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Reconstructing discards profiles of unreported catches

Francisco Leitão, Vânia Baptista, Karim Erzini

Centro de Ciências do Mar, Universidade do Algarve, Campus de Gambelas, 8005-139 Faro, Portugal.
(FL) (Corresponding author) E-mail: fleitao@ualg.pt. ORCID iD: http://orcid.org/0000-0003-4983-9782
(VB) E-mail: vania_bap@hotmail.com. ORCID iD: http://orcid.org/0000-0002-1428-3334
(KE) E-mail: kerzini@ualg.pt. ORCID iD: http://orcid.org/0000-0002-1411-0126

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 multiespecíficos.

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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 assignment 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 (*rapa*)	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 Direcção 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 was *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*, *Dicentrachus* spp., *Alosa* spp., *Lophius* spp., Gurnards, Mullets, *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-

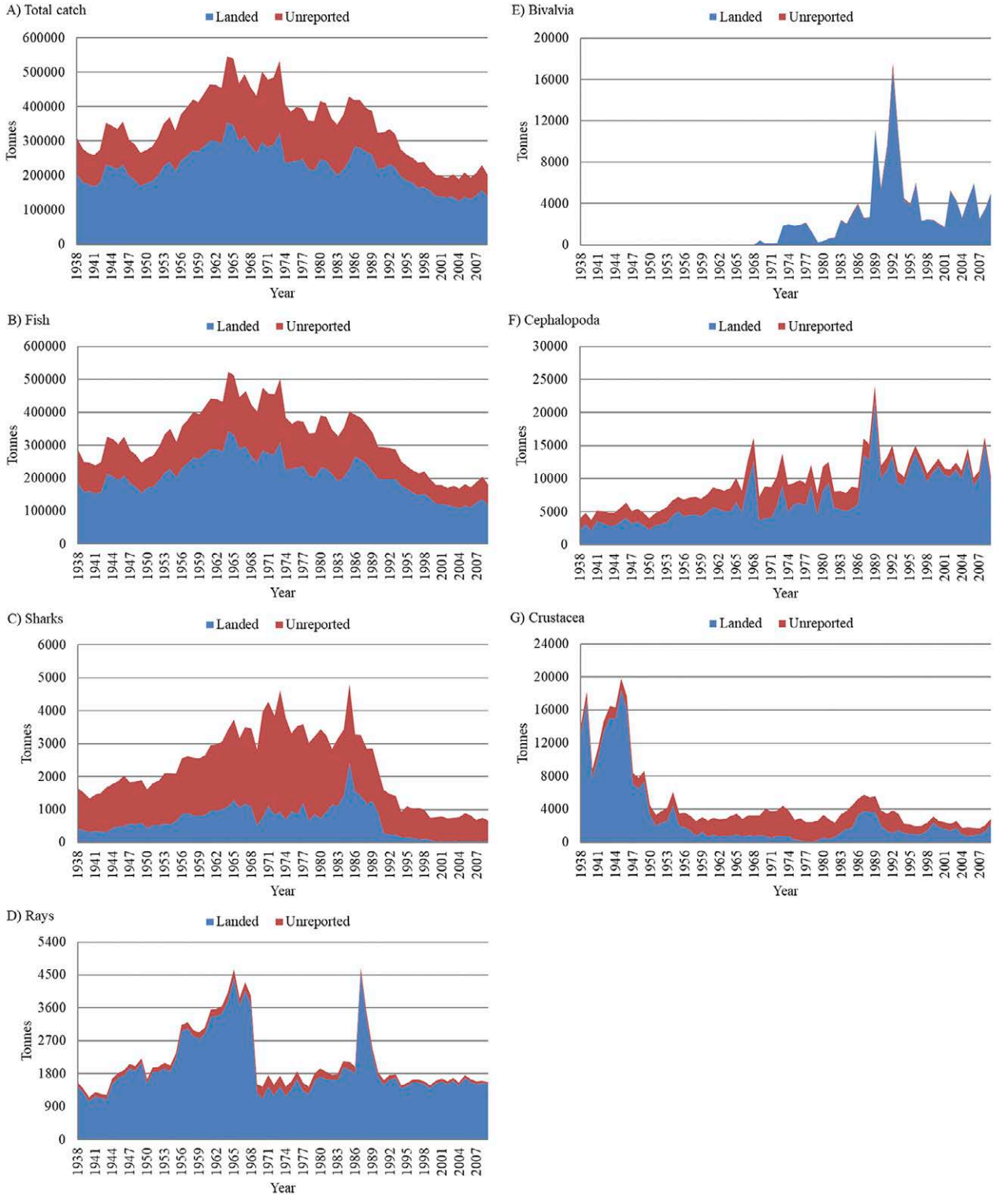

Fig. 1. – Total landed and unreported (discarded) catches for different commercial groups between 1938 and 2009. A, Total catches; B, fish; C, sharks; D, rays; E, Bivalvia; F, Cephalopoda; and G, Crustacea. Source: Portuguese National Statistical Office – INE.

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 (t±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 (±57399)	84.5	115493 (±38908)	93.5	322911 (±94492)	35.8	33.2
Sharks	649 (±467)	0.3	1638 (±725)	1.3	2287 (±1106)	71.6	0.47
Rays	1971 (±850)	0.8	154 (±64)	0.1	2125 (±872)	7.2	0.04
Bivalvia	1959 (±3049)	0.8	50 (±101)	0,0	2009 (±3140)	2.5	0,0
Cephalopoda	7162 (±3932)	2.9	2345 (±1007)	1.9	9508 (±3762)	24.7	0.68
Gastropoda			55 (±21)	0.04	55 (±21)	100.0	0.02
Other Mollusca	1563 (±1535)	0.6			1563 (±1535)	0,0	0,0
Crustacea	3187 (±4489)	1.3	1745 (±721)	1.4	4931 (±4322)	35.4	0.5
Other fish and invertebrates		8.7	2016 (±833)	1,6	2016 (±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-Rodriguez 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 selectivity 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 (±SD)	%
Total catch				
	Sardina pilchardus	Fish	109004 (±27351)	31.4
	Trachurus trachurus	Fish	37689 (±16971)	10.8
	Scomber colias	Fish	34342 (±12533)	9.9
	Merluccius merluccius	Fish	22923 (±13171)	6.6
	Micromesistius poutassou	Fish	12689 (±5140)	5.5
	Trachurus picturatus	Fish	12378 (±5291)	3.6
	Boops Boops	Fish	12022 (±3199)	3.5
	Liza aurata	Fish	8650 (±6239)	2.5
	Scomber scombrus	Fish	6251 (±1967)	1.8
	Octopus vulgaris	Cephalopoda	5279 (±2970)	1.5
	Others		86178 (±27906)	24.8
Landed				
	Sardina pilchardus	Fish	100312 (±25625)	44.8
	Trachurus trachurus	Fish	33187 (±15418)	14.8
	Merluccius merluccius	Fish	12652 (±8936)	5.7
	Scomber colias	Fish	12559 (±7265)	5.6
	Octopus vulgaris	Cephalopoda	5116 (±3001)	2.3
	Micromesistius poutassou	Fish	4188 (±218)	1.9
	Trisopterus luscus	Fish	3940 (±1549)	1.8
	Scomber scombrus	Fish	3045 (±1454)	1.4
	Lepidopus caudatus	Fish	2621 (±3223)	1.2
	Pagellus spp.	Fish	2234 (±944)	1.0
	Others		44055 (±15820)	19.7
Unreported				
	Scomber colias	Fish	21784 (±7048)	17.6
	Boops Boops	Fish	11162 (±2868)	9.0
	Trachurus picturatus	Fish	10659 (±4865)	8.6
	Merluccius merluccius	Fish	10271 (±4529)	8.3
	Sardina pilchardus	Fish	8692 (±2476)	7.0
	Liza aurata	Fish	8650 (±6239)	7.0
	Micromesistius poutassou	Fish	8501 (±3879)	6.9
	Trachurus trachurus	Fish	4502 (±1886)	3.6
	Belone belone	Fish	3614 (±966)	2.9
	Scomber scombrus	Fish	3205 (±1026)	2.6
	Others		32454 (±11688)	26.3
Unreported - multi-gear				
	Liza aurata	Fish	8650 (±6239)	35.9
	Scomber colias	Fish	4382 (±2597)	18.2
	Sardina pilchardus	Fish	3133 (±1304)	13.0
	Trachinus draco	Fish	930 (±387)	3.9
	Boops boops	Fish	840 (±628)	3.5
	Microchirus azevia	Fish	830 (±345)	3.4
	Chelidonichthys obscurus	Fish	745 (±310)	3.1
	Merluccius merluccius	Fish	708 (±581)	2.9
	Scorpaena notata	Fish	614 (±639)	2.5
	Pagellus acarne	Fish	465 (±193)	1.9
	Others		2793 (±952)	11.6
Unreported - seine				
	Boops boops	Fish	7466 (±1995)	31.3
	Scomber colias	Fish	4335 (±1159)	18.2
	Belone belone	Fish	3613 (±965)	15.2
	Sardina pilchardus	Fish	3613 (±965)	15.2
	Macroramphosus scolopax	Fish	2649 (±708)	11.1
	Scomber scombrus	Fish	1445 (±386)	6.1
	Halobatrachus didactylus	Fish	241 (±64)	1.0
	Spicara flexuosa	Fish	241 (±64)	1.0
	Trachurus trachurus	Fish	241 (±64)	1.0
Unreported - trawl				
	Trachurus picturatus	Fish	10659 (±4865)	15.9
	Merluccius merluccius	Fish	8854 (±4041)	13.2
	Scomber colias	Fish	8642 (±3944)	12.9
	Micromesistius poutassou	Fish	8494 (±3877)	12.6
	Trachurus trachurus	Fish	3888 (±1775)	5.8
	Capros aper	Fish	2522 (±1151)	3.8
	Chondrichthyes	Fish	2178 (±994)	3,2
	Boops boops	Fish	1985 (±906)	3,0
	Conger conger	Fish	1974 (±901)	2.9
	Sardina pilchardus	Fish	1947 (±888)	2.9
	Others		16082 (±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%)

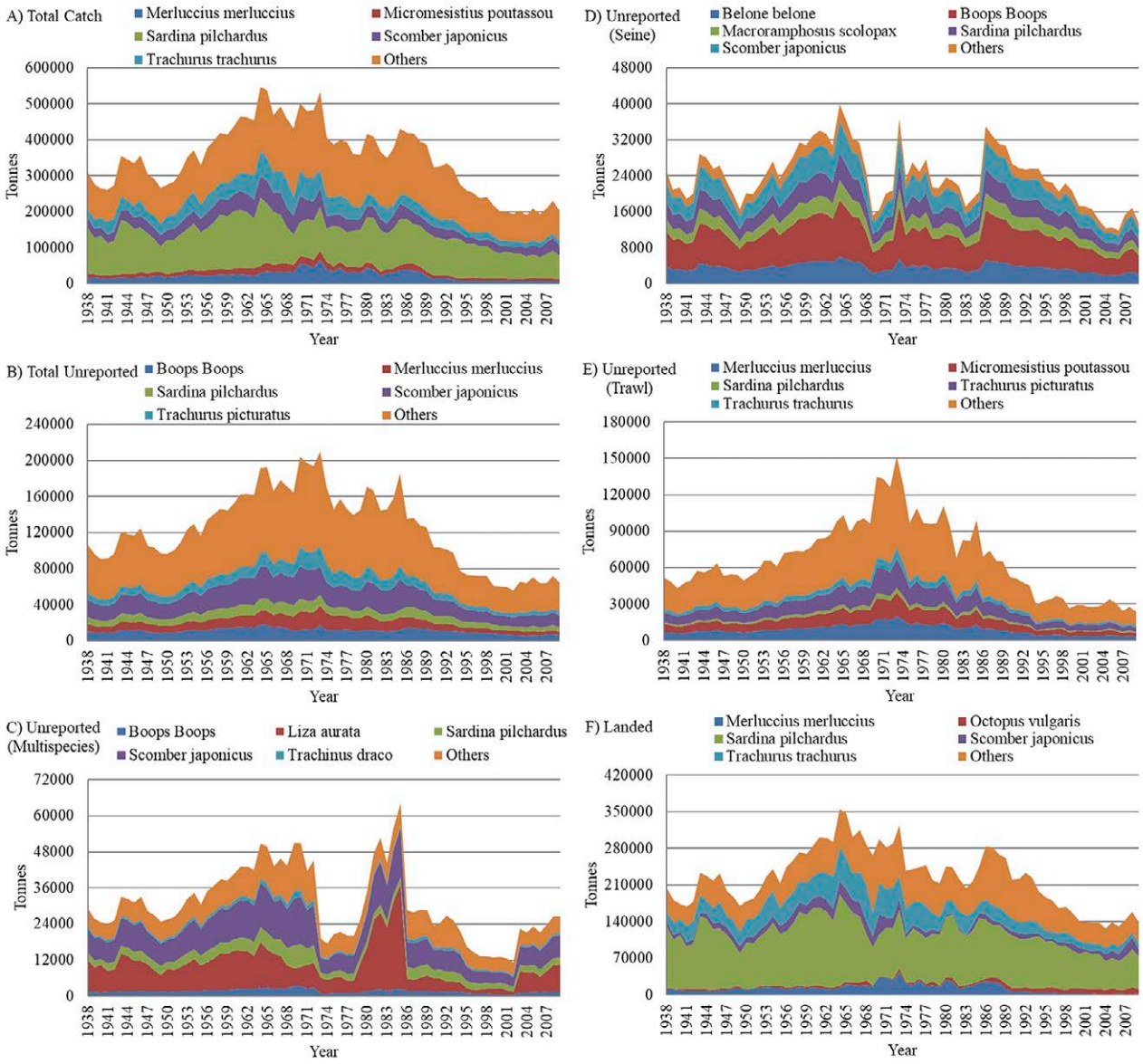

Fig. 2. – Catches of main species, unreported discards (including per métier) and landed catches. A, total catches; B, unreported; C, unreported multispecies; D, unreported purse seine; E, unreported trawl; F, landed catches. Source: Portuguese National Statistical Office – INE.

