were not rebuilt.

For Mollusca the same procedure as for crustacea was followed, since the resolution of the data also only increased after 1969 in the INE database. In the DGPA database cephalopods account for four reported taxa: octopus (*Octopus vulgaris*), squid (*Loligo vulgaris*), cuttlefish (*Sepia officinalis*) and shortfin-squid (which can include *Illex coindetti*, *Todarodes sagittatus* and *Ommastrephes bartrami*). The “Other Mollusca” in the INE database, according to the DGPA database, can include Gastropoda (whelks) and other mollusc species (potentially other Octopodidae: *Eledone cirrhosa* and *Eledone moschata*).

Until 1969, most landed fish taxa were included as non-specified marine fish (INE category = “Diverse marine fish”), which include both Osteichthyes and Chondrichthyes. Based on INE data available from recent years (between 1991 and 2009), the proportion of “Other fish” was re-estimated (5.83%), with the remaining proportion being used to re-distribute “Other fish” by taxa category whenever data per taxa were missing (using the DGPA database). The average percentage contribution of each taxa to total catch was therefore used to rebuild and redistribute “Other fish” by each taxa. The categories of commercial groups in the INE database include the following:

- Other crustaceans (crabs, such as *Maja squinado* and *Cancer pagurus* and other non-specified crustaceans).
- Bivalves, including subtidal coastal clams (*Donax* spp., clams and razor clam), herein considered to be mainly caught by the artisanal/multispecies dredge fishery/sector.
- *Pagellus* spp. (*Pagellus acarne*, *Pagellus bogaraveo* and *Pagellus erythrinus*).
- Pleuronectiformes (Turbot, *Microchirus* spp., *Microchirus variegatus*, *Platichthys flesus*, *Psetta maxima*, *Solea* spp., *Solea lascaris*, *Solea solea*, *Lepidorhombus boscii*, *Lepidorhombus whiffiagonis* and *Pleuronectes platessa*).
- Sparidae (*Spondyliosoma cantharus*, *Sparus aurata*, *Diplodus* spp. and *Sarpa salpa*).
- *Thunnus* spp. and other tunas (*Thunnus thynnus*, *Katsuwonus pelamis*, *Thunnus albacares* and *Auxis rochei*).
- The “Other fish” category includes *Pagrus*

spp., *Dentex* spp., *Merluccius* spp., *Beryx splendens*, *Merlangius merlangus*, *Polyprion americanus*, *Argyrosomus regius*, *Dicentrarchus* spp., *Alosa* spp., *Lophius* spp., Gurnards, Mulllets, *Helicolenus dactylopterus*, Serranidae, *Zeus faber*, *Beryx decadactylus*, *Anguilla anguilla* and *Brama brama*.

RESULTS

There are few studies on reconstruction of unreported discards with higher taxonomic resolution, because of the enormous time required for obtaining sound fisheries information, processing the data and developing/applying accurate methodologies. After we estimated IUU in a previous study (see methods in Leitão et al. 2014), we reconstructed unreported discard profiles, because enhancing taxonomic information on discards is imperative for fisheries management within the new CFP and the landing obligation directive. Inevitably, reconstructions of catches are largely based on assumptions derived by analyses of recent data (e.g. discards studies, Table 1). For example, in the present work, the catch composition and discard ratios were mainly based on studies dating from after the mid-1990s but the reconstruction goes back to 1938. Furthermore, the recent studies may cover a small region, raising the question of whether the discards estimates apply to the whole Portuguese mainland. The Portuguese fishery is characterized by nearshore fisheries with the top rank preference in terms of species changing little over time (Almeida et al. 2015). In fact, small pelagics (*Sardine pilchardus*, *Trachurus* spp. and *Scomber* spp.) and European hake, for instance, account for the greater proportion of the catches (landed and discards). These groups/species are data rich in the INE long-term database. Therefore, for the main métiers and traditionally consumed species, the rebuilding and taxonomic disaggregation of the discarded species (most of which match the landed species) should be considered more accurate, whereas in the case of species with smaller catches, rebuilding procedures may introduce larger estimation errors. However, the number of unreported species discarded is independent of the percentage in weight of the unreported discards estimated. That is, we can assume that qualitative analyses might be less affected than quantitative estimations in rebuilding methods. The average total number of marketable taxa landed per year is around 296 (Source: DGPA 1989-2009), with 225 taxa being discarded. Of the 225 species discarded, approximately half (109 taxa, 48%) are also landed or reported/discriminated at auction (according to the DGPA database). Therefore, this study showed that 89% of unreported bony fish and shark species are thought to have commercial value.

The compositions of unreported and landed catches do not vary much in terms of the main groups caught (Fig. 1, Table 2). In the Portuguese mainland fisheries the landings comprised mostly fish (84.5%), with cephalopods and crustaceans accounting for 2.9% and 1.3% of the total catches, respectively. For the period 1938 to 2009, the average landings of fish, cephalopods and crustaceans were 207419, 7162 and 3187 t (Fig. 1, Ta-

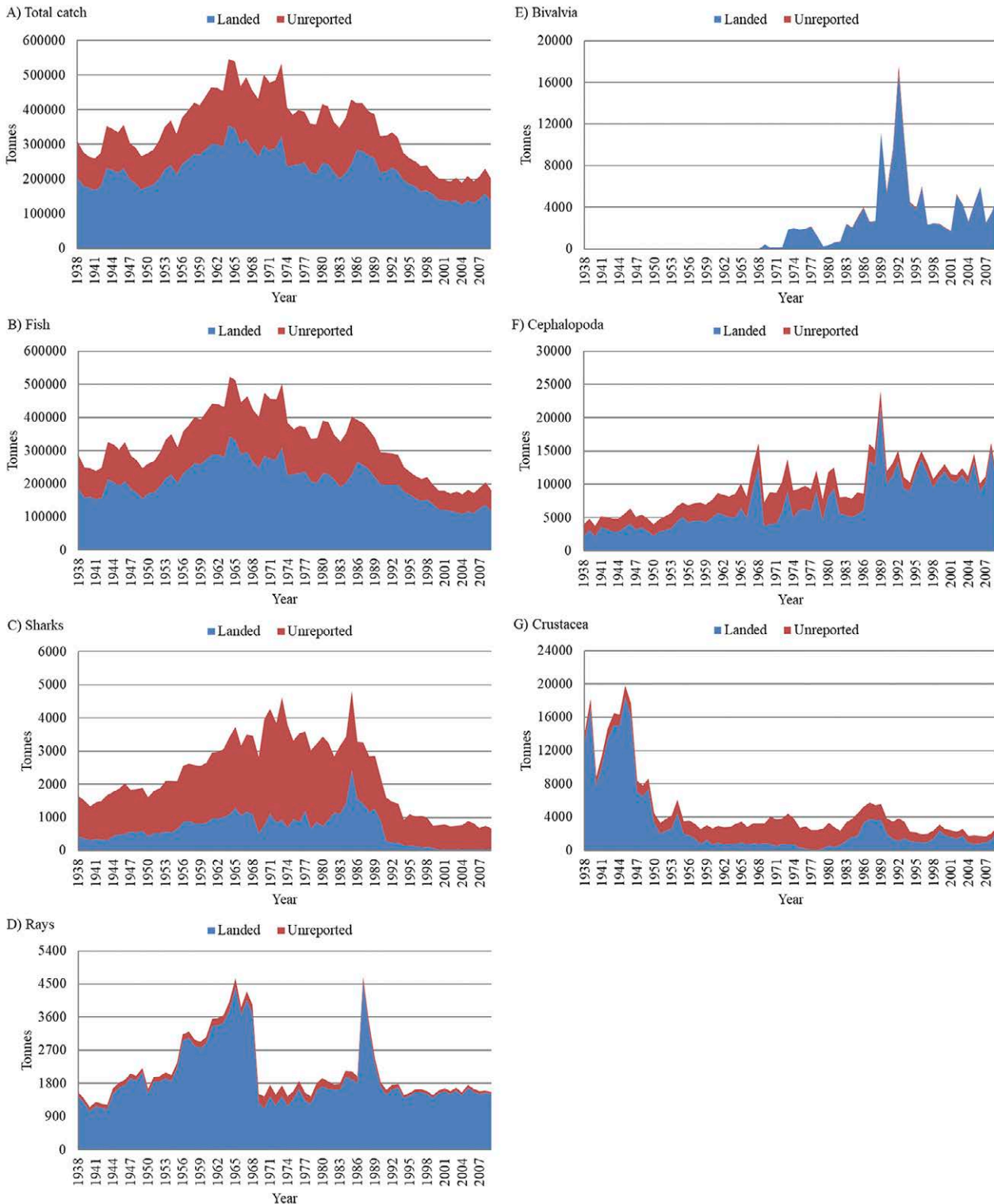


Fig. 1. – Total landed and unreported (discarded) catches for different commercial groups between 1938 and 2009. A, Total catches; B, fish; C, sharks; D, rays; E, Bivalvia; F, Cephalopoda; and G, Crustacea. Source: Portuguese National Statistical Office – INE.

ble 2). Fish accounted for 93.5% of the total unreported catches, with an average of 115493 t/y. The contributions of cephalopods and crustaceans to the unreported catches are minor compared with those of fish: 1.9% and 1.4% of total unreported catches, with averages of 2345 and 1754 t/y, respectively (Fig. 1, Table 2). The shark

group accounts for 1.3% of total unreported catches in weight (1638 t/y). The recreational/subsistence fishery focuses mainly on fish, but there are no studies or data available on recreational fisheries/harvesting that target small invertebrates such as mussels, goose-barnacles or, more recently, sea urchins.

Table 2. – Average catches in weight (\pm SD) of landed and unreported (discarded) catches per commercial groups, with respective relative contribution (%) of each group to total group catch and overall catch, for the period 1938-2009.

Commercial group	Landed (MT)	% landed	Unreported (MT)	% unreported	Total catch (MT)	Ratio IUU/total group catch (%IUU)	Ratio IUU/total catch (%IUU)
Fish	207419 (\pm 57399)	84.5	115493 (\pm 38908)	93.5	322911 (\pm 94492)	35.8	33.2
Sharks	649 (\pm 467)	0.3	1638 (\pm 725)	1.3	2287 (\pm 1106)	71.6	0.47
Rays	1971 (\pm 850)	0.8	154 (\pm 64)	0.1	2125 (\pm 872)	7.2	0.04
Bivalvia	1959 (\pm 3049)	0.8	50 (\pm 101)	0,0	2009 (\pm 3140)	2.5	0,0
Cephalopoda	7162 (\pm 3932)	2.9	2345 (\pm 1007)	1.9	9508 (\pm 3762)	24.7	0.68
Gastropoda			55 (\pm 21)	0.04	55 (\pm 21)	100.0	0.02
Other Mollusca	1563 (\pm 1535)	0.6			1563 (\pm 1535)	0,0	0,0
Crustacea	3187 (\pm 4489)	1.3	1745 (\pm 721)	1.4	4931 (\pm 4322)	35.4	0.5
Other fish and invertebrates		8.7	2016 (\pm 833)	1,6	2016 (\pm 833)	100.0	0.6

Between 1938 and 2009, sardine (*S. pilchardus*, 44.8%), horse mackerel (*T. trachurus*, 14.8%), hake (*M. merluccius*, 5.7%), chub mackerel (*Scomber colias*, 5.6%) and octopus (*Octopus vulgaris*, 2.3%) together accounted for an average of 73.2% of the landings (163826 t/year) and 36.8% of unreported catches (450411 t/year) (Table 3, Fig. 2). The unreported species included mainly *S. colias* (17.6%), *Boops boops* (9%), *Trachurus picturatus* (8.6%), *M. merluccius* (8.3%), *S. pilchardus* (7%), *Liza aurata* (7%), *Micromesistius poutassou* (6.9%) and *T. trachurus* (3.6%), all marketable species that together accounted for 68.2% of the total average annual unreported catches of approximately 84222 t (Table 3, Fig. 2; see also Supplementary Material Table S2). Species such as the two-banded sea bream (*Diplodus vulgaris*) and the Senegal sea bream (*Diplodus bellottii*) are often discarded in purse seine fisheries when they are small-sized but above the minimum legal size, as taking them to auction is considered not worthwhile (Gonçalves et al. 2008).

The composition of landings varies considerably according to a number of factors, including the nature of the fishery, the type of fishing gear used, gear selectivity, tow duration, the target species and their price value, the depth of capture and the time of year (Oliver 1993, García-Rodríguez and Esteban 1999, Rochet et al. 2002). As expected, all the above factors also affect the discard species composition of each métier. In mainland Portuguese fisheries, the number of unreported/discarded species was higher in the multi-gear sector (N=184), followed by trawl (N=79) and seine (N=9) (Table 4). The large number of taxa in the multi-gear category is due to the differences between gears, fishing grounds and target species. Within the multi-gear métiers, the number of species discarded from trammel nets (N=120 taxa) was far greater than that of other static gears such as scabbardfish longlines (N=29), gill net and longline (N=22), artisanal dredges (N=18), trap (N=16) and demersal seine (N= 5) (see Supplementary Material Table S2). This is due to the greater diversity of trammel net catches compared with other static gear (Martins et al. 1992, Erzini et al. 2003) and can be accounted for by the species and size selec-

tivity of trammel nets (Erzini et al. 2006, Stergiou et al. 2006). In the Algarve (south coast of Portugal), one exhaustive study showed that more than 900 species can be caught and discarded by the commercial fishery (trawls, purse seine and trammel nets): 69% are always discarded, 27% are frequently discarded and only 4% are occasionally discarded (Borges 2007). The number of taxa recorded above is far greater than those reported herein that were based on specific scientific literature. This finding might be related to the fact that scientific surveys are usually restricted to short time periods and are also limited in terms of the geographic area surveyed (scientific surveys onboard commercial boats allow exhaustive faunistic records to be obtained).

In multi-gear fisheries the unreported catches consisted mainly of *L. aurata*, *S. colias*, *S. pilchardus*, *Trachinus draco* and *B. boops* (Fig. 2, Table 3). Together, the latter species account for 76.4% of the multi-gear discards, with an average of 17935 t/y. The unreported multi-gear catches of *S. colias*, *S. pilchardus* and *B. boops* were mostly due to demersal seine and trammel net discards, while those of *L. aurata* were mostly due to demersal purse seine discards (see Supplementary Material Table S2).

