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Semi Pelagic Longline and Trammel Net Elasmobranch Catches in the Algarve (Southern Portugal): Catch Composition, Catch Rates and Discards

(Elasmobranch Fisheries – Poster)

by

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Abstract

In Portugal, elasmobranch landings have decreased substantially in recent years. In this work, elasmobranch catches in experimental hake near bottom semi pelagic longlines (1997 and 1998) were compared with those of experimental trammel nets (2000). In the hake semi pelagic longline fishery, 7 elasmobranch species represented 33.4% (2185 specimens) of the total fish captures. The most abundant species were *Galeus melastomus* (63.3%), *Etmopterus pusillus* (21.7%) and *Scyliorhinus canicula* (14.2%). Most of these elasmobranchs (68.3% in total) were discarded. In the trammel net fishery, 16 different elasmobranch species represented 4.3% (597 specimens) of total fish catches and the most important species were *Raja undulata* (43.6%) and *Scyliorhinus canicula* (10.2%). The majority of the elasmobranchs caught with this gear had commercial value, and only 5.4% were discarded. In both fisheries, intra-specific catch rates varied with depth. Length frequency distributions for the only species with relatively high catches in both fisheries, the small-spotted catshark, showed that in general, trammel nets catch larger specimens and in a more restricted length range than longlines.

Introduction

Elasmobranch fishes have life strategies that make them especially vulnerable to overexploitation (Pratt and Casey, 1990; Smale and Goosen, 1999; Wintner and Cliff, 1999; Hazin *et al*., 2002; Coelho and Erzini, *in press*). Worldwide, the problem of elasmobranch overexploitation has been well documented for the case of targeted fisheries (Bonfil *et al*., 1990; Campbell *et al*., 1992; Hurley, 1998; Stevens *at al*., 2000) as well as those with high levels of by-catch of these species (Buencuerpo *et al*., 1998; Mckinnell and Seki, 1998) and for other fishing activities, such as recreational fishing (Francis, 1998).

Elasmobranch fishes are a very important component of the by-catch of the artisanal fisheries in Portugal (Erzini *et al*., 2000; Erzini *et al*., 2001), but no management program has been established yet. In the past few years, catches decreased 46.3% in the Algarve (from 888.1 t in 1988 to 447.0 t in 2000) and 30.1 % at a national level (from 5634.4 t in 1997 to 3938.6 t in 2000) (DGPA, 2000). In some cases, those reductions have been very drastic and might even indicate that these species are at high risk. Such is the case of the gulper shark (*Centrophorus granulosus*) where there was a catch reduction of 92.3 % at a national level and 80.4 % in the Algarve, or the smooth hounds (*Mustelus* spp.) that registered reductions of 79.4% at a national level and 54.2% in the Algarve. The rays and skates (*Raja* spp.) have also suffered great reductions, namely 43.8 % at a national level 48.7 % in the Algarve.

The objectives of this study are to describe and compare elasmobranch catches in two different types of artisanal fisheries in the South of Portugal, trammel nets and semi-pelagic longlines. Catch composition and catch rates were compared and discards were analyzed for both fisheries.

Material and Methods

Fishing trials with the semi-pelagic longlines were carried out from March 1997 to August 1998. A total of 20 fishing trials (10 per year) were carried out by a commercial longliner that usually operates in these waters, and the fishing took place on traditional fishing grounds in the Algarve, at depths that varied from 210 to 550 m (Fig.1). The semi pelagic longline used consisted of a 1.60 mm diameter monofilament main line with 0.90 mm diameter monofilament gangions of approximately 1.2 m attached without swivels, directly to the mainline, at intervals of approximately 1.8 m. The longline was lifted off the bottom by glass balls ("bolas") at intervals of 40 hooks, and weighted down with small rocks ("pedras") in between. The longlines were stored in plastic tubs, each containing 120 hooks. Four hook sizes (numbers 10, 9, 7 and 5), the most commonly used in the Algarve, were used. The mean number of tubs used per set was 44, with 11 tubs (1320 hooks) of each hook size. Frozen sardines were thawed on the way to the fishing grounds and after being cut in half, used to bait the longline. The total length of the longline was between 10 and 15 km and typically, the fishing trips lasted 17 to 21 hours. All the hooks were registered for position, presence or absence of bait and catches. All the catches were quantified by species and measurement of TL (mm) was recorded for the target species, the European hake (*Merluccius merluccius*), and the most important by-catch elasmobranch species, the blackmouth catshark (*Galeus melastomus*).