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 undesirable 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.

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

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
	Dasyatis violacea	0.01317
	Etmopterus pusillus	0.34307
	Etmopteurs spinax	0.77651
	Galeus melastomus	0.18932
	Hoplostethus mediterraneus	0.00840
	Hymenocephalus italicus	0.02519
	Illex coindetii	0.10075
	Lagocephalus lagocephalus	0.01317
	Malacocephalus laevis	0.01317
	Merluccius merluccius	92.68932
	Micromesistius poutassou	0.44810
	Naucrates ductor	0.00840
	Nephrops norvegicus	0.00840
	Phycis blennoides	0.04972
	Scyliorhinus canicula	0.06355
	Todaropsis eblanae	1.12506
Trap		
	Astropecten aranciacus	6.28639
	Acanthocardia spinosa	0.09600
	Diplodus annularis	0.54002
	Diplodus bellottii	7.72297
	Diplodus vulgaris	0.39501
	Homala barbata	0.02872
	Halobatrachus didactylus	68.18440
	Maja squinado	0.02382
	Murex trunculus	0.03609
	Ophioderma longicaudum	0.00512
	Symphodus bailloni	0.27933
	Spondyliosoma cantharus	0.95410
	Spicara flexuosa	0.53472
	Sphaerechinus granularis	1.55022
	Serranus hepatus	0.03850
	Scorpaena notata	13.32461
Trammel net		
	Alosa fallax	0.00332
	Ammodytes tobianus	0.00037
	Aplysia punctata	0.00831
	Argentina sphyraena	0.00010
	Arnoglossus imperialis	0.00641
	Arnoglossus laterna	0.00045
	Arnoglossus spp.	0.00031
	Arnoglossus thori	0.00008
	Aspitrigla cuculus	0.00100
	Asterias rubens	0.00138
	Astropecten aranciacus	0.32857
	Atrina pectinata	0.02003
	Balistes capriscus	0.10595
	Balistes carolinensis	0.01098
	Belone belone	0.00940
	Boops boops	8.07890
	Bothidae	0.00004
	Bothus podas	0.00105
	Calappa granulata	0.00049
	Callionymus lyra	0.09803
	Callionymus reticulatus	0.00001
	Capros aper	0.01261
	Carcinus maenas	0.00011
	Centrolabrus exoletus	0.00170
	Chelidonichthys lastoviza	0.01619
	Chelidonichthys lucernus	0.01978
	Chelidonichthys obscurus	4.63812
	Chelon labrosus	0.00425
	Citharus linguatula	1.32968
	Conger conger	0.00081
	Coris julis	0.00040
	Cymbium olla	0.11782
	Dardanus arrosor	0.00179
	Dentex dentex	0.00143
	Dentex macrophthalmus	0.00053
	Dentex maroccanus	0.00100
	Dentex spp.	0.00075
	Dicentrarchus labrax	0.00621
	Dicologlossa cuneata	0.02471
	Diplodus annularis	0.00077
	Diplodus bellottii	0.01098
	Diplodus sargus	0.00055
	Diplodus spp.	0.00081
	Echinus acutus	0.00137
	Goneplax rhomboides	0.00003
	Gymnammodytes cicerelus	0.00018
	Halobatrachus didactylus	0.02503
	Holothuroidea	0.08317
	Labridae	0.00082
	Labrus mixtus	0.00085
	Lepidorhombus boscii	0.00111
	Lepidotrigla cavillone	0.00958
	Lepidotrigla dieuzeidei	0.00067
	Liocarcinus holsatus	0.00002
	Liza ramada	0.02964
	Liza spp.	0.00022
	Loligo spp.	0.00577
	Macroramphosus scolopax	0.08791
	Maja goltziana	0.00008
	Maja squinado	0.01776
	Marthasterias glacialis	0.00201
	Merluccius merluccius	1.51962
	Microchirus azevia	5.16478
	Microchirus ocellatus	0.00128
	Microchirus variegatus	0.00211
	Micromesistius poutassou	0.00697
	Mola mola	0.04104
	Mugil cephalus	0.01307
	Mullus barbatus	0.00478
	Mullus spp.	0.00434
	Mullus surmuletus	0.00111
	Myliobatis aquila	0.02242
	Nucella lapillus	0.00023
	Pagellus acarne	2.89204
	Pagellus erythrinus	0.01855
	Pagellus spp.	0.00142
	Pagrus pagrus	0.00256
	Pagurus forbesii	0.00006
	Palinurus elephas	0.00019
	Paracentrotus lividus	0.00133
	Pecten maximus	0.00320
	Phycis phycis	1.21960
	Pleuronectiformes	0.00026
	Polybius henslowii	0.00004
	Raja brachyura	0.01713
	Raja clavata	0.02768
	Raja miraletus	0.04638
	Raja spp.	0.00221
	Raja undulata	0.01940
	Sardina pilchardus	19.49873
	Scomber colias	34.75575
	Scomber scombrus	0.06729
	Scomber spp.	0.00047
	Scophthalmus maximus	0.00107
	Scophthalmus rhombus	0.00261
	Scorpaena notata	7.18370
	Scorpaena porcus	0.00503
	Scyliorhinus canicula	0.00733
	Sepia officinalis	1.66134
	Serranus cabrilla	2.20532
	Serranus hepatus	0.00049
	Solea lascaris	0.05993
	Solea senegalensis	0.05684
	Solea solea	0.00183
	Solea spp.	0.00286
	Soleidae	0.00046
	Sparus aurata	0.00382
	Spondyliosoma cantharus	0.03863
	Symphodus bailloni	0.00016
	Symphodus spp.	0.00028
	Torpedo torpedo	0.03430
	Trachinus draco	5.78890
	Trachurus trachurus	2.32199
	Trigla lyra	0.00077
	Trigla sp.	0.02197
	Trigloporus lastoviza	0.01098
	Trisopterus luscus	0.08946
	Uranoscopus scaber	0.00068
	Zeugopterus punctatus	0.00009
	Zeus faber	0.01073

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			
Scomber colias	Fish	21783.6 (±7048.2)	17.63919
Boops boops	Fish	11162.3 (±2868.3)	9.03861
Trachurus picturatus	Fish	10659.5 (±4864.9)	8.63148
Merluccius merluccius	Fish	10270.8 (±4528.6)	8.31675
Sardina pilchardus	Fish	8692 (±2476.4)	7.03830
Liza aurata	Fish	8650.4 (±6238.9)	7.00460
Micromesistius poutassou	Fish	8500.9 (±3878.9)	6.88360
Trachurus trachurus	Fish	4502.1 (±1886.5)	3.64554
Belone belone	Fish	3614.3 (±965.6)	2.92666
Scomber scombrus	Fish	3205.3 (±1026.1)	2.59552
Macroramphosus scolopax	Fish	2901.9 (±762.7)	2.34980
Capros aper	Fish	2524.1 (±1151.5)	2.04389
Chondrichthyes	Fish	2178.2 (±994.1)	1.76379
Conger conger	Fish	1976.7 (±901.9)	1.60059
Scorpaena notata	Fish	1228.4 (±499.9)	0.99467
Scyliorhinus canicula	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