As in the multi-gear category, *B. boops*, *S. colias* and *S. pilchardus* were the species most discarded by purse seiners (Table 3). Together with *Belone belone*, these species accounted for 79% of the unreported purse seine discards, with an average of approximately 19027 t/y. In purse seiners that use electronic equipment to detect the schools around which the seine net is set, the lack of success in determining the species and/or size composition of the fish in the school before setting the net is a major factor leading to high volume discards. In fact, the target species (sardine or horse mackerel) may also be captured and discarded when mixed with by-catch species, making the sorting of large catches uneconomical, and when the sizes caught are not suitable for the market or for canning (Borges et al. 2001).

In Portugal, the “trawling” category includes two different fleet components: deepwater trawlers that target crustaceans, and fish trawlers that operate mainly on the continental shelf (CEC 1993). Fishing

Table 3. – Top ten species landed and unreported in Portugal Mainland fisheries, for the period 1938-2009.

	Species	Taxa Group	Tonnes (\pm SD)	%
Total catch	<i>Sardina pilchardus</i>	Fish	109004 (\pm 27351)	31.4
	<i>Trachurus trachurus</i>	Fish	37689 (\pm 16971)	10.8
	<i>Scomber colias</i>	Fish	34342 (\pm 12533)	9.9
	<i>Merluccius merluccius</i>	Fish	22923 (\pm 13171)	6.6
	<i>Micromesistius poutassou</i>	Fish	12689 (\pm 5140)	5.5
	<i>Trachurus picturatus</i>	Fish	12378 (\pm 5291)	3.6
	<i>Boops Boops</i>	Fish	12022 (\pm 3199)	3.5
	<i>Liza aurata</i>	Fish	8650 (\pm 6239)	2.5
	<i>Scomber scombrus</i>	Fish	6251 (\pm 1967)	1.8
	<i>Octopus vulgaris</i>	Cephalopoda	5279 (\pm 2970)	1.5
	Others		86178 (\pm 27906)	24.8
Landed	<i>Sardina pilchardus</i>	Fish	100312 (\pm 25625)	44.8
	<i>Trachurus trachurus</i>	Fish	33187 (\pm 15418)	14.8
	<i>Merluccius merluccius</i>	Fish	12652 (\pm 8936)	5.7
	<i>Scomber colias</i>	Fish	12559 (\pm 7265)	5.6
	<i>Octopus vulgaris</i>	Cephalopoda	5116 (\pm 3001)	2.3
	<i>Micromesistius poutassou</i>	Fish	4188 (\pm 218)	1.9
	<i>Trisopterus luscus</i>	Fish	3940 (\pm 1549)	1.8
	<i>Scomber scombrus</i>	Fish	3045 (\pm 1454)	1.4
	<i>Lepidopus caudatus</i>	Fish	2621 (\pm 3223)	1.2
	<i>Pagellus</i> spp.	Fish	2234 (\pm 944)	1.0
	Others		44055 (\pm 15820)	19.7
Unreported	<i>Scomber colias</i>	Fish	21784 (\pm 7048)	17.6
	<i>Boops Boops</i>	Fish	11162 (\pm 2868)	9.0
	<i>Trachurus picturatus</i>	Fish	10659 (\pm 4865)	8.6
	<i>Merluccius merluccius</i>	Fish	10271 (\pm 4529)	8.3
	<i>Sardina pilchardus</i>	Fish	8692 (\pm 2476)	7.0
	<i>Liza aurata</i>	Fish	8650 (\pm 6239)	7.0
	<i>Micromesistius poutassou</i>	Fish	8501 (\pm 3879)	6.9
	<i>Trachurus trachurus</i>	Fish	4502 (\pm 1886)	3.6
	<i>Belone belone</i>	Fish	3614 (\pm 966)	2.9
	<i>Scomber scombrus</i>	Fish	3205 (\pm 1026)	2.6
	Others		32454 (\pm 11688)	26.3
Unreported - multi-gear	<i>Liza aurata</i>	Fish	8650 (\pm 6239)	35.9
	<i>Scomber colias</i>	Fish	4382 (\pm 2597)	18.2
	<i>Sardina pilchardus</i>	Fish	3133 (\pm 1304)	13.0
	<i>Trachinus draco</i>	Fish	930 (\pm 387)	3.9
	<i>Boops boops</i>	Fish	840 (\pm 628)	3.5
	<i>Microchirus azevia</i>	Fish	830 (\pm 345)	3.4
	<i>Chelidonichthys obscurus</i>	Fish	745 (\pm 310)	3.1
	<i>Merluccius merluccius</i>	Fish	708 (\pm 581)	2.9
	<i>Scorpaena notata</i>	Fish	614 (\pm 639)	2.5
	<i>Pagellus acarne</i>	Fish	465 (\pm 193)	1.9
	Others		2793 (\pm 952)	11.6
Unreported - seine	<i>Boops boops</i>	Fish	7466 (\pm 1995)	31.3
	<i>Scomber colias</i>	Fish	4335 (\pm 1159)	18.2
	<i>Belone belone</i>	Fish	3613 (\pm 965)	15.2
	<i>Sardina pilchardus</i>	Fish	3613 (\pm 965)	15.2
	<i>Macroramphosus scolopax</i>	Fish	2649 (\pm 708)	11.1
	<i>Scomber scombrus</i>	Fish	1445 (\pm 386)	6.1
	<i>Halobatrachus didactylus</i>	Fish	241 (\pm 64)	1.0
	<i>Spicara flexuosa</i>	Fish	241 (\pm 64)	1.0
	<i>Trachurus trachurus</i>	Fish	241 (\pm 64)	1.0
Unreported - trawl	<i>Trachurus picturatus</i>	Fish	10659 (\pm 4865)	15.9
	<i>Merluccius merluccius</i>	Fish	8854 (\pm 4041)	13.2
	<i>Scomber colias</i>	Fish	8642 (\pm 3944)	12.9
	<i>Micromesistius poutassou</i>	Fish	8494 (\pm 3877)	12.6
	<i>Trachurus trachurus</i>	Fish	3888 (\pm 1775)	5.8
	<i>Capros aper</i>	Fish	2522 (\pm 1151)	3.8
	<i>Chondrichthyes</i>	Fish	2178 (\pm 994)	3.2
	<i>Boops boops</i>	Fish	1985 (\pm 906)	3.0
	<i>Conger conger</i>	Fish	1974 (\pm 901)	2.9
	<i>Sardina pilchardus</i>	Fish	1947 (\pm 888)	2.9
	Others		16082 (\pm 7340)	23.9

trip duration is one of the most important factors influencing the proportion of the fish by-catch that is commercialized, and the quantity of by-catch landed is inversely related to trip duration (Clucas 1997,

Costa et al. 2008). The main species unreported due to trawl discards differed from both the multi-gear (small-scale/artisanal) and purse seine fleets. For the trawls, *T. picturatus* (16%) and *M. merluccius* (13%)

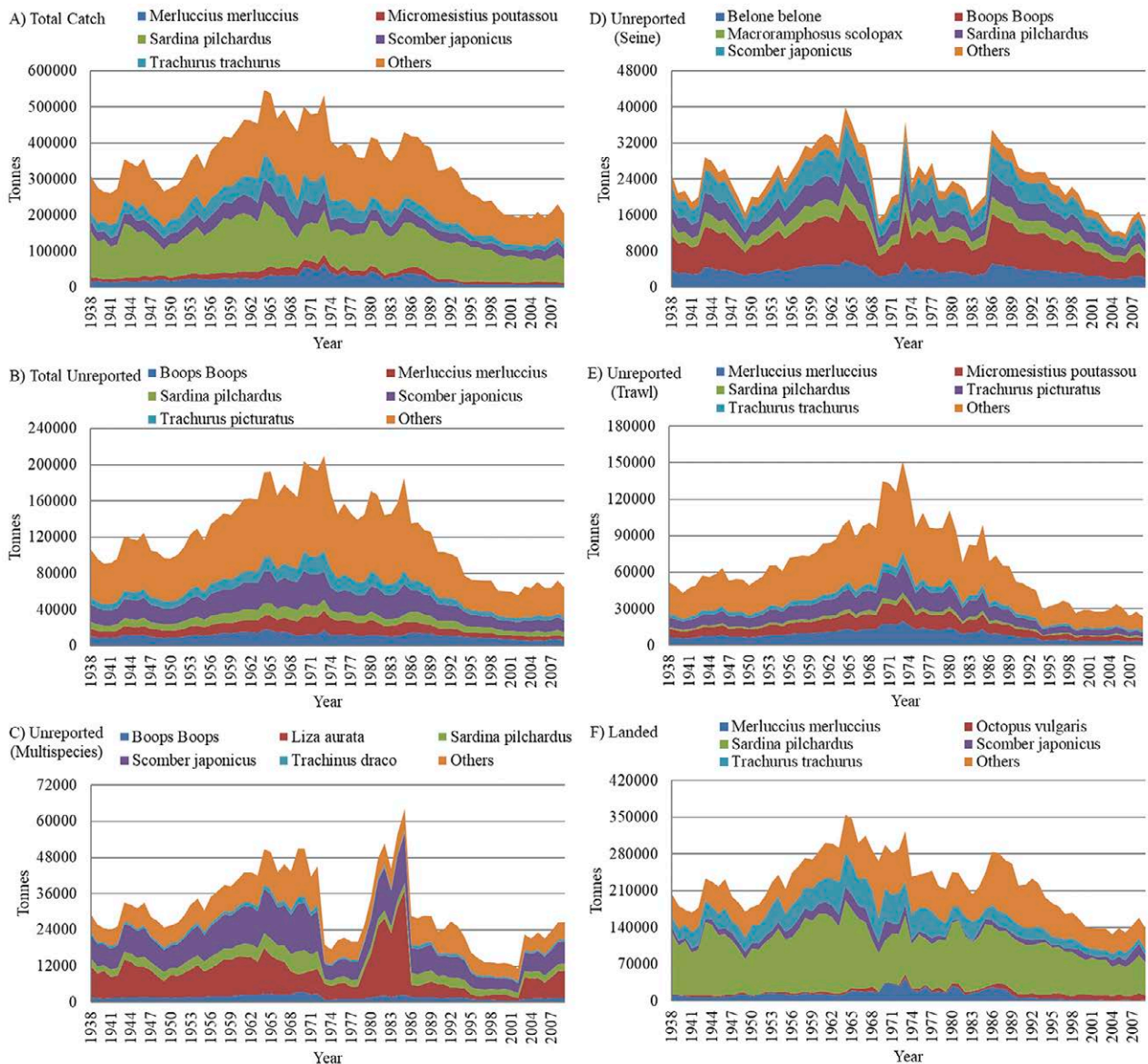


Fig. 2. – Catches of main species, unreported discards (including per métier) and landed catches. A, total catches; B, unreported; C, unreported multispecies; D, unreported purse seine; E, unreported trawl; F, landed catches. Source: Portuguese National Statistical Office – INE.

Table 4. – Number of taxa present in landings and unreported (discarded) catches.

Commercial group	Landed	Unreported (total)	Unreported (seine)	Unreported (trawl)	Unreported (artisanal/multi-gear)
Fish	179	136	9	49	114
Sharks	33	17	-	4	17
Rays	12	11	-	4	8
Bivalvia	26	10	-	0	10
Cephalopoda	9	11	-	9	4
Gastropoda	6	6	-	2	4
Other Mollusca	-	-	-	-	-
Crustacea	28	20	-	7	16
Other fish and invertebrates	2	14	-	4	11
Total	295	225	9	79	184

were the most discarded species, accounting for 29% of the unreported catches and approximately 19514 t/y. Together with *S. colias* (13%) and *M. poutassou* (13%) these species comprised more than half (55%) the unreported trawl catches. The occurrence of high concentrations of small, non-commercial species such as *Capros aper* and *Macroramphosus scolopax*

accounts for the occasional high volume discards witnessed onboard trawlers (Borges et al. 2001). However, in this analysis different trawl studies were used and *C. aper* was the sixth most important species in terms of trawl discards.

Despite some overlap in the species that contribute most to unreported discards of different metiers, some

significant differences were found. In fact, the discards of sharks were always higher than landings in all the time series, which is not surprising in view of discard rates for most species (see studies on trawl, Table 1). In fact, the catch ratio of IUU sharks/total sharks showed that 71.6% of the sharks are discarded without being reported (Table 2). The discards of sharks have increased in the last few decades although landings of sharks have not. This finding may also be related to discards of deepwater sharks, which were formerly used to produce liver oil, including during the Second World War. Compared with other sectors (see also Supplementary Material Table S2), trawlers (mainly crustacean trawls) discard considerable quantities of mainly deepwater sharks such as *Scyliorhinus cannicula*, *Galeus melastomus*, *Etmopterus pusillus* and *Hexanchus griseus*, which may have poor resilience to high levels of fishing mortality because of their life history characteristics (Stevens et al. 2000). In such deepwater communities with long-lived, slow growing, low-fecundity species, fishing activity with associated discard-related mortality may be expected to severely impact some populations of non-commercial species and in the long-term result in community changes (Kaiser and de Groot 2000).

DISCUSSION

The results showed that independently of the métier, common marketable species account for most of the unreported discarded catches. In fact, the species that most contribute to overall unreported catches are among the most frequently landed and are those that contribute most to overall landings. This point is important, because these species are considered choke species under the new Common Fisheries Policy landing obligation. So what are the implications of the landing obligation in relation to this finding and what is the value of this study? The identification of discarded species is a key factor for launching the debate regarding their use, particularly because most of them have quotas/total allowed catches (TACs). Until recently, the EU prohibited discards of fish with established quotas which could be legally landed (high-grading). However, it was legal to discard non-commercial fish and other organisms. As discussed by Leitão and Baptista (2017), it is difficult to know with certainty whether there will be any costs for fishermen if they land more fish than their quota for one or more species. In short, fish caught in excess of individual quotas can be marketed normally and “by-catch quotas” can be set as part of the fishing opportunities established by the EU council each year.

The difficulty of managing Portuguese fisheries can be largely attributed to their multi-gear nature, insufficient research (funding and lack of support for monitoring and analysis of non-target fisheries) and unreported catches, which affect stock assessment and management. Fisheries data collection, advice and management have traditionally been based on single-species approaches. However, ignoring interactions between métiers and species could lead to an undesir-

able situation in which fishing for one species may lead to discarding of another whose quota has already been exceeded. Moreover, the by-catch and discarding of non-target species may have negative consequences for non-commercial as well as commercial species due to influences on species interactions and consequent cascading effects throughout the trophic web (Harris and Poiner 1990, Hill and Wassenberg 1990, Yamamura 1997).

Borges (2007) state that the main reasons for discarding are economic restrictions (e.g. low or no commercial value of the species with no immediate market) and technical restrictions (fishing gear selectivity). Moreover, Bellido et al. (2011) reported that discarding may have a number of adverse ecological impacts on marine ecosystems, causing changes in the overall structure of trophic webs and habitats, which could in turn pose risks for the sustainability of current fisheries. Discarding is less frequently associated with legal/administrative restrictions such as quotas, minimum landing size and TACs. However, given the overfished state of many of the world’s most important stocks (Pauly et al. 2002, Leitão 2015), there has been great interest in documenting and finding solutions to the economic, political, and ecological implications of by-catch and discarding (Costa et al. 2008). Research on by-catch utilization is rapidly moving to the field of food and nutrition research, creating value-added fish products from by-catch or discarded fish: extracting gelatin from Alaska pollock (*Theragra chalcogramma*; Zhou and Regestein 2005) and shark cartilage (*Isurus oxyrinchus*, Cho et al. 2004), and even using these value-added products as alternatives to the use of mammalian gelatin (Karim and Bhat 2009).

There are still few summaries of estimates of unreported discards, especially with taxonomic detail. However, a complete review of IUU catches was made by Pauly and Zeller (2016). Overall, world results show that the taxonomic composition of unreported catches of the main target species vary considerably among areas, which is an expected result as fish assemblages, and target species, differ among regions. However, small pelagics and some demersal species are some of the most frequently reported species in the Mediterranean and Southern Europe (Coll et al. 2014, Pauly and Zeller 2016). Coll et al. (2014) showed that in Southern Europe unreported catches were due to (i) illegal catches of commercial species (undersized or with quotas, such as bluefin tuna), (ii) illegal fishing techniques (such as the Spanish driftnet fishery after the 1992 ban), and (iii) portions of misreported catches of protected species or species at risk (such as pelagic sharks). Illegal catches in the study area were mainly identified as juvenile commercial species such as juveniles of demersal species as hake or small pelagic fish such as sardines and anchovies. These results are similar to those found herein for unreported discards of species/groups. In Italy the main taxa discarded were clams (Bivalvia; 12.0%), sharks (Selachimorpha; 8.9%), jacks (*Trachurus* spp. 6.7%) and rays (Rajidae; 5.6%) (Piroddi et al. 2015). In fact, the worldwide unreported proportion is most often due to the dis-

carded component (Pauly and Zeller 2016). It remains, however, to be determined whether worldwide total unreported discard species also match the commercial species most frequently landed and with the highest contribution to total catch, as in Portugal.

From an economic perspective, there are possibilities for making better use of some discarded species, thereby possibly reducing the pressure on target species (Leitão and Baptista 2017). Most of the discarded species in Portuguese fisheries have been shown to have economic potential. The critical fact is that sustainable management of fishing resources must take place in the ecosystem context, with a good understanding of all the possible effects of fishing activities (Borges 2007). Any effect on one stock, population or species may produce a change in another, resulting in readjustment in both populations (Hongskul 1979, Saila 1983, Kennelly 1995). Moreover, discard estimates are necessary, not only to evaluate the impact of fishing on non-commercial species but also on ecosystems as a whole (Alverson et al. 1994, Hall 1999), since they are not usually taken into account in stock assessments (Borges et al. 2005). Knowledge of unreported catches may change the way we assess the marine ecosystem, including the poorly understood trophic effects of fisheries in the marine environment, thereby improving our understanding of fishing trend variability and catch predictions.

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SUPPLEMENTARY MATERIAL

The following supplementary material is available through the online version of this article and at the following link: <http://scimar.icm.csic.es/scimar/supplm/sm04723esm.pdf>

Table S1. – Taxonomic list with the average discard rate per métier per taxa (based on studies of Table 1) used for the rebuilding of unreported catches.

Table S2. – Taxonomic list with the average absolute and relative weight contribution of each taxa to total unreported catch, per métier, for the period between 1938 and 2009.

Reconstructing discards profiles of unreported catches

Francisco Leitão, Vânia Baptista, Karim Erzini

Supplementary material

Table S1. – Taxonomic list with the average discard rate per métier per taxa (based on studies of Table 1) used for the rebuilding of unreported catches.

Métier	Species	% of the discards	Métier	Species	% of the discards
Trawl	<i>Argentina sphyraena</i>	0.02551		<i>Trisopterus luscus</i>	0.52301
	<i>Argobuccinum olearium</i>	0.02551		<i>Xiphias gladius</i>	0.25513
	<i>Boops boops</i>	2.95311		<i>Zenopsis conchifer</i>	0.00638
	<i>Caelorinchus caelorhincus</i>	0.01276		<i>Zeus faber</i>	0.19135
	<i>Capros aper</i>	3.75166	Purse seine	<i>Belone belone</i>	15.15152
	<i>Cassidaria tyrrhena</i>	0.02551		<i>Boops boops</i>	31.31313
	<i>Cephalopoda</i>	1.14808		<i>Halobatrachus didactylus</i>	1.01010
	<i>Chimaera monstrosa</i>	0.00255		<i>Macroramphosus scolopax</i>	11.11111
	<i>Chondrichthyes</i>	3.24013		<i>Sardina pilchardus</i>	15.15152
	<i>Citharus linguatula</i>	0.00255		<i>Scomber colias</i>	18.18182
	<i>Conger conger</i>	2.93652		<i>Scomber scombrus</i>	6.06061
	<i>Dardanus arrosor</i>	0.05103		<i>Spicara flexuosa</i>	1.01010
	<i>Diverse</i>	1.65833		<i>Trachurus trachurus</i>	1.01010
	<i>Echinoidea</i>	0.14032	Black scabbardfish longline	<i>Alepisaurus ferax</i>	0.43956
	<i>Eledone cirrhosa</i>	0.00383		<i>Alepocephalus bairdii</i>	7.69231
	<i>Eledone moschata</i>	0.00128		<i>Aphanopus carbo</i>	0.10989
	<i>Etmopterus pusillus</i>	0.00128		<i>Benthodesmus elongates</i>	0.32967
	<i>Gadiculus argenteus</i>	1.12384		<i>Centrophorus granulosus</i>	0.32967
	<i>Galeus melastomus</i>	0.60465		<i>Centrophorus lusitanicus</i>	0.10989
	<i>Helicolenus dactylopterus</i>	0.30870		<i>Centrophorus squamosus</i>	17.03297
	<i>Hexanchus griseus</i>	0.00128		<i>Centroscymnus coelolepis</i>	0.32967
	<i>Holothuroidea</i>	0.79090		<i>Centroscymnus crepidater</i>	1.31868
	<i>Hoplostethus mediterraneus</i>	0.00128		<i>Coryphaena hippurus</i>	0.10989
	<i>Illex coindetii</i>	0.00638		<i>Coryphaenoides rupestris</i>	0.10989
	<i>Lepidopus caudatus</i>	1.17869		<i>Deania calcea</i>	18.57143
	<i>Lepidorhombus spp.</i>	0.03827		<i>Deania profundorum</i>	0.10989
	<i>Lophius piscatorius</i>	0.00255		<i>Epigonus telescopus</i>	0.21978
	<i>Lophius spp.</i>	1.25013		<i>Etmopterus pusillus</i>	35.60440
	<i>Macropipus tuberculatus</i>	0.06378		<i>Etmopterus spinax</i>	5.71429
	<i>Macroramphosus scolopax</i>	0.35463		<i>Galeus melastomus</i>	1.75824
	<i>Maja squinado</i>	0.38269		<i>Hexanchus griseus</i>	0.21978
	<i>Malacocephalus laevis</i>	0.01403		<i>Isurus oxyrinchus</i>	0.10989
	<i>Merluccius merluccius</i>	13.17099		<i>Lepidion guentheri</i>	0.65934
	<i>Micromesistius poutassou</i>	12.63522		<i>Lepidion spp.</i>	0.32967
	<i>Mullus spp.</i>	0.44647		<i>Nesiarchus nasutus</i>	0.76923
	<i>Mullus surmuletus</i>	0.02551		<i>Phycis blennoides</i>	0.76923
	<i>Octopodidae</i>	1.60731		<i>Prionace glauca</i>	0.32967
	<i>Octopus salutii</i>	0.00255		<i>Raja spp.</i>	0.10989
	<i>Octopus vulgaris</i>	0.24237		<i>Scymnodon ringens</i>	0.54945
	<i>Ophisurus serpens</i>	0.00510		<i>Synaphobranchus kaupii</i>	5.27473
	<i>Pagellus bogaraveo</i>	0.00128		<i>Thunnus alalunga</i>	0.10989
	<i>Pagellus spp.</i>	0.38269		<i>Trachyrincus scabrus</i>	0.87912
	<i>Pagrus pagrus</i>	0.25513	Demersal purse seine (“rapa”)	<i>Boops boops</i>	3.06122
	<i>Pagrus spp.</i>	0.35718		<i>Liza aurata</i>	69.38776
	<i>Pagrus alatus</i>	0.03827		<i>Liza ramada</i>	1.02041
	<i>Parapenaeus longirostris</i>	0.93122		<i>Sarpa salpa</i>	1.02041
	<i>Peristedion cataphractum</i>	0.00128		<i>Scomber colias</i>	25.51020
	<i>Phycis blennoides</i>	0.00128	Dredge	<i>Citharus linguatula</i>	5.92862
	<i>Phycis spp.</i>	0.94397		<i>Dicologlossa cuneata</i>	0.00100
	<i>Plesionika spp.</i>	0.19135		<i>Sepia officinalis</i>	0.19689
<i>Pleuronectes platessa</i>	0.10205		<i>Spisula solida</i>	0.08316	
<i>Polybius henslowii</i>	0.76538		<i>Donax vittatus</i>	1.00196	
<i>Raja clavata</i>	0.00128		<i>Tellina tenuis</i>	8.49715	
<i>Raja oxyrinchus</i>	0.00128		<i>Ensis siliqua</i>	0.45840	
<i>Rajidae</i>	0.16583		<i>Venus striatula</i>	0.01503	
<i>Rossia macrosoma</i>	0.05230		<i>Dosinia exoleta</i>	9.58178	
<i>Ruvettus pretiosus</i>	0.00128		<i>Mactra corallina stultorum</i>	0.06863	
<i>Sardina pilchardus</i>	2.89570		<i>Atelecyclus undecimdentatus</i>	0.50098	
<i>Sarpa salpa</i>	0.25513		<i>Liocarcinus depurator</i>	1.71135	
<i>Scomber colias</i>	12.85463		<i>Polybius henslowii</i>	0.61270	
<i>Scomber scombrus</i>	2.60231		<i>Pagurus spp.</i>	41.43121	
<i>Scyliorhinus canicula</i>	1.74125		<i>Squilla mantis</i>	3.49685	
<i>Serranus cabrilla</i>	0.20410		<i>Echinocardium cordatum</i>	26.05106	
<i>Solea spp.</i>	0.05103		<i>Polychaetes</i>	0.25400	
<i>Sphoeroides cutaneus</i>	0.00510		<i>Trachinus vipera</i>	0.10921	
<i>Sphoeroides pachygaster</i>	0.39545	Gill net and Long-line	<i>Benthodesmus elongatus</i>	3.02126	
<i>Spondyliosoma cantharus</i>	0.21686		<i>Brama brama</i>	0.52991	
<i>Tealia spp.</i>	0.15308		<i>Centrolophus monstrosa</i>	0.14273	
<i>Todaropsis eblanae</i>	0.00255		<i>Chimaera monstrosa</i>	0.13071	
<i>Torpedo nobiliana</i>	0.01913		<i>Conger conger</i>	0.19096	
<i>Trachurus mediterraneus</i>	0.00128		<i>Dalatias licha</i>	0.10915	
<i>Trachurus picturatus</i>	15.85621				
<i>Trachurus spp.</i>	0.38269				
<i>Trachurus trachurus</i>	5.78375				
<i>Triglidae</i>	1.17359				

Table S1. – Taxonomic list with the average discard rate per métier per taxa (based on studies of Table 1) used for the rebuilding of unreported catches.