Diplodus sargus	Fish	1067.9 (±266.9)	0.86469
Trachinus draco	Fish	930 (±387)	0.75307
Lophius spp.	Fish	840.4 (±383.6)	0.68052
Microchirus azevia	Fish	829.7 (±345.3)	0.67188
Triglidae	Fish	792.5 (±360.8)	0.64171
Lepidopus caudatus	Fish	792.4 (±361.6)	0.64163
Cephalopoda	Cephalopoda	771.8 (±352.2)	0.62497
Gadiculus argenteus	Fish	755.5 (±344.8)	0.61177
Chelidonichthys obscurus	Fish	745.1 (±310.1)	0.60337
Phycis spp.	Fish	634.6 (±289.6)	0.51386
Parapenaeus longirostris	Crustacea	626 (±285.7)	0.50692
Halobatrachus didactylus	Fish	625 (±157.9)	0.50611
Holothuroidea	Other Invertebrates	545 (±245.5)	0.44135
Polybius henslowii	Crustacea	516 (±234)	0.41781
Serranus cabrilla	Fish	491.5 (±187)	0.39799
Pagellus acarne	Fish	464.6 (±193.3)	0.37622
Galeus melastomus	Sharks	409.7 (±186.3)	0.33174
Sarpa salpa	Fish	403.6 (±156.6)	0.32678
Trisopterus luscus	Fish	366 (±163.6)	0.29634
Mullus spp.	Fish	300.8 (±137.1)	0.24361
Sepia officinalis	Cephalopoda	267.4 (±111)	0.21649
Sphoeroides pachygaster	Fish	265.8 (±121.3)	0.21527
Maja squinado	Crustacea	260.3 (±118)	0.21074
Pagellus spp.	Fish	257.5 (±117.5)	0.20851
Trachurus spp.	Fish	257.3 (±117.4)	0.20832
Spicara flexuosa	Fish	243.8 (±64.5)	0.19744
Pagrus spp.	Fish	240.1 (±109.6)	0.19443
Citharus linguatula	Fish	229.2 (±91.4)	0.18558
Helicolenus dactylopterus	Fish	207.5 (±94.7)	0.16805
Phycis phycis	Fish	195.9 (±81.5)	0.15866
Pagrus pagrus	Fish	171.9 (±78.4)	0.13922
Spondyliosoma cantharus	Fish	171.5 (±71)	0.13891
Xiphias gladius	Fish	171.5 (±78.3)	0.13888
Octopus vulgaris	Cephalopoda	162.9 (±74.4)	0.13194
Mugilidae	Fish	142.4 (±35.6)	0.11528
Liza ramada	Fish	132 (±91.9)	0.10686
Zeus faber	Fish	130.4 (±59.1)	0.10556
Plesionika spp.	Crustacea	128.6 (±58.7)	0.10416
Diplodus vulgaris	Fish	122.6 (±30.4)	0.09925
Rajidae (+ other similar)	Rays	111.9 (±50.9)	0.09060
Tealia spp.	Other Invertebrates	102.9 (±47)	0.08333
Pagurus spp.	Crustacea	96.8 (±213.1)	0.07837
Dicentrarchus labrax	Fish	96.8 (±24.2)	0.07836
Echinoidea	Other Invertebrates	94.3 (±43.1)	0.07638
Sparus aurata	Fish	93.8 (±23.5)	0.07595
Astropecten aranciacus	Other Invertebrates	87.8 (±32.2)	0.07112
Balistes capriscus	Fish	81.7 (±21.8)	0.06618
Pleuronectes platessa	Fish	68.6 (±31.3)	0.05555
Echinocardium cordatum	Other Invertebrates	60.9 (±134)	0.04928
Diplodus bellottii	Fish	44.8 (±15.9)	0.03630
Macropipus tuberculatus	Crustacea	42.9 (±19.6)	0.03472
Benthodesmus elongatus	Fish	38.4 (±15.7)	0.03107
Rossia macrosoma	Cephalopoda	35.2 (±16)	0.02847
Soleidae	Fish	34.8 (±15.8)	0.02821
Dardanus arrosor	Crustacea	34.6 (±15.7)	0.02801
Lepidorhombus 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)	%
Pagurus alatus	Crustacea	25.7 (±11.7)	0.02083
Dosinia exoleta	Bivalvia	22.4 (±49.3)	0.01813
Etmopterus pusillus	Sharks	21.5 (±17.5)	0.01743
Tellina tenuis	Bivalvia	19.9 (±43.7)	0.01607
Cymbium olla	Gastropoda	18.9 (±7.9)	0.01533
Mullus surmuletus	Fish	17.3 (±7.9)	0.01403
Argentina sphyraena	Fish	17.2 (±7.8)	0.01390
Argobuccinum olearium	Gastropoda	17.2 (±7.8)	0.01389
Cassidaria tyrrhena	Gastropoda	17.2 (±7.8)	0.01389
Todaropsis eblanae	Cephalopoda	15.9 (±6.6)	0.01291
Callionymus lyra	Fish	15.7 (±6.6)	0.01275
Dicentrarchus punctatus	Fish	14.2 (±3.6)	0.01153
Torpedo nobiliana	Rays	12.9 (±5.9)	0.01042
Etmopterus spinax	Sharks	12.4 (±4.6)	0.01008
Solea lascaris	Fish	9.6 (±4)	0.00780
Malacocephalus laevis	Fish	9.6 (±4.4)	0.00777
Solea senegalensis	Fish	9.1 (±3.8)	0.00739
Sphaerechinus granularis	Other Invertebrates	8.6 (±3.1)	0.00700
Caelorinchus caelorhincus	Fish	8.6 (±3.9)	0.00694
Deania calcea	Sharks	8.5 (±9.3)	0.00690
Squilla mantis	Crustacea	8.2 (±18)	0.00661
Centrophorus squamosus	Sharks	7.8 (±8.5)	0.00633
Raja miraletus	Rays	7.5 (±3.1)	0.00603
Brama brama	Fish	6.7 (±2.8)	0.00543
Mola mola	Fish	6.6 (±2.7)	0.00534
Illex coindetii	Cephalopoda	5.6 (±2.4)	0.00450
Torpedo torpedo	Rays	5.5 (±2.3)	0.00446
Raja clavata	Rays	5.3 (±2.1)	0.00430
Zenopsis conchifer	Fish	4.3 (±2)	0.00347
Liocarcinus depurator	Crustacea	4 (±8.8)	0.00324
Dicologlossa cuneata	Fish	4 (±1.7)	0.00322
Myliobatis aquila	Rays	3.6 (±1.5)	0.00292
Alepocephalus bairdii	Fish	3.5 (±3.8)	0.00286
Ophisurus serpens	Fish	3.4 (±1.6)	0.00278
Sphoeroides cutaneus	Fish	3.4 (±1.6)	0.00278
Chimaera monstrosa	Fish	3.4 (±1.4)	0.00273
Atrina pectinata	Bivalvia	3.2 (±1.3)	0.00261
Chelidonichthys lucernus	Fish	3.2 (±1.3)	0.00257
Diplodus annularis	Fish	3.1 (±1.1)	0.00254
Raja undulata	Rays	3.1 (±1.3)	0.00252
Pagellus erythrinus	Fish	3 (±1.2)	0.00241
Raja brachyura	Rays	2.8 (±1.1)	0.00223
Chelidonichthys lastoviza	Fish	2.6 (±1.1)	0.00211
Eledone cirrhosa	Cephalopoda	2.6 (±1.2)	0.00208
Synaphobranchus kaupii	Fish	2.4 (±2.6)	0.00196
Donax vittatus	Bivalvia	2.3 (±5.2)	0.00190
Mugil cephalus	Fish	2.1 (±0.9)	0.00170
Phycis blennoides	Fish	1.8 (±0.7)	0.00149
Centrolophus monstrosa	Sharks	1.8 (±0.7)	0.00146
Balistes carolinensis	Fish	1.8 (±0.7)	0.00143
Trigloporus lastoviza	Fish	1.8 (±0.7)	0.00143
Lophius piscatorius	Fish	1.7 (±0.8)	0.00139
Octopus salutii	Cephalopoda	1.7 (±0.8)	0.00139
Symphodus bailloni	Fish	1.6 (±0.6)	0.00128
Lepidotrigla cavillone	Fish	1.5 (±0.6)	0.00125
Dalatias licha	Sharks	1.4 (±0.6)	0.00112
Aplysia punctata	Gastropoda	1.3 (±0.6)	0.00108
Atelecyclus undecimdentatus	Crustacea	1.2 (±2.6)	0.00095
Ensis siliqua	Bivalvia	1.1 (±2.4)	0.00087
Arnoglossus imperialis	Fish	1 (±0.4)	0.00083
Hoplostethus mediterraneus	Fish	1 (±0.4)	0.00078
Hexanchus griseus	Sharks	1 (±0.4)	0.00078
Loligo spp.	Cephalopoda	0.9 (±0.4)	0.00075
Eledone moschata	Cephalopoda	0.9 (±0.4)	0.00069
Pagellus bogaraveo	Fish	0.9 (±0.4)	0.00069
Peristedion cataphractum	Fish	0.9 (±0.4)	0.00069
Raja oxyrinchus	Rays	0.9 (±0.4)	0.00069
Ruvettus pretiosus	Fish	0.9 (±0.4)	0.00069
Trachurus mediterraneus	Fish	0.9 (±0.4)	0.00069
Scorpaena porcus	Fish	0.8 (±0.3)	0.00065
Mullus barbatus	Fish	0.8 (±0.3)	0.00062
Chelon labrosus	Fish	0.7 (±0.3)	0.00055
Centroscymnus crepidater	Sharks	0.6 (±0.7)	0.00049
Polychaetes	Other Invertebrates	0.6 (±1.3)	0.00048
Acanthocardia spinosa	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)	%
Alosa fallax	Fish	0.5 (±0.2)	0.00043
Pecten maximus	Bivalvia	0.5 (±0.2)	0.00042
Scophthalmus rhombus	Fish	0.4 (±0.2)	0.00034
Trachyrincus scabrus	Fish	0.4 (±0.4)	0.00033
Nesiarchus nasutus	Fish	0.4 (±0.4)	0.00029
Microchirus variegatus	Fish	0.3 (±0.1)	0.00027
Marthasterias glacialis	Other Invertebrates	0.3 (±0.1)	0.00026
Hymenocephalus italicus	Fish	0.3 (±0.1)	0.00026
Lepidion guentheri	Fish	0.3 (±0.3)	0.00024
Solea solea	Fish	0.3 (±0.1)	0.00024
Serranus hepatus	Fish	0.3 (±0.1)	0.00024
Centrolabrus exoletus	Fish	0.3 (±0.1)	0.00022
Trachinus vipera	Fish	0.3 (±0.6)	0.00021
Scymnodon ringens	Sharks	0.3 (±0.3)	0.00020
Dentex dentex	Fish	0.2 (±0.1)	0.00019
Asterias rubens	Other Invertebrates	0.2 (±0.1)	0.00018
Echinus acutus	Other Invertebrates	0.2 (±0.1)	0.00018
Paracentrotus lividus	Other Invertebrates	0.2 (±0.1)	0.00017
Microchirus ocellatus	Fish	0.2 (±0.1)	0.00017
Alepisaurus ferox	Fish	0.2 (±0.2)	0.00016
Murex trunculus	Gastropoda	0.2 (±0.1)	0.00016
Spisula solida	Bivalvia	0.2 (±0.4)	0.00016
Lepidorhombus boscii	Fish	0.2 (±0.1)	0.00015
Scophthalmus maximus	Fish	0.2 (±0.1)	0.00014
Bothus podas	Fish	0.2 (±0.1)	0.00014
Dasyatis violacea	Rays	0.2 (±0.1)	0.00013
Lagocephalus lagocephalus	Fish	0.2 (±0.1)	0.00013
Aspitrigla cuculus	Fish	0.2 (±0.1)	0.00013
Dentex maroccanus	Fish	0.2 (±0.1)	0.00013
Mactra corallina stultorum	Bivalvia	0.2 (±0.4)	0.00013
Homala barbata	Crustacea	0.2 (±0.1)	0.00013
Centrophorus granulosus	Sharks	0.2 (±0.2)	0.00012
Centroscymnus coelolepis	Sharks	0.2 (±0.2)	0.00012
Lepidion spp.	Fish	0.2 (±0.2)	0.00012
Prionace glauca	Sharks	0.2 (±0.2)	0.00012
Labrus mixtus	Fish	0.1 (±0.1)	0.00011
Labridae	Fish	0.1 (±0.1)	0.00011
Diplodus spp.	Fish	0.1 (±0.1)	0.00011
Trigla lyra	Fish	0.1 (±0.1)	0.00010
Dentex spp.	Fish	0.1 (±0.1)	0.00010
Uranoscopus scaber	Fish	0.1 (±0)	0.00009
Lepidotrigla dieuzeidei	Fish	0.1 (±0)	0.00009
Naucrates ductor	Fish	0.1 (±0)	0.00009
Nephrops norvegicus	Crustacea	0.1 (±0)	0.00009
Epigonus telescopus	Fish	0.1 (±0.1)	0.00008
Dentex macrophthalmus	Fish	0.1 (±0)	0.00007
Calappa granulata	Crustacea	0.1 (±0)	0.00006
Scomber spp.	Fish	0.1 (±0)	0.00006
Arnoglossus laterna	Fish	0.1 (±0)	0.00006
Coris julis	Fish	0.1 (±0)	0.00005
Ammodytes tobianus	Fish	0.1 (±0)	0.00005
Aphanopus carbo	Fish	0.1 (±0.1)	0.00004
Centrophorus lusitanicus	Sharks	0.1 (±0.1)	0.00004
Coryphaena hippurus	Fish	0.1 (±0.1)	0.00004
Coryphaenoides rupestris	Fish	0.1 (±0.1)	0.00004
Deania profundorum	Sharks	0.1 (±0.1)	0.00004
Isurus oxyrinchus	Sharks	0.1 (±0.1)	0.00004
Thunnus alalunga	Fish	0.1 (±0.1)	0.00004
Arnoglossus spp.	Fish	0.05 (±0.02)	0.00004
Symphodus spp.	Fish	0.04 (±0.02)	0.00004
Pleuronectiformes	Fish	0.04 (±0.02)	0.00003
Nucella lapillus	Gastropoda	0.04 (±0.02)	0.00003
Venus striatula	Bivalvia	0.04 (±0.08)	0.00003
Liza spp.	Fish	0.04 (±0.01)	0.00003
Palinurus elephas	Crustacea	0.03 (±0.01)	0.00002
Ophioderma longicaudum	Other Invertebrates	0.03 (±0.01)	0.00002
Gymnammodytes cicerelus	Other Invertebrates	0.03 (±0.01)	0.00002
Carcinus maenas	Crustacea	0.02 (±0.01)	0.00001
Zeugopterus punctatus	Fish	0.01 (±0.01)	0.00001
Arnoglossus thori	Fish	0.01 (±0.01)	0.00001
Maja goltziana	Crustacea	0.01 (±0.01)	0.00001
Pagurus forbesii	Crustacea	0.009 (±0.004)	0.00001
Bothidae	Fish	0.006 (±0.002)	0.000005
Goneplax rhomboides	Crustacea	0.005 (±0.002)	0.000004
Liocarcinus holsatus	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)	%
Callionymus reticulatus	Fish	0.002 (±0.001)	0.000002
Black scabbardfish longline			
Etmopterus pusillus	Sharks	16.33 (±17.74)	35.6
Deania calcea	Sharks	8.52 (±9.25)	18.6
Centrophorus squamosus	Sharks	7.81 (±8.49)	17.0
Alepocephalus bairdii	Fish	3.53 (±3.83)	7.7
Etmopterus spinax	Sharks	2.62 (±2.85)	5.7
Synaphobranchus kaupii	Fish	2.42 (±2.63)	5.3
Galeus melastomus	Sharks	0.81 (±0.88)	1.8
Centroscymnus crepidater	Sharks	0.6 (±0.66)	1.3
Trachyrincus scabrus	Fish	0.4 (±0.44)	0.9
Nesiarchus nasutus	Fish	0.35 (±0.38)	0.8
Phycis blennoides	Fish	0.35 (±0.38)	0.8
Lepidion guentheri	Fish	0.3 (±0.33)	0.7
Scymnodon ringens	Sharks	0.25 (±0.27)	0.5
Alepisaurus ferox	Fish	0.2 (±0.22)	0.4
Benthodesmus elongatus	Fish	0.15 (±0.16)	0.3
Lepidion spp.	Fish	0.15 (±0.16)	0.3
Centrophorus granulosus	Sharks	0.15 (±0.16)	0.3
Centroscymnus coelolepis	Sharks	0.15 (±0.16)	0.3
Prionace glauca	Sharks	0.15 (±0.16)	0.3
Epigonus telescopus	Fish	0.1 (±0.11)	0.2
Hexanchus griseus	Sharks	0.1 (±0.11)	0.2