Métier	Species	% of the discards	Métier	Species	% of the discards
Trap	<i>Dasyatis violacea</i>	0.01317		<i>Echinus acutus</i>	0.00137
	<i>Etmopterus pusillus</i>	0.34307		<i>Goneplax rhomboides</i>	0.00003
	<i>Etmopterus spinax</i>	0.77651		<i>Gymnammodytes cicereus</i>	0.00018
	<i>Galeus melastomus</i>	0.18932		<i>Halobatrachus didactylus</i>	0.02503
	<i>Hoplostethus mediterraneus</i>	0.00840		Holothuroidea	0.08317
	<i>Hymenocephalus italicus</i>	0.02519		Labridae	0.00082
	<i>Illex coindetii</i>	0.10075		<i>Labrus mixtus</i>	0.00085
	<i>Lagocephalus lagocephalus</i>	0.01317		<i>Lepidorhombus boscii</i>	0.00111
	<i>Malacocephalus laevis</i>	0.01317		<i>Lepidotrigla cavillone</i>	0.00958
	<i>Merluccius merluccius</i>	92.68932		<i>Lepidotrigla dieuzeidei</i>	0.00067
	<i>Micromesistius poutassou</i>	0.44810		<i>Liocarcinus holsatus</i>	0.00002
	<i>Naucrates ductor</i>	0.00840		<i>Liza ramada</i>	0.02964
	<i>Nephrops norvegicus</i>	0.00840		<i>Liza</i> spp.	0.00022
	<i>Phycis blennoides</i>	0.04972		<i>Loligo</i> spp.	0.00577
	<i>Scyliorhinus canicula</i>	0.06355		<i>Macroramphosus scolopax</i>	0.08791
	<i>Todaropsis eblanae</i>	1.12506		<i>Maja goltziana</i>	0.00008
				<i>Maja squinado</i>	0.01776
				<i>Marthasterias glacialis</i>	0.00201
				<i>Merluccius merluccius</i>	1.51962
				<i>Microchirus azevia</i>	5.16478
				<i>Microchirus ocellatus</i>	0.00128
				<i>Microchirus variegatus</i>	0.00211
				<i>Micromesistius poutassou</i>	0.00697
				<i>Mola mola</i>	0.04104
				<i>Mugil cephalus</i>	0.01307
				<i>Mullus barbatus</i>	0.00478
				<i>Mullus</i> spp.	0.00434
				<i>Mullus surmuletus</i>	0.00111
				<i>Myliobatis aquila</i>	0.02242
			<i>Nucella lapillus</i>	0.00023	
			<i>Pagellus acarne</i>	2.89204	
			<i>Pagellus erythrinus</i>	0.01855	
			<i>Pagellus</i> spp.	0.00142	
			<i>Pagrus pagrus</i>	0.00256	
			<i>Pagurus forbesii</i>	0.00006	
			<i>Palinurus elephas</i>	0.00019	
			<i>Paracentrotus lividus</i>	0.00133	
			<i>Pecten maximus</i>	0.00320	
			<i>Phycis phycis</i>	1.21960	
			Pleuronectiformes	0.00026	
			<i>Polybius henslowii</i>	0.00004	
			<i>Raja brachyura</i>	0.01713	
			<i>Raja clavata</i>	0.02768	
			<i>Raja miraletus</i>	0.04638	
			<i>Raja</i> spp.	0.00221	
			<i>Raja undulata</i>	0.01940	
			<i>Sardina pilchardus</i>	19.49873	
			<i>Scomber colias</i>	34.75575	
			<i>Scomber scombrus</i>	0.06729	
			<i>Scomber</i> spp.	0.00047	
			<i>Scophthalmus maximus</i>	0.00107	
			<i>Scophthalmus rhombus</i>	0.00261	
			<i>Scorpaena notata</i>	7.18370	
			<i>Scorpaena porcus</i>	0.00503	
			<i>Scyliorhinus canicula</i>	0.00733	
			<i>Sepia officinalis</i>	1.66134	
			<i>Serranus cabrilla</i>	2.20532	
			<i>Serranus hepatus</i>	0.00049	
			<i>Solea lascaris</i>	0.05993	
			<i>Solea senegalensis</i>	0.05684	
			<i>Solea solea</i>	0.00183	
			<i>Solea</i> spp.	0.00286	
			Soleidae	0.00046	
			<i>Sparus aurata</i>	0.00382	
			<i>Spondyliosoma cantharus</i>	0.03863	
			<i>Symphodus bailloni</i>	0.00016	
			<i>Symphodus</i> spp.	0.00028	
			<i>Torpedo torpedo</i>	0.03430	
			<i>Trachinus draco</i>	5.78890	
			<i>Trachurus trachurus</i>	2.32199	
			<i>Trigla lyra</i>	0.00077	
			<i>Trigla</i> sp.	0.02197	
			<i>Trigloporus lastoviza</i>	0.01098	
			<i>Trisopterus luscus</i>	0.08946	
			<i>Uranoscopus scaber</i>	0.00068	
			<i>Zeugopterus punctatus</i>	0.00009	
			<i>Zeus faber</i>	0.01073	
Trammel net	<i>Alopias fallax</i>	0.00332			
	<i>Ammodytes tobianus</i>	0.00037			
	<i>Aplysia punctata</i>	0.00831			
	<i>Argentina sphyraena</i>	0.00010			
	<i>Arnoglossus imperialis</i>	0.00641			
	<i>Arnoglossus laterna</i>	0.00045			
	<i>Arnoglossus</i> spp.	0.00031			
	<i>Arnoglossus thori</i>	0.00008			
	<i>Aspitrigla cuculus</i>	0.00100			
	<i>Asterias rubens</i>	0.00138			
	<i>Astropecten aranciatus</i>	0.32857			
	<i>Atrina pectinata</i>	0.02003			
	<i>Balistes capriscus</i>	0.10595			
	<i>Balistes carolinensis</i>	0.01098			
	<i>Belone belone</i>	0.00940			
	<i>Boops boops</i>	8.07890			
	Bothidae	0.00004			
	<i>Bothus podas</i>	0.00105			
	<i>Calappa granulata</i>	0.00049			
	<i>Callionymus lyra</i>	0.09803			
	<i>Callionymus reticulatus</i>	0.00001			
	<i>Capros aper</i>	0.01261			
	<i>Carcinus maenas</i>	0.00011			
	<i>Centrolabrus exoletus</i>	0.00170			
	<i>Chelidonichthys lastoviza</i>	0.01619			
	<i>Chelidonichthys lucernus</i>	0.01978			
	<i>Chelidonichthys obscurus</i>	4.63812			
	<i>Chelon labrosus</i>	0.00425			
	<i>Citharus linguatula</i>	1.32968			
	<i>Conger conger</i>	0.00081			
	<i>Coris julis</i>	0.00040			
	<i>Cymbium olla</i>	0.11782			
	<i>Dardanus arrosor</i>	0.00179			
	<i>Dentex dentex</i>	0.00143			
	<i>Dentex macrophthalmus</i>	0.00053			
	<i>Dentex maroccanus</i>	0.00100			
	<i>Dentex</i> spp.	0.00075			
	<i>Dicentrarchus labrax</i>	0.00621			
	<i>Dicologlossa cuneata</i>	0.02471			
	<i>Diplodus annularis</i>	0.00077			
	<i>Diplodus bellottii</i>	0.01098			
	<i>Diplodus sargus</i>	0.00055			
	<i>Diplodus</i> spp.	0.00081			

Table S2. – Taxonomic list with the average absolute and relative weight contribution of each taxa to total unreported catch, per métier, for the period between 1938 and 2009.

Species	Taxa Group	Tonnes (SD)	%
Unreported			
<i>Scomber colias</i>	Fish	21783.6 (±7048.2)	17.63919
<i>Boops boops</i>	Fish	11162.3 (±2868.3)	9.03861
<i>Trachurus picturatus</i>	Fish	10659.5 (±4864.9)	8.63148
<i>Merluccius merluccius</i>	Fish	10270.8 (±4528.6)	8.31675
<i>Sardina pilchardus</i>	Fish	8692 (±2476.4)	7.03830
<i>Liza aurata</i>	Fish	8650.4 (±6238.9)	7.00460
<i>Micromesistius poutassou</i>	Fish	8500.9 (±3878.9)	6.88360
<i>Trachurus trachurus</i>	Fish	4502.1 (±1886.5)	3.64554
<i>Belone belone</i>	Fish	3614.3 (±965.6)	2.92666
<i>Scomber scombrus</i>	Fish	3205.3 (±1026.1)	2.59552
<i>Macroramphosus scolopax</i>	Fish	2901.9 (±762.7)	2.34980
<i>Capros aper</i>	Fish	2524.1 (±1151.5)	2.04389
<i>Chondrichthyes</i>	Fish	2178.2 (±994.1)	1.76379
<i>Conger conger</i>	Fish	1976.7 (±901.9)	1.60059
<i>Scorpaena notata</i>	Fish	1228.4 (±499.9)	0.99467
<i>Scyliorhinus canicula</i>	Sharks	1172.6 (±534.8)	0.94947
Other fish and Invertebrates	Other Fish and Invertebrates	1114.8 (±508.8)	0.90273
Octopodidae	Cephalopoda	1080.5 (±493.1)	0.87495
<i>Diplodus sargus</i>	Fish	1067.9 (±266.9)	0.86469
<i>Trachinus draco</i>	Fish	930 (±387)	0.75307
<i>Lophius</i> spp.	Fish	840.4 (±383.6)	0.68052
<i>Microchirus azevia</i>	Fish	829.7 (±345.3)	0.67188
Triglidae	Fish	792.5 (±360.8)	0.64171
<i>Lepidopus caudatus</i>	Fish	792.4 (±361.6)	0.64163
Cephalopoda	Cephalopoda	771.8 (±352.2)	0.62497
<i>Gadiculus argenteus</i>	Fish	755.5 (±344.8)	0.61177
<i>Chelidonichthys obscurus</i>	Fish	745.1 (±310.1)	0.60337
<i>Phycis</i> spp.	Fish	634.6 (±289.6)	0.51386
<i>Parapenaeus longirostris</i>	Crustacea	626 (±285.7)	0.50692
<i>Halobatrachus didactylus</i>	Fish	625 (±157.9)	0.50611
Holothuroidea	Other Invertebrates	545 (±245.5)	0.44135
<i>Polybius henslowii</i>	Crustacea	516 (±234)	0.41781
<i>Serranus cabrilla</i>	Fish	491.5 (±187)	0.39799
<i>Pagellus acarne</i>	Fish	464.6 (±193.3)	0.37622
<i>Galeus melastomus</i>	Sharks	409.7 (±186.3)	0.33174
<i>Sarpa salpa</i>	Fish	403.6 (±156.6)	0.32678
<i>Trisopterus luscus</i>	Fish	366 (±163.6)	0.29634
<i>Mullus</i> spp.	Fish	300.8 (±137.1)	0.24361
<i>Sepia officinalis</i>	Cephalopoda	267.4 (±111)	0.21649
<i>Sphoeroides pachygaster</i>	Fish	265.8 (±121.3)	0.21527
<i>Maja squinado</i>	Crustacea	260.3 (±118)	0.21074
<i>Pagellus</i> spp.	Fish	257.5 (±117.5)	0.20851
<i>Trachurus</i> spp.	Fish	257.3 (±117.4)	0.20832
<i>Spicara flexuosa</i>	Fish	243.8 (±64.5)	0.19744
<i>Pagrus</i> spp.	Fish	240.1 (±109.6)	0.19443
<i>Citharus linguatula</i>	Fish	229.2 (±91.4)	0.18558
<i>Helicolenus dactylopterus</i>	Fish	207.5 (±94.7)	0.16805
<i>Phycis phycis</i>	Fish	195.9 (±81.5)	0.15866
<i>Pagrus pagrus</i>	Fish	171.9 (±78.4)	0.13922
<i>Spondylisoma cantharus</i>	Fish	171.5 (±71)	0.13891
<i>Xiphias gladius</i>	Fish	171.5 (±78.3)	0.13888
<i>Octopus vulgaris</i>	Cephalopoda	162.9 (±74.4)	0.13194
Mugilidae	Fish	142.4 (±35.6)	0.11528
<i>Liza ramada</i>	Fish	132 (±91.9)	0.10686
<i>Zeus faber</i>	Fish	130.4 (±59.1)	0.10556
<i>Plesionika</i> spp.	Crustacea	128.6 (±58.7)	0.10416
<i>Diplodus vulgaris</i>	Fish	122.6 (±30.4)	0.09925
Rajidae (+ other similar)	Rays	111.9 (±50.9)	0.09060
<i>Tealia</i> spp.	Other Invertebrates	102.9 (±47)	0.08333
<i>Pagurus</i> spp.	Crustacea	96.8 (±213.1)	0.07837
<i>Dicentrarchus labrax</i>	Fish	96.8 (±24.2)	0.07836
Echinoidea	Other Invertebrates	94.3 (±43.1)	0.07638
<i>Sparus aurata</i>	Fish	93.8 (±23.5)	0.07595
<i>Astropecten aranciacus</i>	Other Invertebrates	87.8 (±32.2)	0.07112
<i>Balistes caprisus</i>	Fish	81.7 (±21.8)	0.06618
<i>Pleuronectes platessa</i>	Fish	68.6 (±31.3)	0.05555
<i>Echinocardium cordatum</i>	Other Invertebrates	60.9 (±134)	0.04928
<i>Diplodus bellottii</i>	Fish	44.8 (±15.9)	0.03630
<i>Macropipus tuberculatus</i>	Crustacea	42.9 (±19.6)	0.03472
<i>Benthodesmus elongatus</i>	Fish	38.4 (±15.7)	0.03107
<i>Rossia macrosoma</i>	Cephalopoda	35.2 (±16)	0.02847
Soleidae	Fish	34.8 (±15.8)	0.02821
<i>Dardanus arrosor</i>	Crustacea	34.6 (±15.7)	0.02801
<i>Lepidorhombus</i> spp.	Fish	25.7 (±11.7)	0.02083

Table S2 (Cont.). – Taxonomic list with the average absolute and relative weight contribution of each taxa to total unreported catch, per métier, for the period between 1938 and 2009.