Aphanopus carbo	Fish	0.05 (±0.05)	0.1
Coryphaena hippurus	Fish	0.05 (±0.05)	0.1
Coryphaenoides rupestris	Fish	0.05 (±0.05)	0.1
Thunnus alalunga	Fish	0.05 (±0.05)	0.1
Raja spp.	Rays	0.05 (±0.05)	0.1
Centrophorus lusitanicus	Sharks	0.05 (±0.05)	0.1
Deania profundorum	Sharks	0.05 (±0.05)	0.1
Isurus oxyrinchus	Sharks	0.05 (±0.05)	0.1
Demersal Seine ("rapa")			
Liza aurata	Fish	8650 (±6239)	69
Scomber colias	Fish	3180 (±2294)	26
Boops boops	Fish	382 (±275)	3
Liza ramada	Fish	127 (±92)	1
Sarpa salpa	Fish	127 (±92)	1
Dredge			
Pagurus spp.	Crustacea	96.8 (±213.1)	41.431
Echinocardium cordatum	Echinodermata	60.9 (±134)	26.051
Dosinia exoleta	Bivalvia	22.4 (±49.3)	9.582
Tellina tenuis	Bivalvia	19.9 (±43.7)	8.497
Citharus linguatula	Fish	13.8 (±30.5)	5.929
Squilla mantis	Crustacea	8.2 (±18)	3.497
Liocarcinus depurator	Crustacea	4 (±8.8)	1.711
Donax vittatus	Bivalvia	2.3 (±5.2)	1.002
Polybius henslowii	Crustacea	1.4 (±3.2)	0.613
Atelecyclus undecimdentatus	Crustacea	1.2 (±2.6)	0.501
Ensis siliqua	Bivalvia	1.1 (±2.4)	0.458
Polychaetes	Other invertebrates	0.6 (±1.3)	0.254
Sepia officinalis	Cephalopoda	0.5 (±1)	0.197
Trachinus vipera	Fish	0.3 (±0.6)	0.109
Spisula solida	Bivalvia	0.2 (±0.4)	0.083
Mactra corallina stultorum	Bivalvia	0.2 (±0.4)	0.069
Venus striatula	Bivalvia	0.04 (±0.1)	0.015
Dicologlossa cuneata	Fish	0.002 (±0.005)	0.001
Gill net and Long-line			
Merluccius merluccius	Fish	1172.4 (±482.2)	92.689
Benthodesmus elongatus	Fish	38.2 (±15.7)	3.021
Todaropsis eblanae	Cephalopoda	14.2 (±5.9)	1.125
Etmopterus spinax	Sharks	9.8 (±4)	0.777
Brama brama	Fish	6.7 (±2.8)	0.530
Micromesistius poutassou	Fish	5.7 (±2.3)	0.448
Etmopterus pusillus	Sharks	4.3 (±1.8)	0.343
Conger conger	Fish	2.4 (±1)	0.191
Galeus melastomus	Sharks	2.4 (±1)	0.189
Centrolophus monstrosa	Sharks	1.8 (±0.7)	0.143
Chimaera monstrosa	Fish	1.7 (±0.7)	0.131
Dalatias licha	Sharks	1.4 (±0.6)	0.109
Illex coindetii	Cephalopoda	1.3 (±0.5)	0.101
Scyliorhinus canicula	Sharks	0.8 (±0.3)	0.064
Phycis blennoides	Fish	0.6 (±0.3)	0.050
Hymenocephalus italicus	Fish	0.3 (±0.1)	0.025
Lagocephalus lagocephalus	Fish	0.2 (±0.1)	0.013
Malacocephalus laevis	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)	%
Dasyatis violacea	Rays	0.2 (±0.1)	0.013
Nephrops norvegicus	Crustacea	0.1 (±0.04)	0.008
Hoplostethus mediterraneus	Fish	0.1 (±0.04)	0.008
Naucrates ductor	Fish	0.1 (±0.04)	0.008
Trammel net			
Scomber colias	Fish	5583.62 (±2323.6)	34.7557
Sardina pilchardus	Fish	3132.53 (±1303.59)	19.4987
Boops boops	Fish	1297.9 (±540.12)	8.0789
Scorpaena notata	Fish	1154.08 (±480.27)	7.1837
Trachinus draco	Fish	930 (±387.02)	5.7889
Microchirus azevia	Fish	829.74 (±345.29)	5.1648
Chelidonichthys obscurus	Fish	745.13 (±310.08)	4.6381
Pagellus acarne	Fish	464.61 (±193.35)	2.8920
Trachurus trachurus	Fish	373.03 (±155.24)	2.3220
Serranus cabrilla	Fish	354.29 (±147.44)	2.2053
Sepia officinalis	Cephalopoda	266.9 (±111.07)	1.6613
Merluccius merluccius	Fish	244.13 (±101.59)	1.5196
Citharus linguatula	Fish	213.62 (±88.9)	1.3297
Phycis phycis	Fish	195.93 (±81.54)	1.2196
Astropecten aranciacus	Echinodermata	52.79 (±21.97)	0.3286
Cymbium olla	Gastropoda	18.93 (±7.88)	0.1178
Balistes capriscus	Fish	17.02 (±7.08)	0.1060
Callionymus lyra	Fish	15.75 (±6.55)	0.0980
Trisopterus luscus	Fish	14.37 (±5.98)	0.0895
Macroramphosus scolopax	Fish	14.12 (±5.88)	0.0879
Holothuroidea	Echinodermata	13.36 (±5.56)	0.0832
Scomber scombrus	Fish	10.81 (±4.5)	0.0673
Solea lascaris	Fish	9.63 (±4.01)	0.0599
Solea senegalensis	Fish	9.13 (±3.8)	0.0568
Raja miraletus	Rays	7.45 (±3.1)	0.0464
Mola mola	Fish	6.59 (±2.74)	0.0410
Spondyliosoma cantharus	Fish	6.21 (±2.58)	0.0386
Torpedo torpedo	Rays	5.51 (±2.29)	0.0343
Liza ramada	Fish	4.76 (±1.98)	0.0296
Raja clavata	Rays	4.45 (±1.85)	0.0277
Halobatrachus didactylus	Fish	4.02 (±1.67)	0.0250
Dicologlossa cuneata	Fish	3.97 (±1.65)	0.0247
Myliobatis aquila	Rays	3.6 (±1.5)	0.0224
Trigla sp.	Fish	3.53 (±1.47)	0.0220
Atrina pectinata	Bivalvia	3.22 (±1.34)	0.0200
Chelidonichthys lucernus	Fish	3.18 (±1.32)	0.0198
Raja undulata	Rays	3.12 (±1.3)	0.0194
Pagellus erythrinus	Fish	2.98 (±1.24)	0.0185
Maja squinado	Crustacea	2.85 (±1.19)	0.0178
Raja brachyura	Rays	2.75 (±1.15)	0.0171
Chelidonichthys lastoviza	Fish	2.6 (±1.08)	0.0162
Mugil cephalus	Fish	2.1 (±0.87)	0.0131
Capros aper	Fish	2.03 (±0.84)	0.0126
Balistes carolinensis	Fish	1.76 (±0.73)	0.0110
Diplodus bellottii	Fish	1.76 (±0.73)	0.0110
Trigloporus lastoviza	Fish	1.76 (±0.73)	0.0110
Zeus faber	Fish	1.72 (±0.72)	0.0107
Lepidotrigla cavillone	Fish	1.54 (±0.64)	0.0096
Belone belone	Fish	1.51 (±0.63)	0.0094
Aplysia punctata	Gastropoda	1.34 (±0.56)	0.0083
Scyliorhinus canicula	Sharks	1.18 (±0.49)	0.0073
Micromesistius poutassou	Fish	1.12 (±0.47)	0.0070
Arnoglossus imperialis	Fish	1.03 (±0.43)	0.0064
Dicentrarchus labrax	Fish	1 (±0.42)	0.0062
Loligo spp.	Cephalopoda	0.93 (±0.39)	0.0058
Scorpaena porcus	Fish	0.81 (±0.34)	0.0050
Mullus barbatus	Fish	0.77 (±0.32)	0.0048
Mullus spp.	Fish	0.7 (±0.29)	0.0043
Chelon labrosus	Fish	0.68 (±0.28)	0.0042
Sparus aurata	Fish	0.61 (±0.26)	0.0038
Alosa fallax	Fish	0.53 (±0.22)	0.0033
Pecten maximus	Bivalvia	0.51 (±0.21)	0.0032
Solea spp.	Fish	0.46 (±0.19)	0.0029
Scophthalmus rhombus	Fish	0.42 (±0.17)	0.0026