Species	Taxa Group	Tonnes (SD)	%
<i>Pagurus alatus</i>	Crustacea	25.7 (±11.7)	0.02083
<i>Dosinia exoleta</i>	Bivalvia	22.4 (±49.3)	0.01813
<i>Etmopterus pusillus</i>	Sharks	21.5 (±17.5)	0.01743
<i>Tellina tenuis</i>	Bivalvia	19.9 (±43.7)	0.01607
<i>Cymbium olla</i>	Gastropoda	18.9 (±7.9)	0.01533
<i>Mullus surmuletus</i>	Fish	17.3 (±7.9)	0.01403
<i>Argentina sphyraena</i>	Fish	17.2 (±7.8)	0.01390
<i>Argobuccinum olearium</i>	Gastropoda	17.2 (±7.8)	0.01389
<i>Cassidaria tyrrhena</i>	Gastropoda	17.2 (±7.8)	0.01389
<i>Todaropsis eblanae</i>	Cephalopoda	15.9 (±6.6)	0.01291
<i>Callionymus lyra</i>	Fish	15.7 (±6.6)	0.01275
<i>Dicentrarchus punctatus</i>	Fish	14.2 (±3.6)	0.01153
<i>Torpedo nobiliana</i>	Rays	12.9 (±5.9)	0.01042
<i>Etmopterus spinax</i>	Sharks	12.4 (±4.6)	0.01008
<i>Solea lascaris</i>	Fish	9.6 (±4)	0.00780
<i>Malacocephalus laevis</i>	Fish	9.6 (±4.4)	0.00777
<i>Solea senegalensis</i>	Fish	9.1 (±3.8)	0.00739
<i>Sphaerechinus granularis</i>	Other Invertebrates	8.6 (±3.1)	0.00700
<i>Caelorinchus caelorhincus</i>	Fish	8.6 (±3.9)	0.00694
<i>Deania calcea</i>	Sharks	8.5 (±9.3)	0.00690
<i>Squilla mantis</i>	Crustacea	8.2 (±18)	0.00661
<i>Centrophorus squamosus</i>	Sharks	7.8 (±8.5)	0.00633
<i>Raja miraletus</i>	Rays	7.5 (±3.1)	0.00603
<i>Brama brama</i>	Fish	6.7 (±2.8)	0.00543
<i>Mola mola</i>	Fish	6.6 (±2.7)	0.00534
<i>Illex coindetii</i>	Cephalopoda	5.6 (±2.4)	0.00450
<i>Torpedo torpedo</i>	Rays	5.5 (±2.3)	0.00446
<i>Raja clavata</i>	Rays	5.3 (±2.1)	0.00430
<i>Zenopsis conchifer</i>	Fish	4.3 (±2)	0.00347
<i>Liocarcinus depurator</i>	Crustacea	4 (±8.8)	0.00324
<i>Dicologlossa cuneata</i>	Fish	4 (±1.7)	0.00322
<i>Myliobatis aquila</i>	Rays	3.6 (±1.5)	0.00292
<i>Alepocephalus bairdii</i>	Fish	3.5 (±3.8)	0.00286
<i>Ophisurus serpens</i>	Fish	3.4 (±1.6)	0.00278
<i>Sphoeroides cutaneus</i>	Fish	3.4 (±1.6)	0.00278
<i>Chimaera monstrosa</i>	Fish	3.4 (±1.4)	0.00273
<i>Atrina pectinata</i>	Bivalvia	3.2 (±1.3)	0.00261
<i>Chelidonichthys lucernus</i>	Fish	3.2 (±1.3)	0.00257
<i>Diplodus annularis</i>	Fish	3.1 (±1.1)	0.00254
<i>Raja undulata</i>	Rays	3.1 (±1.3)	0.00252
<i>Pagellus erythrinus</i>	Fish	3 (±1.2)	0.00241
<i>Raja brachyura</i>	Rays	2.8 (±1.1)	0.00223
<i>Chelidonichthys lastoviza</i>	Fish	2.6 (±1.1)	0.00211
<i>Eledone cirrhosa</i>	Cephalopoda	2.6 (±1.2)	0.00208
<i>Synaphobranchus kaupii</i>	Fish	2.4 (±2.6)	0.00196
<i>Donax vittatus</i>	Bivalvia	2.3 (±5.2)	0.00190
<i>Mugil cephalus</i>	Fish	2.1 (±0.9)	0.00170
<i>Phycis blennoides</i>	Fish	1.8 (±0.7)	0.00149
<i>Centrolophus monstrosa</i>	Sharks	1.8 (±0.7)	0.00146
<i>Balistes carolinensis</i>	Fish	1.8 (±0.7)	0.00143
<i>Trigloporus lastoviza</i>	Fish	1.8 (±0.7)	0.00143
<i>Lophius piscatorius</i>	Fish	1.7 (±0.8)	0.00139
<i>Octopus salutii</i>	Cephalopoda	1.7 (±0.8)	0.00139
<i>Symphodus bailloni</i>	Fish	1.6 (±0.6)	0.00128
<i>Lepidotrigla cavillone</i>	Fish	1.5 (±0.6)	0.00125
<i>Dalatias licha</i>	Sharks	1.4 (±0.6)	0.00112
<i>Aplysia punctata</i>	Gastropoda	1.3 (±0.6)	0.00108
<i>Atelecyclus undecimdentatus</i>	Crustacea	1.2 (±2.6)	0.00095
<i>Ensis siliqua</i>	Bivalvia	1.1 (±2.4)	0.00087
<i>Arnoglossus imperialis</i>	Fish	1 (±0.4)	0.00083
<i>Hoplostethus mediterraneus</i>	Fish	1 (±0.4)	0.00078
<i>Hexanchus griseus</i>	Sharks	1 (±0.4)	0.00078
<i>Loligo spp.</i>	Cephalopoda	0.9 (±0.4)	0.00075
<i>Eledone moschata</i>	Cephalopoda	0.9 (±0.4)	0.00069
<i>Pagellus bogaraveo</i>	Fish	0.9 (±0.4)	0.00069
<i>Peristedion cataphractum</i>	Fish	0.9 (±0.4)	0.00069
<i>Raja oxyrinchus</i>	Rays	0.9 (±0.4)	0.00069
<i>Ruvettus pretiosus</i>	Fish	0.9 (±0.4)	0.00069
<i>Trachurus mediterraneus</i>	Fish	0.9 (±0.4)	0.00069
<i>Scorpaena porcus</i>	Fish	0.8 (±0.3)	0.00065
<i>Mullus barbatus</i>	Fish	0.8 (±0.3)	0.00062
<i>Chelon labrosus</i>	Fish	0.7 (±0.3)	0.00055
<i>Centroscymnus crepidater</i>	Sharks	0.6 (±0.7)	0.00049
<i>Polychaetes</i>	Other Invertebrates	0.6 (±1.3)	0.00048
<i>Acanthocardia spinosa</i>	Bivalvia	0.5 (±0.2)	0.00043

Table S2 (Cont.). – Taxonomic list with the average absolute and relative weight contribution of each taxa to total unreported catch, per métier, for the period between 1938 and 2009.

Species	Taxa Group	Tonnes (SD)	%
<i>Alosa fallax</i>	Fish	0.5 (±0.2)	0.00043
<i>Pecten maximus</i>	Bivalvia	0.5 (±0.2)	0.00042
<i>Scophthalmus rhombus</i>	Fish	0.4 (±0.2)	0.00034
<i>Trachyrincus scabrus</i>	Fish	0.4 (±0.4)	0.00033
<i>Nesiarchus nasutus</i>	Fish	0.4 (±0.4)	0.00029
<i>Microchirus variegatus</i>	Fish	0.3 (±0.1)	0.00027
<i>Marthasterias glacialis</i>	Other Invertebrates	0.3 (±0.1)	0.00026
<i>Hymenocephalus italicus</i>	Fish	0.3 (±0.1)	0.00026
<i>Lepidion gualantheri</i>	Fish	0.3 (±0.3)	0.00024
<i>Solea solea</i>	Fish	0.3 (±0.1)	0.00024
<i>Serranus hepatus</i>	Fish	0.3 (±0.1)	0.00024
<i>Centrolabrus exoletus</i>	Fish	0.3 (±0.1)	0.00022
<i>Trachinus vipera</i>	Fish	0.3 (±0.6)	0.00021
<i>Scymnodon ringens</i>	Sharks	0.3 (±0.3)	0.00020
<i>Dentex dentex</i>	Fish	0.2 (±0.1)	0.00019
<i>Asterias rubens</i>	Other Invertebrates	0.2 (±0.1)	0.00018
<i>Echinus acutus</i>	Other Invertebrates	0.2 (±0.1)	0.00018
<i>Paracentrotus lividus</i>	Other Invertebrates	0.2 (±0.1)	0.00017
<i>Microchirus exollatus</i>	Fish	0.2 (±0.1)	0.00017
<i>Alepisaurus ferax</i>	Fish	0.2 (±0.2)	0.00016
<i>Murex trunculus</i>	Gastropoda	0.2 (±0.1)	0.00016
<i>Spisula solida</i>	Bivalvia	0.2 (±0.4)	0.00016
<i>Lepidorhombus boscii</i>	Fish	0.2 (±0.1)	0.00015
<i>Scophthalmus maximus</i>	Fish	0.2 (±0.1)	0.00014
<i>Bothus podas</i>	Fish	0.2 (±0.1)	0.00014
<i>Dasyatis violacea</i>	Rays	0.2 (±0.1)	0.00013
<i>Lagocephalus lagocephalus</i>	Fish	0.2 (±0.1)	0.00013
<i>Aspitrigla cuculus</i>	Fish	0.2 (±0.1)	0.00013
<i>Dentex maroccanus</i>	Fish	0.2 (±0.1)	0.00013
<i>Mactra corallina stultorum</i>	Bivalvia	0.2 (±0.4)	0.00013
<i>Homala barbata</i>	Crustacea	0.2 (±0.1)	0.00013
<i>Centrophorus granulosus</i>	Sharks	0.2 (±0.2)	0.00012
<i>Centroscymnus coelolepis</i>	Sharks	0.2 (±0.2)	0.00012
<i>Lepidion spp.</i>	Fish	0.2 (±0.2)	0.00012
<i>Prionace glauca</i>	Sharks	0.2 (±0.2)	0.00012
<i>Labrus mixtus</i>	Fish	0.1 (±0.1)	0.00011
<i>Labridae</i>	Fish	0.1 (±0.1)	0.00011
<i>Diplodus spp.</i>	Fish	0.1 (±0.1)	0.00011
<i>Trigla lyra</i>	Fish	0.1 (±0.1)	0.00010
<i>Dentex spp.</i>	Fish	0.1 (±0.1)	0.00010
<i>Uranoscopus scaber</i>	Fish	0.1 (±0)	0.00009
<i>Lepidotrigla dieuzeidei</i>	Fish	0.1 (±0)	0.00009
<i>Naucrates ductor</i>	Fish	0.1 (±0)	0.00009
<i>Nephrops norvegicus</i>	Crustacea	0.1 (±0)	0.00009
<i>Epigonus telescopus</i>	Fish	0.1 (±0.1)	0.00008
<i>Dentex macrophthalmus</i>	Fish	0.1 (±0)	0.00007
<i>Calappa granulata</i>	Crustacea	0.1 (±0)	0.00006
<i>Scomber spp.</i>	Fish	0.1 (±0)	0.00006
<i>Arnoglossus laterna</i>	Fish	0.1 (±0)	0.00006
<i>Coris julis</i>	Fish	0.1 (±0)	0.00005
<i>Ammodytes tobianus</i>	Fish	0.1 (±0)	0.00005
<i>Aphanopus carbo</i>	Fish	0.1 (±0.1)	0.00004
<i>Centrophorus lusitanicus</i>	Sharks	0.1 (±0.1)	0.00004
<i>Coryphaena hippurus</i>	Fish	0.1 (±0.1)	0.00004
<i>Coryphaenoides rupestris</i>	Fish	0.1 (±0.1)	0.00004
<i>Deania profundorum</i>	Sharks	0.1 (±0.1)	0.00004
<i>Isurus oxyrinchus</i>	Sharks	0.1 (±0.1)	0.00004
<i>Thunnus alalunga</i>	Fish	0.1 (±0.1)	0.00004
<i>Arnoglossus spp.</i>	Fish	0.05 (±0.02)	0.00004
<i>Symphodus spp.</i>	Fish	0.04 (±0.02)	0.00004
<i>Pleuronectiformes</i>	Fish	0.04 (±0.02)	0.00003
<i>Nucella lapillus</i>	Gastropoda	0.04 (±0.02)	0.00003
<i>Venus striatula</i>	Bivalvia	0.04 (±0.08)	0.00003
<i>Liza spp.</i>	Fish	0.04 (±0.01)	0.00003
<i>Palinurus elephas</i>	Crustacea	0.03 (±0.01)	0.00002
<i>Ophioderma longicaudum</i>	Other Invertebrates	0.03 (±0.01)	0.00002
<i>Gymnammodytes cicerelus</i>	Other Invertebrates	0.03 (±0.01)	0.00002
<i>Carcinus maenas</i>	Crustacea	0.02 (±0.01)	0.00001
<i>Zeugopterus punctatus</i>	Fish	0.01 (±0.01)	0.00001
<i>Arnoglossus thori</i>	Fish	0.01 (±0.01)	0.00001
<i>Maja goletziana</i>	Crustacea	0.01 (±0.01)	0.00001
<i>Pagurus forbesii</i>	Crustacea	0.009 (±0.004)	0.00001
<i>Bothidae</i>	Fish	0.006 (±0.002)	0.000005
<i>Goneplax rhomboides</i>	Crustacea	0.005 (±0.002)	0.000004
<i>Liocarcinus holsatus</i>	Crustacea	0.003 (±0.001)	0.000003

Table S2 (Cont.). – Taxonomic list with the average absolute and relative weight contribution of each taxa to total unreported catch, per métier, for the period between 1938 and 2009.

Species	Taxa Group	Tonnes (SD)	%
<i>Callionymus reticulatus</i>	Fish	0.002 (±0.001)	0.000002
Black scabbardfish longline			
<i>Etmopterus pusillus</i>	Sharks	16.33 (±17.74)	35.6
<i>Deania calcea</i>	Sharks	8.52 (±9.25)	18.6
<i>Centrophorus squamosus</i>	Sharks	7.81 (±8.49)	17.0
<i>Alepocephalus bairdii</i>	Fish	3.53 (±3.83)	7.7
<i>Etmopterus spinax</i>	Sharks	2.62 (±2.85)	5.7
<i>Synaphobranchus kaupii</i>	Fish	2.42 (±2.63)	5.3
<i>Galeus melastomus</i>	Sharks	0.81 (±0.88)	1.8
<i>Centroscymnus crepidater</i>	Sharks	0.6 (±0.66)	1.3
<i>Trachyrincus scabrus</i>	Fish	0.4 (±0.44)	0.9
<i>Nesiarchus nasutus</i>	Fish	0.35 (±0.38)	0.8
<i>Phycis blennoides</i>	Fish	0.35 (±0.38)	0.8
<i>Lepidion guentheri</i>	Fish	0.3 (±0.33)	0.7
<i>Scymnodon ringens</i>	Sharks	0.25 (±0.27)	0.5
<i>Alepisaurus ferox</i>	Fish	0.2 (±0.22)	0.4
<i>Benthodesmus elongatus</i>	Fish	0.15 (±0.16)	0.3
<i>Lepidion</i> spp.	Fish	0.15 (±0.16)	0.3
<i>Centrophorus granulosus</i>	Sharks	0.15 (±0.16)	0.3
<i>Centroscymnus coelolepis</i>	Sharks	0.15 (±0.16)	0.3
<i>Prionace glauca</i>	Sharks	0.15 (±0.16)	0.3
<i>Epigonus telescopus</i>	Fish	0.1 (±0.11)	0.2
<i>Hexanchus griseus</i>	Sharks	0.1 (±0.11)	0.2
<i>Aphanopus carbo</i>	Fish	0.05 (±0.05)	0.1
<i>Coryphaena hippurus</i>	Fish	0.05 (±0.05)	0.1
<i>Coryphaenoides rupestris</i>	Fish	0.05 (±0.05)	0.1
<i>Thunnus alalunga</i>	Fish	0.05 (±0.05)	0.1
<i>Raja</i> spp.	Rays	0.05 (±0.05)	0.1
<i>Centrophorus lusitanicus</i>	Sharks	0.05 (±0.05)	0.1
<i>Deania profundorum</i>	Sharks	0.05 (±0.05)	0.1
<i>Isurus oxyrinchus</i>	Sharks	0.05 (±0.05)	0.1
Demersal Seine ("rapa")			
<i>Liza aurata</i>	Fish	8650 (±6239)	69
<i>Scomber colias</i>	Fish	3180 (±2294)	26
<i>Boops boops</i>	Fish	382 (±275)	3
<i>Liza ramada</i>	Fish	127 (±92)	1
<i>Sarpa salpa</i>	Fish	127 (±92)	1
Dredge			
<i>Pagurus</i> spp.	Crustacea	96.8 (±213.1)	41.431
<i>Echinocardium cordatum</i>	Echinodermata	60.9 (±134)	26.051
<i>Dosinia exoleta</i>	Bivalvia	22.4 (±49.3)	9.582
<i>Tellina tenuis</i>	Bivalvia	19.9 (±43.7)	8.497
<i>Citharus linguatula</i>	Fish	13.8 (±30.5)	5.929
<i>Squilla mantis</i>	Crustacea	8.2 (±18)	3.497
<i>Liocarcinus depurator</i>	Crustacea	4 (±8.8)	1.711
<i>Donax vittatus</i>	Bivalvia	2.3 (±5.2)	1.002
<i>Polybius henslowii</i>	Crustacea	1.4 (±3.2)	0.613
<i>Atelecyclus undecimdentatus</i>	Crustacea	1.2 (±2.6)	0.501
<i>Ensis siliqua</i>	Bivalvia	1.1 (±2.4)	0.458
<i>Polychaetes</i>	Other invertebrates	0.6 (±1.3)	0.254
<i>Sepia officinalis</i>	Cephalopoda	0.5 (±1)	0.197
<i>Trachinus vipera</i>	Fish	0.3 (±0.6)	0.109
<i>Spisula solida</i>	Bivalvia	0.2 (±0.4)	0.083
<i>Mactra corallina stultorum</i>	Bivalvia	0.2 (±0.4)	0.069
<i>Venus striatula</i>	Bivalvia	0.04 (±0.1)	0.015
<i>Dicologlossa cuneata</i>	Fish	0.002 (±0.005)	0.001
Gill net and Long-line			
<i>Merluccius merluccius</i>	Fish	1172.4 (±482.2)	92.689
<i>Benthodesmus elongatus</i>	Fish	38.2 (±15.7)	3.021
<i>Todaropsis eblanae</i>	Cephalopoda	14.2 (±5.9)	1.125
<i>Etmopterus spinax</i>	Sharks	9.8 (±4)	0.777
<i>Brama brama</i>	Fish	6.7 (±2.8)	0.530
<i>Micromesistius poutassou</i>	Fish	5.7 (±2.3)	0.448
<i>Etmopterus pusillus</i>	Sharks	4.3 (±1.8)	0.343
<i>Conger conger</i>	Fish	2.4 (±1)	0.191
<i>Galeus melastomus</i>	Sharks	2.4 (±1)	0.189
<i>Centrolophus monstrosa</i>	Sharks	1.8 (±0.7)	0.143
<i>Chimaera monstrosa</i>	Fish	1.7 (±0.7)	0.131
<i>Dalatias licha</i>	Sharks	1.4 (±0.6)	0.109
<i>Illex coindetii</i>	Cephalopoda	1.3 (±0.5)	0.101
<i>Scyliorhinus canicula</i>	Sharks	0.8 (±0.3)	0.064
<i>Phycis blennoides</i>	Fish	0.6 (±0.3)	0.050
<i>Hymenocephalus italicus</i>	Fish	0.3 (±0.1)	0.025
<i>Lagocephalus lagocephalus</i>	Fish	0.2 (±0.1)	0.013
<i>Malacocephalus laevis</i>	Fish	0.2 (±0.1)	0.013

Table S2 (Cont.). – Taxonomic list with the average absolute and relative weight contribution of each taxa to total unreported catch, per métier, for the period between 1938 and 2009.

Species	Taxa Group	Tonnes (SD)	%
<i>Dasyatis violacea</i>	Rays	0.2 (±0.1)	0.013
<i>Nephrops norvegicus</i>	Crustacea	0.1 (±0.04)	0.008
<i>Hoplostethus mediterraneus</i>	Fish	0.1 (±0.04)	0.008
<i>Naucrates ductor</i>	Fish	0.1 (±0.04)	0.008
Trammel net			
<i>Scomber colias</i>	Fish	5583.62 (±2323.6)	34.7557
<i>Sardina pilchardus</i>	Fish	3132.53 (±1303.59)	19.4987
<i>Boops boops</i>	Fish	1297.9 (±540.12)	8.0789
<i>Scorpaena notata</i>	Fish	1154.08 (±480.27)	7.1837
<i>Trachinus draco</i>	Fish	930 (±387.02)	5.7889
<i>Microchirus azevia</i>	Fish	829.74 (±345.29)	5.1648
<i>Chelidonichthys obscurus</i>	Fish	745.13 (±310.08)	4.6381
<i>Pagellus acarne</i>	Fish	464.61 (±193.35)	2.8920
<i>Trachurus trachurus</i>	Fish	373.03 (±155.24)	2.3220
<i>Serranus cabrilla</i>	Fish	354.29 (±147.44)	2.2053
<i>Sepia officinalis</i>	Cephalopoda	266.9 (±111.07)	1.6613
<i>Merluccius merluccius</i>	Fish	244.13 (±101.59)	1.5196
<i>Citharus linguatula</i>	Fish	213.62 (±88.9)	1.3297
<i>Phycis phycis</i>	Fish	195.93 (±81.54)	1.2196
<i>Astropecten aranciacus</i>	Echinodermata	52.79 (±21.97)	0.3286
<i>Cymbium olla</i>	Gastropoda	18.93 (±7.88)	0.1178
<i>Balistes capriscus</i>	Fish	17.02 (±7.08)	0.1060
<i>Callionymus lyra</i>	Fish	15.75 (±6.55)	0.0980
<i>Trisopterus luscus</i>	Fish	14.37 (±5.98)	0.0895
<i>Macroramphosus scolopax</i>	Fish	14.12 (±5.88)	0.0879
<i>Holothuroidea</i>	Echinodermata	13.36 (±5.56)	0.0832
<i>Scomber scombrus</i>	Fish	10.81 (±4.5)	0.0673
<i>Solea lascaris</i>	Fish	9.63 (±4.01)	0.0599
<i>Solea senegalensis</i>	Fish	9.13 (±3.8)	0.0568
<i>Raja miraletus</i>	Rays	7.45 (±3.1)	0.0464
<i>Mola mola</i>	Fish	6.59 (±2.74)	0.0410
<i>Spondyliosoma cantharus</i>	Fish	6.21 (±2.58)	0.0386
<i>Torpedo torpedo</i>	Rays	5.51 (±2.29)	0.0343
<i>Liza ramada</i>	Fish	4.76 (±1.98)	0.0296
<i>Raja clavata</i>	Rays	4.45 (±1.85)	0.0277
<i>Halobatrachus didactylus</i>	Fish	4.02 (±1.67)	0.0250
<i>Dicologlossa cuneata</i>	Fish	3.97 (±1.65)	0.0247
<i>Myliobatis aquila</i>	Rays	3.6 (±1.5)	0.0224
<i>Trigla</i> sp.	Fish	3.53 (±1.47)	0.0220
<i>Atrina pectinata</i>	Bivalvia	3.22 (±1.34)	0.0200
<i>Chelidonichthys lucernus</i>	Fish	3.18 (±1.32)	0.0198
<i>Raja undulata</i>	Rays	3.12 (±1.3)	0.0194
<i>Pagellus erythrinus</i>	Fish	2.98 (±1.24)	0.0185
<i>Maja squinado</i>	Crustacea	2.85 (±1.19)	0.0178
<i>Raja brachyura</i>	Rays	2.75 (±1.15)	0.0171
<i>Chelidonichthys lastoviza</i>	Fish	2.6 (±1.08)	0.0162
<i>Mugil cephalus</i>	Fish	2.1 (±0.87)	0.0131
<i>Capros aper</i>	Fish	2.03 (±0.84)	0.0126
<i>Balistes carolinensis</i>	Fish	1.76 (±0.73)	0.0110
<i>Diplodus bellottii</i>	Fish	1.76 (±0.73)	0.0110
<i>Trigloporus lastoviza</i>	Fish	1.76 (±0.73)	0.0110
<i>Zeus faber</i>	Fish	1.72 (±0.72)	0.0107
<i>Lepidotrigla cavillone</i>	Fish	1.54 (±0.64)	0.0096
<i>Belone belone</i>	Fish	1.51 (±0.63)	0.0094
<i>Aplysia punctata</i>	Gastropoda	1.34 (±0.56)	0.0083
<i>Scyliorhinus canicula</i>	Sharks	1.18 (±0.49)	0.0073
<i>Micromesistius poutassou</i>	Fish	1.12 (±0.47)	0.0070
<i>Arnoglossus imperialis</i>	Fish	1.03 (±0.43)	0.0064
<i>Dicentrarchus labrax</i>	Fish	1 (±0.42)	0.0062
<i>Loligo</i> spp.	Cephalopoda	0.93 (±0.39)	0.0058
<i>Scorpaena porcus</i>	Fish	0.81 (±0.34)	0.0050
<i>Mullus barbatus</i>	Fish	0.77 (±0.32)	0.0048
<i>Mullus</i> spp.	Fish	0.7 (±0.29)	0.0043
<i>Chelon labrosus</i>	Fish	0.68 (±0.28)	0.0042
<i>Sparus aurata</i>	Fish	0.61 (±0.26)	0.0038
<i>Alosa fallax</i>	Fish	0.53 (±0.22)	0.0033
<i>Pecten maximus</i>	Bivalvia	0.51 (±0.21)	0.0032
<i>Solea</i> spp.	Fish	0.46 (±0.19)	0.0029
<i>Scophthalmus rhombus</i>	Fish	0.42 (±0.17)	0.0026
<i>Pagrus pagrus</i>	Fish	0.41 (±0.17)	0.0026
<i>Raja</i> spp.	Rays	0.36 (±0.15)	0.0022
<i>Microchirus variegatus</i>	Fish	0.34 (±0.14)	0.0021
<i>Marthasterias glacialis</i>	Echinodermata	0.32 (±0.13)	0.0020
<i>Solea solea</i>	Fish	0.29 (±0.12)	0.0018
<i>Dardanus arrosor</i>	Crustacea	0.29 (±0.12)	0.0018

Table S2 (Cont.). – Taxonomic list with the average absolute and relative weight contribution of each taxa to total unreported catch, per métier, for the period between 1938 and 2009.