Pagrus pagrus	Fish	0.41 (±0.17)	0.0026
Raja spp.	Rays	0.36 (±0.15)	0.0022
Microchirus variegatus	Fish	0.34 (±0.14)	0.0021
Marthasterias glacialis	Echinodermata	0.32 (±0.13)	0.0020
Solea solea	Fish	0.29 (±0.12)	0.0018
Dardanus arrosor	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)	%
Centrolabrus exoletus	Fish	0.27 (±0.11)	0.0017
Dentex dentex	Fish	0.23 (±0.1)	0.0014
Pagellus spp.	Fish	0.23 (±0.09)	0.0014
Asterias rubens	Echinodermata	0.22 (±0.09)	0.0014
Echinus acutus	Echinodermata	0.22 (±0.09)	0.0014
Paracentrotus lividus	Echinodermata	0.21 (±0.09)	0.0013
Microchirus ocellatus	Fish	0.21 (±0.09)	0.0013
Lepidorhombus boscii	Fish	0.18 (±0.07)	0.0011
Mullus surmuletus	Fish	0.18 (±0.07)	0.0011
Scophthalmus maximus	Fish	0.17 (±0.07)	0.0011
Bothus podas	Fish	0.17 (±0.07)	0.0011
Aspitrigla cuculus	Fish	0.16 (±0.07)	0.0010
Dentex maroccanus	Fish	0.16 (±0.07)	0.0010
Labrus mixtus	Fish	0.14 (±0.06)	0.0009
Labridae	Fish	0.13 (±0.05)	0.0008
Conger conger	Fish	0.13 (±0.05)	0.0008
Diplodus spp.	Fish	0.13 (±0.05)	0.0008
Trigla lyra	Fish	0.12 (±0.05)	0.0008
Diplodus annularis	Fish	0.12 (±0.05)	0.0008
Dentex spp.	Fish	0.12 (±0.05)	0.0007
Uranoscopus scaber	Fish	0.11 (±0.05)	0.0007
Lepidotrigla dieuzeidei	Fish	0.11 (±0.04)	0.0007
Diplodus sargus	Fish	0.09 (±0.04)	0.0005
Dentex macrophthalmus	Fish	0.09 (±0.04)	0.0005
Calappa granulata	Crustacea	0.08 (±0.03)	0.0005
Serranus hepatus	Fish	0.08 (±0.03)	0.0005
Scomber spp.	Fish	0.08 (±0.03)	0.0005
Soleidae	Fish	0.07 (±0.03)	0.0005
Arnoglossus laterna	Fish	0.07 (±0.03)	0.0005
Coris julis	Fish	0.06 (±0.03)	0.0004
Ammodytes tobianus	Fish	0.06 (±0.02)	0.0004
Arnoglossus spp.	Fish	0.05 (±0.02)	0.0003
Symphodus spp.	Fish	0.04 (±0.02)	0.0003
Pleuronectiformes	Fish	0.04 (±0.02)	0.0003
Nucella lapillus	Gastropoda	0.04 (±0.02)	0.0002
Liza spp.	Fish	0.04 (±0.01)	0.0002
Palinurus elephas	Crustacea	0.03 (±0.01)	0.0002
Gymnammodytes cicerelus	Echinodermata	0.03 (±0.01)	0.0002
Symphodus bailloni	Fish	0.03 (±0.01)	0.0002
Carcinus maenas	Crustacea	0.02 (±0.01)	0.0001
Argentina sphyraena	Fish	0.02 (±0.01)	0.0001
Zeugopterus punctatus	Fish	0.01 (±0.01)	0.0001
Maja goltziana	Crustacea	0.01 (±0.01)	0.0001
Arnoglossus thori	Fish	0.01 (±0.01)	0.0001
Pagurus forbesii	Crustacea	0.01 (±0)	0.0001
Polybius henslowii	Crustacea	0.01 (±0)	0.00004
Bothidae	Fish	0.01 (±0)	0.00004
Goneplax rhomboides	Crustacea	0.005 (±0.002)	0.00003
Liocarcinus holsatus	Crustacea	0.003 (±0.001)	0.00002
Callionymus reticulatus	Fish	0.002 (±0.001)	0.00001
Trap			
Halobatrachus didactylus	Fish	380.2 (±135.4)	68.184
Scorpaena notata	Fish	74.3 (±26.5)	13.325
Diplodus bellottii	Fish	43.1 (±15.3)	7.723
Astropecten aranciacus	Echinodermata	35 (±12.5)	6.286
Sphaerechinus granularis	Echinodermata	8.6 (±3.1)	1.550
Spondyliosoma cantharus	Fish	5.3 (±1.9)	0.954
Diplodus annularis	Fish	3 (±1.1)	0.540
Spicara flexuosa	Fish	3 (±1.1)	0.535
Diplodus vulgaris	Fish	2.2 (±0.8)	0.395
Symphodus bailloni	Fish	1.6 (±0.6)	0.279
Acanthocardia spinosa	Bivalvia	0.5 (±0.2)	0.096
Serranus hepatus	Fish	0.2 (±0.1)	0.038
Murex trunculus	Gastropoda	0.2 (±0.1)	0.036
Homala barbata	Crustacea	0.2 (±0.1)	0.029
Maja squinado	Crustacea	0.1 (±0.05)	0.024
Ophioderma longicaudum	Echinodermata	0.03 (±0.01)	0.005
Artisanal/multi-gear			
Liza aurata	Fish	8650.35 (±6238.89)	36.87007
Scomber colias	Fish	4381.95 (±2597.49)	18.67701
Sardina pilchardus	Fish	3132.53 (±1303.59)	13.35167
Trachinus draco	Fish	930 (±387.02)	3.96392
Boops boops	Fish	839.77 (±627.54)	3.57931
Microchirus azevia	Fish	829.74 (±345.29)	3.53656
Chelidonichthys obscurus	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)	%
Merluccius merluccius	Fish	708.24 (±580.94)	3.01873
Scorpaena notata	Fish	614.19 (±639.06)	2.61782
Pagellus acarne	Fish	464.61 (±193.35)	1.98031
Trachurus trachurus	Fish	373.03 (±155.24)	1.58997
Serranus cabrilla	Fish	354.29 (±147.44)	1.51008
Phycis phycis	Fish	195.93 (±81.54)	0.83511
Halobatrachus didactylus	Fish	192.09 (±211.47)	0.81872
Sepia officinalis	Cephalopoda	133.68 (±154.91)	0.56978
Sarpa salpa	Fish	127.21 (±91.75)	0.54221
Citharus linguatula	Fish	113.73 (±120.13)	0.48476
Pagurus spp.	Crustacea	96.79 (±213.13)	0.41254
Liza ramada	Fish	65.99 (±89.2)	0.28125
Echinocardium cordatum	Echinodermata	60.86 (±134.01)	0.25939
Astropecten aranciacus	Echinodermata	43.92 (±19.9)	0.18719
Diplodus bellottii	Fish	22.41 (±23.37)	0.09552
Dosinia exoleta	Bivalvia	22.38 (±49.29)	0.09541
Tellina tenuis	Bivalvia	19.85 (±43.71)	0.08461
Benthodesmus elongates	Fish	19.18 (±22.08)	0.08176
Cymbium olla	Gastropoda	18.93 (±7.88)	0.08068
Balistes capriscus	Fish	17.02 (±7.08)	0.07255
Callionymus lyra	Fish	15.75 (±6.55)	0.06713
Trisopterus luscus	Fish	14.37 (±5.98)	0.06126
Todaropsis eblanae	Cephalopoda	14.23 (±5.85)	0.06065
Macroramphosus scolopax	Fish	14.12 (±5.88)	0.06020
Holothuroidea	Echinodermata	13.36 (±5.56)	0.05695
Scomber scombrus	Fish	10.81 (±4.5)	0.04608
Etmopterus pusillus	Sharks	10.33 (±13.93)	0.04405
Solea lascaris	Fish	9.63 (±4.01)	0.04104
Solea senegalensis	Fish	9.13 (±3.8)	0.03892
Sphaerechinus granularis	Echinodermata	8.64 (±3.08)	0.03684
Deania calcea	Sharks	8.52 (±9.25)	0.03631
Squilla mantis	Crustacea	8.17 (±17.99)	0.03482
Centrophorus squamosus	Sharks	7.81 (±8.49)	0.03330