Species	Taxa Group	Tonnes (SD)	%
<i>Centrolabrus exoletus</i>	Fish	0.27 (±0.11)	0.0017
<i>Dentex dentex</i>	Fish	0.23 (±0.1)	0.0014
<i>Pagellus</i> spp.	Fish	0.23 (±0.09)	0.0014
<i>Asterias rubens</i>	Echinodermata	0.22 (±0.09)	0.0014
<i>Echinus acutus</i>	Echinodermata	0.22 (±0.09)	0.0014
<i>Paracentrotus lividus</i>	Echinodermata	0.21 (±0.09)	0.0013
<i>Microchirus ocellatus</i>	Fish	0.21 (±0.09)	0.0013
<i>Lepidorhombus boscii</i>	Fish	0.18 (±0.07)	0.0011
<i>Mullus surmuletus</i>	Fish	0.18 (±0.07)	0.0011
<i>Scophthalmus maximus</i>	Fish	0.17 (±0.07)	0.0011
<i>Bothus podas</i>	Fish	0.17 (±0.07)	0.0011
<i>Aspitrigla cuculus</i>	Fish	0.16 (±0.07)	0.0010
<i>Dentex maroccanus</i>	Fish	0.16 (±0.07)	0.0010
<i>Labrus mixtus</i>	Fish	0.14 (±0.06)	0.0009
Labridae	Fish	0.13 (±0.05)	0.0008
<i>Conger conger</i>	Fish	0.13 (±0.05)	0.0008
<i>Diplodus</i> spp.	Fish	0.13 (±0.05)	0.0008
<i>Trigla lyra</i>	Fish	0.12 (±0.05)	0.0008
<i>Diplodus annularis</i>	Fish	0.12 (±0.05)	0.0008
<i>Dentex</i> spp.	Fish	0.12 (±0.05)	0.0007
<i>Uranoscopus scaber</i>	Fish	0.11 (±0.05)	0.0007
<i>Lepidotrigla dieuzeidei</i>	Fish	0.11 (±0.04)	0.0007
<i>Diplodus sargus</i>	Fish	0.09 (±0.04)	0.0005
<i>Dentex macrophthalmus</i>	Fish	0.09 (±0.04)	0.0005
<i>Calappa granulata</i>	Crustacea	0.08 (±0.03)	0.0005
<i>Serranus hepatus</i>	Fish	0.08 (±0.03)	0.0005
<i>Scomber</i> spp.	Fish	0.08 (±0.03)	0.0005
Soleidae	Fish	0.07 (±0.03)	0.0005
<i>Arnoglossus laterna</i>	Fish	0.07 (±0.03)	0.0005
<i>Coris julis</i>	Fish	0.06 (±0.03)	0.0004
<i>Ammodytes tobianus</i>	Fish	0.06 (±0.02)	0.0004
<i>Arnoglossus</i> spp.	Fish	0.05 (±0.02)	0.0003
<i>Symphodus</i> spp.	Fish	0.04 (±0.02)	0.0003
Pleuronectiformes	Fish	0.04 (±0.02)	0.0003
<i>Nucella lapillus</i>	Gastropoda	0.04 (±0.02)	0.0002
<i>Liza</i> spp.	Fish	0.04 (±0.01)	0.0002
<i>Palinurus elephas</i>	Crustacea	0.03 (±0.01)	0.0002
<i>Gymnammodytes cicerelus</i>	Echinodermata	0.03 (±0.01)	0.0002
<i>Symphodus bailloni</i>	Fish	0.03 (±0.01)	0.0002
<i>Carcinus maenas</i>	Crustacea	0.02 (±0.01)	0.0001
<i>Argentina sphyraena</i>	Fish	0.02 (±0.01)	0.0001
<i>Zeugopterus punctatus</i>	Fish	0.01 (±0.01)	0.0001
<i>Maja goletziana</i>	Crustacea	0.01 (±0.01)	0.0001
<i>Arnoglossus thori</i>	Fish	0.01 (±0.01)	0.0001
<i>Pagurus forbesii</i>	Crustacea	0.01 (±0)	0.0001
<i>Polybius henslowii</i>	Crustacea	0.01 (±0)	0.00004
Bothidae	Fish	0.01 (±0)	0.00004
<i>Goneplax rhomboides</i>	Crustacea	0.005 (±0.002)	0.00003
<i>Liocarcinus holsatus</i>	Crustacea	0.003 (±0.001)	0.00002
<i>Callionymus reticulatus</i>	Fish	0.002 (±0.001)	0.00001
Trap			
<i>Halobatrachus didactylus</i>	Fish	380.2 (±135.4)	68.184
<i>Scorpaena notata</i>	Fish	74.3 (±26.5)	13.325
<i>Diplodus bellottii</i>	Fish	43.1 (±15.3)	7.723
<i>Astropecten aranciacus</i>	Echinodermata	35 (±12.5)	6.286
<i>Sphaerechinus granularis</i>	Echinodermata	8.6 (±3.1)	1.550
<i>Spondyliosoma cantharus</i>	Fish	5.3 (±1.9)	0.954
<i>Diplodus annularis</i>	Fish	3 (±1.1)	0.540
<i>Spicara flexuosa</i>	Fish	3 (±1.1)	0.535
<i>Diplodus vulgaris</i>	Fish	2.2 (±0.8)	0.395
<i>Symphodus bailloni</i>	Fish	1.6 (±0.6)	0.279
<i>Acanthocardia spinosa</i>	Bivalvia	0.5 (±0.2)	0.096
<i>Serranus hepatus</i>	Fish	0.2 (±0.1)	0.038
<i>Murex trunculus</i>	Gastropoda	0.2 (±0.1)	0.036
<i>Homala barbata</i>	Crustacea	0.2 (±0.1)	0.029
<i>Maja squinado</i>	Crustacea	0.1 (±0.05)	0.024
<i>Ophioderma longicaudum</i>	Echinodermata	0.03 (±0.01)	0.005
Artisanal/multi-gear			
<i>Liza aurata</i>	Fish	8650.35 (±6238.89)	36.87007
<i>Scomber colias</i>	Fish	4381.95 (±2597.49)	18.67701
<i>Sardina pilchardus</i>	Fish	3132.53 (±1303.59)	13.35167
<i>Trachinus draco</i>	Fish	930 (±387.02)	3.96392
<i>Boops boops</i>	Fish	839.77 (±627.54)	3.57931
<i>Microchirus azevia</i>	Fish	829.74 (±345.29)	3.53656
<i>Chelidonichthys obscurus</i>	Fish	745.13 (±310.08)	3.17593

Table S2 (Cont.). – Taxonomic list with the average absolute and relative weight contribution of each taxa to total unreported catch, per métier, for the period between 1938 and 2009.

Species	Taxa Group	Tonnes (SD)	%
<i>Merluccius merluccius</i>	Fish	708.24 (±580.94)	3.01873
<i>Scorpaena notata</i>	Fish	614.19 (±639.06)	2.61782
<i>Pagellus acarne</i>	Fish	464.61 (±193.35)	1.98031
<i>Trachurus trachurus</i>	Fish	373.03 (±155.24)	1.58997
<i>Serranus cabrilla</i>	Fish	354.29 (±147.44)	1.51008
<i>Phycis phycis</i>	Fish	195.93 (±81.54)	0.83511
<i>Halobatrachus didactylus</i>	Fish	192.09 (±211.47)	0.81872
<i>Sepia officinalis</i>	Cephalopoda	133.68 (±154.91)	0.56978
<i>Sarpa salpa</i>	Fish	127.21 (±91.75)	0.54221
<i>Citharus linguatula</i>	Fish	113.73 (±120.13)	0.48476
<i>Pagurus</i> spp.	Crustacea	96.79 (±213.13)	0.41254
<i>Liza ramada</i>	Fish	65.99 (±89.2)	0.28125
<i>Echinocardium cordatum</i>	Echinodermata	60.86 (±134.01)	0.25939
<i>Astropecten aranciatus</i>	Echinodermata	43.92 (±19.9)	0.18719
<i>Diplodus bellottii</i>	Fish	22.41 (±23.37)	0.09552
<i>Dosinia exoleta</i>	Bivalvia	22.38 (±49.29)	0.09541
<i>Tellina tenuis</i>	Bivalvia	19.85 (±43.71)	0.08461
<i>Benthodesmus elongates</i>	Fish	19.18 (±22.08)	0.08176
<i>Cymbium olla</i>	Gastropoda	18.93 (±7.88)	0.08068
<i>Balistes caprisicus</i>	Fish	17.02 (±7.08)	0.07255
<i>Callionymus lyra</i>	Fish	15.75 (±6.55)	0.06713
<i>Trisopterus luscus</i>	Fish	14.37 (±5.98)	0.06126
<i>Todaropsis eblanae</i>	Cephalopoda	14.23 (±5.85)	0.06065
<i>Macroramphosus scolopax</i>	Fish	14.12 (±5.88)	0.06020
Holothuroidea	Echinodermata	13.36 (±5.56)	0.05695
<i>Scomber scombrus</i>	Fish	10.81 (±4.5)	0.04608
<i>Etmopterus pusillus</i>	Sharks	10.33 (±13.93)	0.04405
<i>Solea lascaris</i>	Fish	9.63 (±4.01)	0.04104
<i>Solea senegalensis</i>	Fish	9.13 (±3.8)	0.03892
<i>Sphaerechinus granularis</i>	Echinodermata	8.64 (±3.08)	0.03684
<i>Deania calcea</i>	Sharks	8.52 (±9.25)	0.03631
<i>Squilla mantis</i>	Crustacea	8.17 (±17.99)	0.03482
<i>Centrophorus squamosus</i>	Sharks	7.81 (±8.49)	0.03330
<i>Raja miraletus</i>	Rays	7.45 (±3.1)	0.03176
<i>Brama brama</i>	Fish	6.7 (±2.76)	0.02857
<i>Mola mola</i>	Fish	6.59 (±2.74)	0.02811
<i>Etmopterus spinax</i>	Sharks	6.22 (±5.02)	0.02652
<i>Spondyliosoma cantharus</i>	Fish	5.76 (±2.3)	0.02456
<i>Torpedo torpedo</i>	Rays	5.51 (±2.29)	0.02348
<i>Raja clavata</i>	Rays	4.45 (±1.85)	0.01895
<i>Liocarcinus depurator</i>	Crustacea	4 (±8.8)	0.01704
<i>Myliobatis aquila</i>	Rays	3.6 (±1.5)	0.01535
<i>Trigla</i> sp.	Fish	3.53 (±1.47)	0.01504
<i>Alepocephalus bairdii</i>	Fish	3.53 (±3.83)	0.01504
<i>Micromesistius poutassou</i>	Fish	3.39 (±2.83)	0.01446
<i>Atrina pectinata</i>	Bivalvia	3.22 (±1.34)	0.01371
<i>Chelidonichthys lucernus</i>	Fish	3.18 (±1.32)	0.01354
<i>Raja undulata</i>	Rays	3.12 (±1.3)	0.01329
<i>Spicara flexuosa</i>	Fish	2.98 (±1.06)	0.01271
<i>Pagellus erythrinus</i>	Fish	2.98 (±1.24)	0.01270
<i>Raja brachyura</i>	Rays	2.75 (±1.15)	0.01173
<i>Chelidonichthys lastoviza</i>	Fish	2.6 (±1.08)	0.01109
<i>Synaphobranchus kaupii</i>	Fish	2.42 (±2.63)	0.01031
<i>Donax vittatus</i>	Bivalvia	2.34 (±5.15)	0.00998
<i>Diplodus vulgaris</i>	Fish	2.2 (±0.78)	0.00939
<i>Mugil cephalus</i>	Fish	2.1 (±0.87)	0.00895
<i>Capros aper</i>	Fish	2.03 (±0.84)	0.00863
<i>Dicologlossa cuneata</i>	Fish	1.99 (±2.31)	0.00846
<i>Centrolophus monstrosa</i>	Sharks	1.81 (±0.74)	0.00769
<i>Balistes carolinensis</i>	Fish	1.76 (±0.73)	0.00752
<i>Trigloporus lastoviza</i>	Fish	1.76 (±0.73)	0.00752
<i>Zeus faber</i>	Fish	1.72 (±0.72)	0.00734
<i>Chimaera monstrosa</i>	Fish	1.65 (±0.68)	0.00705
<i>Galeus melastomus</i>	Sharks	1.6 (±1.22)	0.00682
<i>Diplodus annularis</i>	Fish	1.57 (±1.63)	0.00668
<i>Lepidotrigla cavillone</i>	Fish	1.54 (±0.64)	0.00656
<i>Belone belone</i>	Fish	1.51 (±0.63)	0.00644
<i>Maja squinado</i>	Crustacea	1.49 (±1.6)	0.00636
<i>Dalatias licha</i>	Sharks	1.38 (±0.57)	0.00588
<i>Aplysia punctata</i>	Gastropoda	1.34 (±0.56)	0.00569
<i>Illex coindetii</i>	Cephalopoda	1.27 (±0.52)	0.00543
<i>Conger conger</i>	Fish	1.27 (±1.34)	0.00543
<i>Atelecyclus undecimdentatus</i>	Crustacea	1.17 (±2.58)	0.00499
<i>Ensis siliqua</i>	Bivalvia	1.07 (±2.36)	0.00456
<i>Arnoglossus imperialis</i>	Fish	1.03 (±0.43)	0.00439

Table S2 (Cont.). – Taxonomic list with the average absolute and relative weight contribution of each taxa to total unreported catch, per métier, for the period between 1938 and 2009.