Raja miraletus	Rays	7.45 (±3.1)	0.03176
Brama brama	Fish	6.7 (±2.76)	0.02857
Mola mola	Fish	6.59 (±2.74)	0.02811
Etmopterus spinax	Sharks	6.22 (±5.02)	0.02652
Spondyliosoma cantharus	Fish	5.76 (±2.3)	0.02456
Torpedo torpedo	Rays	5.51 (±2.29)	0.02348
Raja clavata	Rays	4.45 (±1.85)	0.01895
Liocarcinus depurator	Crustacea	4 (±8.8)	0.01704
Myliobatis aquila	Rays	3.6 (±1.5)	0.01535
Trigla sp.	Fish	3.53 (±1.47)	0.01504
Alepocephalus bairdii	Fish	3.53 (±3.83)	0.01504
Micromesistius poutassou	Fish	3.39 (±2.83)	0.01446
Atrina pectinata	Bivalvia	3.22 (±1.34)	0.01371
Chelidonichthys lucernus	Fish	3.18 (±1.32)	0.01354
Raja undulata	Rays	3.12 (±1.3)	0.01329
Spicara flexuosa	Fish	2.98 (±1.06)	0.01271
Pagellus erythrinus	Fish	2.98 (±1.24)	0.01270
Raja brachyura	Rays	2.75 (±1.15)	0.01173
Chelidonichthys lastoviza	Fish	2.6 (±1.08)	0.01109
Synaphobranchus kaupii	Fish	2.42 (±2.63)	0.01031
Donax vittatus	Bivalvia	2.34 (±5.15)	0.00998
Diplodus vulgaris	Fish	2.2 (±0.78)	0.00939
Mugil cephalus	Fish	2.1 (±0.87)	0.00895
Capros aper	Fish	2.03 (±0.84)	0.00863
Dicologlossa cuneata	Fish	1.99 (±2.31)	0.00846
Centrolophus monstrosa	Sharks	1.81 (±0.74)	0.00769
Balistes carolinensis	Fish	1.76 (±0.73)	0.00752
Trigloporus lastoviza	Fish	1.76 (±0.73)	0.00752
Zeus faber	Fish	1.72 (±0.72)	0.00734
Chimaera monstrosa	Fish	1.65 (±0.68)	0.00705
Galeus melastomus	Sharks	1.6 (±1.22)	0.00682
Diplodus annularis	Fish	1.57 (±1.63)	0.00668
Lepidotrigla cavillone	Fish	1.54 (±0.64)	0.00656
Belone belone	Fish	1.51 (±0.63)	0.00644
Maja squinado	Crustacea	1.49 (±1.6)	0.00636
Dalatias licha	Sharks	1.38 (±0.57)	0.00588
Aplysia punctata	Gastropoda	1.34 (±0.56)	0.00569
Illex coindetii	Cephalopoda	1.27 (±0.52)	0.00543
Conger conger	Fish	1.27 (±1.34)	0.00543
Atelecyclus undecimdentatus	Crustacea	1.17 (±2.58)	0.00499
Ensis siliqua	Bivalvia	1.07 (±2.36)	0.00456
Arnoglossus imperialis	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)	%
Dicentrarchus labrax	Fish	1 (±0.42)	0.00425
Scyliorhinus canicula	Sharks	0.99 (±0.46)	0.00422
Loligo spp.	Cephalopoda	0.93 (±0.39)	0.00395
Scorpaena porcus	Fish	0.81 (±0.34)	0.00345
Symphodus bailloni	Fish	0.79 (±0.86)	0.00337
Mullus barbatus	Fish	0.77 (±0.32)	0.00327
Polybius henslowii	Crustacea	0.72 (±2.33)	0.00306
Mullus spp.	Fish	0.7 (±0.29)	0.00297
Chelon labrosus	Fish	0.68 (±0.28)	0.00291
Sparus aurata	Fish	0.61 (±0.26)	0.00261
Centroscymnus crepidater	Sharks	0.6 (±0.66)	0.00258
Polychaetes	Other invertebrates	0.59 (±1.31)	0.00253
Acanthocardia spinosa	Bivalvia	0.54 (±0.19)	0.00228
Alosa fallax	Fish	0.53 (±0.22)	0.00227
Pecten maximus	Bivalvia	0.51 (±0.21)	0.00219
Phycis blennoides	Fish	0.49 (±0.35)	0.00209
Solea spp.	Fish	0.46 (±0.19)	0.00196
Scophthalmus rhombus	Fish	0.42 (±0.17)	0.00179
Pagrus pagrus	Fish	0.41 (±0.17)	0.00176
Trachyrincus scabrus	Fish	0.4 (±0.44)	0.00172
Nesiarchus nasutus	Fish	0.35 (±0.38)	0.00150
Microchirus variegatus	Fish	0.34 (±0.14)	0.00145
Marthasterias glacialis	Echinodermata	0.32 (±0.13)	0.00138
Hymenocephalus italicus	Fish	0.32 (±0.13)	0.00136
Lepidion guentheri	Fish	0.3 (±0.33)	0.00129
Solea solea	Fish	0.29 (±0.12)	0.00125
Dardanus arrosor	Crustacea	0.29 (±0.12)	0.00122
Centrolabrus exoletus	Fish	0.27 (±0.11)	0.00116
Trachinus vipera	Fish	0.26 (±0.56)	0.00109
Scymnodon ringens	Sharks	0.25 (±0.27)	0.00107
Dentex dentex	Fish	0.23 (±0.1)	0.00098
Pagellus spp.	Fish	0.23 (±0.09)	0.00097
Asterias rubens	Echinodermata	0.22 (±0.09)	0.00095
Echinus acutus	Echinodermata	0.22 (±0.09)	0.00094
Paracentrotus lividus	Echinodermata	0.21 (±0.09)	0.00091
Microchirus ocellatus	Fish	0.21 (±0.09)	0.00088
Raja spp.	Rays	0.2 (±0.19)	0.00087
Alepisaurus ferox	Fish	0.2 (±0.22)	0.00086
Murex trunculus	Gastropoda	0.2 (±0.07)	0.00086
Spisula solida	Bivalvia	0.19 (±0.43)	0.00083
Lepidorhombus boscii	Fish	0.18 (±0.07)	0.00076
Mullus surmuletus	Fish	0.18 (±0.07)	0.00076
Scophthalmus maximus	Fish	0.17 (±0.07)	0.00073
Bothus podas	Fish	0.17 (±0.07)	0.00072
Lagocephalus lagocephalus	Fish	0.17 (±0.07)	0.00071
Malacocephalus laevis	Fish	0.17 (±0.07)	0.00071
Dasyatis violacea	Rays	0.17 (±0.07)	0.00071
Aspitrigla cuculus	Fish	0.16 (±0.07)	0.00069
Dentex maroccanus	Fish	0.16 (±0.07)	0.00069
Mactra corallina stultorum	Bivalvia	0.16 (±0.35)	0.00068
Homala barbata	Crustacea	0.16 (±0.06)	0.00068
Lepidion spp.	Fish	0.15 (±0.16)	0.00064
Centrophorus granulosus	Sharks	0.15 (±0.16)	0.00064
Centroscymnus coelolepis	Sharks	0.15 (±0.16)	0.00064
Prionace glauca	Sharks	0.15 (±0.16)	0.00064
Serranus hepatus	Fish	0.15 (±0.09)	0.00062
Labrus mixtus	Fish	0.14 (±0.06)	0.00059
Labridae	Fish	0.13 (±0.05)	0.00056
Diplodus spp.	Fish	0.13 (±0.05)	0.00056
Trigla lyra	Fish	0.12 (±0.05)	0.00053
Dentex spp.	Fish	0.12 (±0.05)	0.00051
Uranoscopus scaber	Fish	0.11 (±0.05)	0.00046
Lepidotrigla dieuzeidei	Fish	0.11 (±0.04)	0.00046
Nephrops norvegicus	Crustacea	0.11 (±0.04)	0.00045
Hoplostethus mediterraneus	Fish	0.11 (±0.04)	0.00045
Naucrates ductor	Fish	0.11 (±0.04)	0.00045
Epigonus telescopus	Fish	0.1 (±0.11)	0.00043
Hexanchus griseus	Sharks	0.1 (±0.11)	0.00043
Diplodus sargus	Fish	0.09 (±0.04)	0.00038
Dentex macrophthalmus	Fish	0.09 (±0.04)	0.00036
Calappa granulata	Crustacea	0.08 (±0.03)	0.00034
Scomber spp.	Fish	0.08 (±0.03)	0.00032
Soleidae	Fish	0.07 (±0.03)	0.00031