Species	Taxa Group	Tonnes (SD)	%
<i>Dicentrarchus labrax</i>	Fish	1 (±0.42)	0.00425
<i>Scyliorhinus canicula</i>	Sharks	0.99 (±0.46)	0.00422
<i>Loligo</i> spp.	Cephalopoda	0.93 (±0.39)	0.00395
<i>Scorpaena porcus</i>	Fish	0.81 (±0.34)	0.00345
<i>Symphodus bailloni</i>	Fish	0.79 (±0.86)	0.00337
<i>Mullus barbatus</i>	Fish	0.77 (±0.32)	0.00327
<i>Polybius henslowii</i>	Crustacea	0.72 (±2.33)	0.00306
<i>Mullus</i> spp.	Fish	0.7 (±0.29)	0.00297
<i>Chelon labrosus</i>	Fish	0.68 (±0.28)	0.00291
<i>Sparus aurata</i>	Fish	0.61 (±0.26)	0.00261
<i>Centroscymnus crepidater</i>	Sharks	0.6 (±0.66)	0.00258
Polychaetes	Other invertebrates	0.59 (±1.31)	0.00253
<i>Acanthocardia spinosa</i>	Bivalvia	0.54 (±0.19)	0.00228
<i>Alosa fallax</i>	Fish	0.53 (±0.22)	0.00227
<i>Pecten maximus</i>	Bivalvia	0.51 (±0.21)	0.00219
<i>Phycis blennoides</i>	Fish	0.49 (±0.35)	0.00209
<i>Solea</i> spp.	Fish	0.46 (±0.19)	0.00196
<i>Scophthalmus rhombus</i>	Fish	0.42 (±0.17)	0.00179
<i>Pagrus pagrus</i>	Fish	0.41 (±0.17)	0.00176
<i>Trachyrincus scabrus</i>	Fish	0.4 (±0.44)	0.00172
<i>Nesiarchus nasutus</i>	Fish	0.35 (±0.38)	0.00150
<i>Microchirus variegatus</i>	Fish	0.34 (±0.14)	0.00145
<i>Marthasterias glacialis</i>	Echinodermata	0.32 (±0.13)	0.00138
<i>Hymenocephalus italicus</i>	Fish	0.32 (±0.13)	0.00136
<i>Lepidion guentheri</i>	Fish	0.3 (±0.33)	0.00129
<i>Solea solea</i>	Fish	0.29 (±0.12)	0.00125
<i>Dardanus arrosor</i>	Crustacea	0.29 (±0.12)	0.00122
<i>Centrolabrus exoletus</i>	Fish	0.27 (±0.11)	0.00116
<i>Trachinus vipera</i>	Fish	0.26 (±0.56)	0.00109
<i>Scymnodon ringens</i>	Sharks	0.25 (±0.27)	0.00107
<i>Dentex dentex</i>	Fish	0.23 (±0.1)	0.00098
<i>Pagellus</i> spp.	Fish	0.23 (±0.09)	0.00097
<i>Asterias rubens</i>	Echinodermata	0.22 (±0.09)	0.00095
<i>Echinus acutus</i>	Echinodermata	0.22 (±0.09)	0.00094
<i>Paracentrotus lividus</i>	Echinodermata	0.21 (±0.09)	0.00091
<i>Microchirus ocellatus</i>	Fish	0.21 (±0.09)	0.00088
<i>Raja</i> spp.	Rays	0.2 (±0.19)	0.00087
<i>Alepisaurus ferox</i>	Fish	0.2 (±0.22)	0.00086
<i>Murex trunculus</i>	Gastropoda	0.2 (±0.07)	0.00086
<i>Spisula solida</i>	Bivalvia	0.19 (±0.43)	0.00083
<i>Lepidorhombus boscii</i>	Fish	0.18 (±0.07)	0.00076
<i>Mullus surmuletus</i>	Fish	0.18 (±0.07)	0.00076
<i>Scophthalmus maximus</i>	Fish	0.17 (±0.07)	0.00073
<i>Bothus podas</i>	Fish	0.17 (±0.07)	0.00072
<i>Lagocephalus lagocephalus</i>	Fish	0.17 (±0.07)	0.00071
<i>Malacocephalus laevis</i>	Fish	0.17 (±0.07)	0.00071
<i>Dasyatis violacea</i>	Rays	0.17 (±0.07)	0.00071
<i>Aspitrigla cuculus</i>	Fish	0.16 (±0.07)	0.00069
<i>Dentex maroccanus</i>	Fish	0.16 (±0.07)	0.00069
<i>Mactra corallina stultorum</i>	Bivalvia	0.16 (±0.35)	0.00068
<i>Homala barbata</i>	Crustacea	0.16 (±0.06)	0.00068
<i>Lepidion</i> spp.	Fish	0.15 (±0.16)	0.00064
<i>Centrophorus granulosus</i>	Sharks	0.15 (±0.16)	0.00064
<i>Centroscymnus coelolepis</i>	Sharks	0.15 (±0.16)	0.00064
<i>Prionace glauca</i>	Sharks	0.15 (±0.16)	0.00064
<i>Serranus hepatus</i>	Fish	0.15 (±0.09)	0.00062
<i>Labrus mixtus</i>	Fish	0.14 (±0.06)	0.00059
Labridae	Fish	0.13 (±0.05)	0.00056
<i>Diplodus</i> spp.	Fish	0.13 (±0.05)	0.00056
<i>Trigla lyra</i>	Fish	0.12 (±0.05)	0.00053
<i>Dentex</i> spp.	Fish	0.12 (±0.05)	0.00051
<i>Uranoscopus scaber</i>	Fish	0.11 (±0.05)	0.00046
<i>Lepidotrigla dieuzeidei</i>	Fish	0.11 (±0.04)	0.00046
<i>Nephrops norvegicus</i>	Crustacea	0.11 (±0.04)	0.00045
<i>Hoplostethus mediterraneus</i>	Fish	0.11 (±0.04)	0.00045
<i>Naucrates ductor</i>	Fish	0.11 (±0.04)	0.00045
<i>Epigonus telescopus</i>	Fish	0.1 (±0.11)	0.00043
<i>Hexanchus griseus</i>	Sharks	0.1 (±0.11)	0.00043
<i>Diplodus sargus</i>	Fish	0.09 (±0.04)	0.00038
<i>Dentex macrophthalmus</i>	Fish	0.09 (±0.04)	0.00036
<i>Calappa granulata</i>	Crustacea	0.08 (±0.03)	0.00034
<i>Scomber</i> spp.	Fish	0.08 (±0.03)	0.00032
Soleidae	Fish	0.07 (±0.03)	0.00031
<i>Arnoglossus laterna</i>	Fish	0.07 (±0.03)	0.00031
<i>Coris julis</i>	Fish	0.06 (±0.03)	0.00027

Table S2 (Cont.). – Taxonomic list with the average absolute and relative weight contribution of each taxa to total unreported catch, per métier, for the period between 1938 and 2009.

Species	Taxa Group	Tonnes (SD)	%
<i>Ammodytes tobianus</i>	Fish	0.06 (±0.02)	0.00025
<i>Aphanopus carbo</i>	Fish	0.05 (±0.05)	0.00021
<i>Coryphaena hippurus</i>	Fish	0.05 (±0.05)	0.00021
<i>Coryphaenoides rupestris</i>	Fish	0.05 (±0.05)	0.00021
<i>Thunnus alalunga</i>	Fish	0.05 (±0.05)	0.00021
<i>Centrophorus lusitanicus</i>	Sharks	0.05 (±0.05)	0.00021
<i>Deania profundorum</i>	Sharks	0.05 (±0.05)	0.00021
<i>Isurus oxyrinchus</i>	Sharks	0.05 (±0.05)	0.00021
<i>Arnoglossus</i> spp.	Fish	0.05 (±0.02)	0.00021
<i>Symphodus</i> spp.	Fish	0.04 (±0.02)	0.00019
Pleuronectiformes	Fish	0.04 (±0.02)	0.00018
<i>Nucella lapillus</i>	Gastropoda	0.04 (±0.02)	0.00015
<i>Venus striatula</i>	Bivalvia	0.04 (±0.08)	0.00015
<i>Liza</i> spp.	Fish	0.04 (±0.01)	0.00015
<i>Palinurus elephas</i>	Crustacea	0.03 (±0.01)	0.00013
<i>Ophioderma longicaudum</i>	Echinodermata	0.03 (±0.01)	0.00012
<i>Gymnammodytes cicerelus</i>	Echinodermata	0.03 (±0.01)	0.00012
<i>Carcinus maenas</i>	Crustacea	0.02 (±0.01)	0.00007
<i>Argentina sphyraena</i>	Fish	0.02 (±0.01)	0.00007
<i>Zeugopterus punctatus</i>	Fish	0.01 (±0.01)	0.00006
<i>Maja goltziana</i>	Crustacea	0.01 (±0.01)	0.00005
<i>Arnoglossus thori</i>	Fish	0.01 (±0.01)	0.00005
<i>Pagurus forbesii</i>	Crustacea	0.01 (±0.004)	0.00004
Bothidae	Fish	0.01 (±0.002)	0.00002
<i>Goneplax rhomboides</i>	Crustacea	0 (±0.002)	0.00002
<i>Liocarcinus holsatus</i>	Crustacea	0.003 (±0.001)	0.00001
<i>Callionymus reticulatus</i>	Fish	0.002 (±0.001)	0.00001
Seine			
<i>Boops boops</i>	Fish	7466 (±1995)	31
<i>Scomber colias</i>	Fish	4335 (±1159)	18
<i>Belone belone</i>	Fish	3613 (±965)	15
<i>Sardina pilchardus</i>	Fish	3613 (±965)	15
<i>Macroramphosus scolopax</i>	Fish	2649 (±708)	11
<i>Scomber scombrus</i>	Fish	1445 (±386)	6
<i>Halobatrachus didactylus</i>	Fish	241 (±64)	1
<i>Spicara flexuosa</i>	Fish	241 (±64)	1
<i>Trachurus trachurus</i>	Fish	241 (±64)	1
Trawl			
<i>Trachurus picturatus</i>	Fish	10659.5 (±4864.9)	15.856
<i>Merluccius merluccius</i>	Fish	8854.3 (±4041)	13.171
<i>Scomber colias</i>	Fish	8641.6 (±3943.9)	12.855
<i>Micromesistius poutassou</i>	Fish	8494.1 (±3876.6)	12.635
<i>Trachurus trachurus</i>	Fish	3888.2 (±1774.5)	5.784
<i>Capros aper</i>	Fish	2522.1 (±1151.1)	3.752
<i>Chondrichthyes</i>	Fish	2178.2 (±994.1)	3.240
<i>Boops boops</i>	Fish	1985.3 (±906)	2.953
<i>Conger conger</i>	Fish	1974.1 (±901)	2.937
<i>Sardina pilchardus</i>	Fish	1946.7 (±888.4)	2.896
<i>Scomber scombrus</i>	Fish	1749.4 (±798.4)	2.602
<i>Scyliorhinus canicula</i>	Sharks	1170.6 (±534.2)	1.741
Diverse	Diverse	1114.8 (±508.8)	1.658
Octopodidae	Cephalopoda	1080.5 (±493.1)	1.607
<i>Lophius</i> spp.	Fish	840.4 (±383.6)	1.250
<i>Lepidopus caudatus</i>	Fish	792.4 (±361.6)	1.179
Triglidae	Fish	789 (±360.1)	1.174
Cephalopoda	Cephalopoda	771.8 (±352.2)	1.148
<i>Gadicus argenteus</i>	Fish	755.5 (±344.8)	1.124
<i>Phycis</i> spp.	Fish	634.6 (±289.6)	0.944
<i>Parapenaeus longirostris</i>	Crustacea	626 (±285.7)	0.931
Holothuroidea	Echinodermata	531.7 (±242.7)	0.791
<i>Polybius henslowii</i>	Crustacea	514.5 (±234.8)	0.765
<i>Galeus melastomus</i>	Sharks	406.5 (±185.5)	0.605
<i>Trisopterus luscus</i>	Fish	351.6 (±160.5)	0.523
<i>Mullus</i> spp.	Fish	300.1 (±137)	0.446
<i>Sphoeroides pachygaster</i>	Fish	265.8 (±121.3)	0.395
<i>Maja squinado</i>	Crustacea	257.3 (±117.4)	0.383
<i>Pagellus</i> spp.	Fish	257.3 (±117.4)	0.383
<i>Trachurus</i> spp.	Fish	257.3 (±117.4)	0.383
<i>Pagrus</i> spp.	Fish	240.1 (±109.6)	0.357
<i>Macroramphosus scolopax</i>	Fish	238.4 (±108.8)	0.355
<i>Helicolenus dactylopterus</i>	Fish	207.5 (±94.7)	0.309
<i>Pagrus pagrus</i>	Fish	171.5 (±78.3)	0.255
<i>Sarpa salpa</i>	Fish	171.5 (±78.3)	0.255
<i>Xiphias gladius</i>	Fish	171.5 (±78.3)	0.255
<i>Octopus vulgaris</i>	Cephalopoda	162.9 (±74.4)	0.242

Table S2 (Cont.). – Taxonomic list with the average absolute and relative weight contribution of each taxa to total unreported catch, per métier, for the period between 1938 and 2009.

Species	Taxa Group	Tonnes (SD)	%
<i>Spondyliosoma cantharus</i>	Fish	145.8 (±66.5)	0.217
<i>Serranus cabrilla</i>	Fish	137.2 (±62.6)	0.204
<i>Plesionika</i> spp.	Crustacea	128.6 (±58.7)	0.191
<i>Zeus faber</i>	Fish	128.6 (±58.7)	0.191
Rajidae	Rays	111.5 (±50.9)	0.166
<i>Tealia</i> spp.	Other invertebrates	102.9 (±47)	0.153
Echinoidea	Echinodermata	94.3 (±43.1)	0.140
<i>Pleuronectes platessa</i>	Fish	68.6 (±31.3)	0.102
<i>Macropipus tuberculatus</i>	Crustacea	42.9 (±19.6)	0.064
<i>Rossia macrosoma</i>	Cephalopoda	35.2 (±16)	0.052
<i>Dardanus arrosor</i>	Crustacea	34.3 (±15.7)	0.051
<i>Solea</i> spp.	Fish	34.3 (±15.7)	0.051
<i>Pagurus alatus</i>	Crustacea	25.7 (±11.7)	0.038
<i>Lepidorhombus</i> spp.	Fish	25.7 (±11.7)	0.038
<i>Argentina sphyraena</i>	Fish	17.2 (±7.8)	0.026
<i>Mullus surmuletus</i>	Fish	17.2 (±7.8)	0.026
<i>Argobuccinum olearium</i>	Gastropoda	17.2 (±7.8)	0.026
<i>Cassidaria tyrrhena</i>	Gastropoda	17.2 (±7.8)	0.026
<i>Torpedo nobiliana</i>	Rays	12.9 (±5.9)	0.019
<i>Malacocephalus laevis</i>	Fish	9.4 (±4.3)	0.014
<i>Caelorinchus caelorhincus</i>	Fish	8.6 (±3.9)	0.013
<i>Illex coindetii</i>	Cephalopoda	4.3 (±2)	0.006
<i>Zenopsis conchifer</i>	Fish	4.3 (±2)	0.006
<i>Ophisurus serpens</i>	Fish	3.4 (±1.6)	0.005
<i>Sphoeroides cutaneus</i>	Fish	3.4 (±1.6)	0.005
<i>Eledone cirrhosa</i>	Cephalopoda	2.6 (±1.2)	0.004
<i>Octopus salutii</i>	Cephalopoda	1.7 (±0.8)	0.003
<i>Todaropsis eblanae</i>	Cephalopoda	1.7 (±0.8)	0.003
<i>Chimaera monstrosa</i>	Fish	1.7 (±0.8)	0.003
<i>Citharus linguatula</i>	Fish	1.7 (±0.8)	0.003
<i>Lophius piscatorius</i>	Fish	1.7 (±0.8)	0.003
<i>Eledone moschata</i>	Cephalopoda	0.9 (±0.4)	0.001
<i>Hoplostethus mediterraneus</i>	Fish	0.9 (±0.4)	0.001
<i>Pagellus bogaraveo</i>	Fish	0.9 (±0.4)	0.001
<i>Peristedion cataphractum</i>	Fish	0.9 (±0.4)	0.001
<i>Phycis blenoides</i>	Fish	0.9 (±0.4)	0.001
<i>Ruvettus pretiosus</i>	Fish	0.9 (±0.4)	0.001
<i>Trachurus mediterraneus</i>	Fish	0.9 (±0.4)	0.001
<i>Raja clavata</i>	Rays	0.9 (±0.4)	0.001
<i>Raja oxyrinchus</i>	Rays	0.9 (±0.4)	0.001
<i>Etmopterus pusillus</i>	Sharks	0.9 (±0.4)	0.001
<i>Hexanchus griseus</i>	Sharks	0.9 (±0.4)	0.001