Arnoglossus laterna	Fish	0.07 (±0.03)	0.00031
Coris julis	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)	%
Ammodytes tobianus	Fish	0.06 (±0.02)	0.00025
Aphanopus carbo	Fish	0.05 (±0.05)	0.00021
Coryphaena hippurus	Fish	0.05 (±0.05)	0.00021
Coryphaenoides rupestris	Fish	0.05 (±0.05)	0.00021
Thunnus alalunga	Fish	0.05 (±0.05)	0.00021
Centrophorus lusitanicus	Sharks	0.05 (±0.05)	0.00021
Deania profundorum	Sharks	0.05 (±0.05)	0.00021
Isurus oxyrinchus	Sharks	0.05 (±0.05)	0.00021
Arnoglossus spp.	Fish	0.05 (±0.02)	0.00021
Symphodus spp.	Fish	0.04 (±0.02)	0.00019
Pleuronectiformes	Fish	0.04 (±0.02)	0.00018
Nucella lapillus	Gastropoda	0.04 (±0.02)	0.00015
Venus striatula	Bivalvia	0.04 (±0.08)	0.00015
Liza spp.	Fish	0.04 (±0.01)	0.00015
Palinurus elephas	Crustacea	0.03 (±0.01)	0.00013
Ophioderma longicaudum	Echinodermata	0.03 (±0.01)	0.00012
Gymnammodytes cicerelus	Echinodermata	0.03 (±0.01)	0.00012
Carcinus maenas	Crustacea	0.02 (±0.01)	0.00007
Argentina sphyraena	Fish	0.02 (±0.01)	0.00007
Zeugopterus punctatus	Fish	0.01 (±0.01)	0.00006
Maja goltziana	Crustacea	0.01 (±0.01)	0.00005
Arnoglossus thori	Fish	0.01 (±0.01)	0.00005
Pagurus forbesii	Crustacea	0.01 (±0.004)	0.00004
Bothidae	Fish	0.01 (±0.002)	0.00002
Goneplax rhomboides	Crustacea	0 (±0.002)	0.00002
Liocarcinus holsatus	Crustacea	0.003 (±0.001)	0.00001
Callionymus reticulatus	Fish	0.002 (±0.001)	0.00001
Seine			
Boops boops	Fish	7466 (±1995)	31
Scomber colias	Fish	4335 (±1159)	18
Belone belone	Fish	3613 (±965)	15
Sardina pilchardus	Fish	3613 (±965)	15
Macroramphosus scolopax	Fish	2649 (±708)	11
Scomber scombrus	Fish	1445 (±386)	6
Halobatrachus didactylus	Fish	241 (±64)	1
Spicara flexuosa	Fish	241 (±64)	1
Trachurus trachurus	Fish	241 (±64)	1
Trawl			
Trachurus picturatus	Fish	10659.5 (±4864.9)	15.856
Merluccius merluccius	Fish	8854.3 (±4041)	13.171
Scomber colias	Fish	8641.6 (±3943.9)	12.855
Micromesistius poutassou	Fish	8494.1 (±3876.6)	12.635
Trachurus trachurus	Fish	3888.2 (±1774.5)	5.784
Capros aper	Fish	2522.1 (±1151.1)	3.752
Chondrichthyes	Fish	2178.2 (±994.1)	3.240
Boops boops	Fish	1985.3 (±906)	2.953
Conger conger	Fish	1974.1 (±901)	2.937
Sardina pilchardus	Fish	1946.7 (±888.4)	2.896
Scomber scombrus	Fish	1749.4 (±798.4)	2.602
Scyliorhinus canicula	Sharks	1170.6 (±534.2)	1.741
Diverse	Diverse	1114.8 (±508.8)	1.658
Octopodidae	Cephalopoda	1080.5 (±493.1)	1.607
Lophius spp.	Fish	840.4 (±383.6)	1.250
Lepidopus caudatus	Fish	792.4 (±361.6)	1.179
Triglidae	Fish	789 (±360.1)	1.174
Cephalopoda	Cephalopoda	771.8 (±352.2)	1.148
Gadiculus argenteus	Fish	755.5 (±344.8)	1.124
Phycis spp.	Fish	634.6 (±289.6)	0.944
Parapenaeus longirostris	Crustacea	626 (±285.7)	0.931
Holothuroidea	Echinodermata	531.7 (±242.7)	0.791
Polybius henslowii	Crustacea	514.5 (±234.8)	0.765
Galeus melastomus	Sharks	406.5 (±185.5)	0.605
Trisopterus luscus	Fish	351.6 (±160.5)	0.523
Mullus spp.	Fish	300.1 (±137)	0.446
Sphoeroides pachygaster	Fish	265.8 (±121.3)	0.395
Maja squinado	Crustacea	257.3 (±117.4)	0.383
Pagellus spp.	Fish	257.3 (±117.4)	0.383
Trachurus spp.	Fish	257.3 (±117.4)	0.383
Pagrus spp.	Fish	240.1 (±109.6)	0.357
Macroramphosus scolopax	Fish	238.4 (±108.8)	0.355
Helicolenus dactylopterus	Fish	207.5 (±94.7)	0.309
Pagrus pagrus	Fish	171.5 (±78.3)	0.255
Sarpa salpa	Fish	171.5 (±78.3)	0.255
Xiphias gladius	Fish	171.5 (±78.3)	0.255
Octopus vulgaris	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)	%
Spondyliosoma cantharus	Fish	145.8 (±66.5)	0.217
Serranus cabrilla	Fish	137.2 (±62.6)	0.204
Plesionika spp.	Crustacea	128.6 (±58.7)	0.191
Zeus faber	Fish	128.6 (±58.7)	0.191
Rajidae	Rays	111.5 (±50.9)	0.166
Tealia spp.	Other invertebrates	102.9 (±47)	0.153
Echinoidea	Echinodermata	94.3 (±43.1)	0.140
Pleuronectes platessa	Fish	68.6 (±31.3)	0.102
Macropipus tuberculatus	Crustacea	42.9 (±19.6)	0.064
Rossia macrosoma	Cephalopoda	35.2 (±16)	0.052
Dardanus arrosor	Crustacea	34.3 (±15.7)	0.051
Solea spp.	Fish	34.3 (±15.7)	0.051
Pagurus alatus	Crustacea	25.7 (±11.7)	0.038
Lepidorhombus spp.	Fish	25.7 (±11.7)	0.038
Argentina sphyraena	Fish	17.2 (±7.8)	0.026
Mullus surmuletus	Fish	17.2 (±7.8)	0.026
Argobuccinum olearium	Gastropoda	17.2 (±7.8)	0.026
Cassidaria tyrrhena	Gastropoda	17.2 (±7.8)	0.026
Torpedo nobiliana	Rays	12.9 (±5.9)	0.019
Malacocephalus laevis	Fish	9.4 (±4.3)	0.014
Caelorinchus caelorhincus	Fish	8.6 (±3.9)	0.013
Illex coindetii	Cephalopoda	4.3 (±2)	0.006
Zenopsis conchifer	Fish	4.3 (±2)	0.006
Ophisurus serpens	Fish	3.4 (±1.6)	0.005
Sphoeroides cutaneus	Fish	3.4 (±1.6)	0.005
Eledone cirrhosa	Cephalopoda	2.6 (±1.2)	0.004
Octopus salutii	Cephalopoda	1.7 (±0.8)	0.003
Todaropsis eblanae	Cephalopoda	1.7 (±0.8)	0.003
Chimaera monstrosa	Fish	1.7 (±0.8)	0.003
Citharus linguatula	Fish	1.7 (±0.8)	0.003
Lophius piscatorius	Fish	1.7 (±0.8)	0.003
Eledone moschata	Cephalopoda	0.9 (±0.4)	0.001
Hoplostethus mediterraneus	Fish	0.9 (±0.4)	0.001
Pagellus bogaraveo	Fish	0.9 (±0.4)	0.001
Peristedion cataphractum	Fish	0.9 (±0.4)	0.001
Phycis blennoides	Fish	0.9 (±0.4)	0.001
Ruvettus pretiosus	Fish	0.9 (±0.4)	0.001
Trachurus mediterraneus	Fish	0.9 (±0.4)	0.001
Raja clavata	Rays	0.9 (±0.4)	0.001
Raja oxyrinchus	Rays	0.9 (±0.4)	0.001
Etmopterus pusillus	Sharks	0.9 (±0.4)	0.001
Hexanchus griseus	Sharks	0.9 (±0.4)	0.001