Experimental fishing trials with the trammel nets were carried out in 2000, from January to November, on a seasonal basis with 10 fishing trials per season. Fishing was carried out by a commercial fishing vessel and took place in traditional fishing grounds in the Algarve. Fishing depths varied from 10 to 90 m (Fig.1). The experimental trammel nets consisted of two larger mesh outer panels (600 and 800 mm stretched mesh) and three smaller mesh inner panels (100, 120, 140 mm stretched mesh). Thus experimental nets consisted of 6 different combinations and each combination was composed of 5 nets with equal mesh size for each panel. Overall 5 groups of these 6 combinations, each with 5 nets were used, giving a total of 150 nets. The 6 distinct combinations were joined together by a footrope, leaving a 2 m gap between them. A total of 8900 m composed by 2500, 3000, 3400 m of each inner mesh size (100, 120 and 140, respectively) were used. Normal fishing practices were followed, with the setting of the gear taking place in the afternoon or evening before sunset and hauling taking place after sunrise. All captured fishes were separated, identified and measured (total length, mm) as they came aboard. The way in which each fish was caught was recorded as gilled, wedged or entangled.

Catches from both fisheries were classified according to value and fate of the specimens as commercial, discard or self-consumption. Catch rates were calculated according to depth in number of fish per 1000 M for the trammel nets and number of fish per 1000 hooks for the semi-pelagic longline. Length frequency distributions for the only species that had relatively high catches in both fisheries, the small-spotted catshark, were constructed by gear and compared with the Kolmogorov-Smirnov test.

Results

In the hake semi pelagic longline 7 different elasmobranch species were captured, representing 33.4% of the total catch. All specimens were identified, except 4 rays, that could only be identified as *Raja* sp.. The most abundant species were the blackmouth catshark, *Galeus melastomus*, with 63.3% (1383 specimens) of the captured elamobranchs, followed by the smooth lanternshark, *Etmopterus pusillus*, representing 21.7% (474 specimens) and the small-spotted catshark, *Scyliorhinus canicula*, with 14.2% (310 specimens). These 3 species together accounted for more than 99% of the elasmobranch catch in this fishery. Abundance and length characteristics of elasmobranchs captured with both fishing gears are presented in Table 1.

In the trammel net elasmobranch catches accounted for 4.3% (597 specimens) of the total catch. A total of 16 different species were caught. All captured fishes were identified except one, that could only be identified as *Raja* sp.. The most abundant elasmobranch species were the undulate ray, *Raja undulata*, accounting for 43.6% (260 specimens), and the small-spotted catshark, *Scyliorhinus canicula*, accounting for 10.2% (61 specimens).

In the trammel nets, most of the captured elasmobranch were either landed for sale or consumed by the fishermen themselves. Discards were low, accounting for only 5.4% of the elasmobranch catch. On the other hand, in the semi pelagic longline there was a much higher level of discards among elasmobranchs, accounting for 68.3% of the catch (Table 2)

In both fisheries, intra-specific catch rates varied with depth. In the trammel net fishery, the two most important species in number had different catch rate patterns. For *R. undulata*, the highest catch rates were in the shallower depths with a progressive decrease with depth, while for *S. canicula*, the opposite pattern was observed, with higher catch rates in deeper waters. In the case of the semi-pelagic longline, the three numerically most important species had similar patterns of variation with depth. As can be seen in Fig. 2 catch rates peaked at two depth ranges, from 200 to 300 m and from 500 to 560 m.

Comparison of the length-frequency distributions for *S. canicula* shows that in general, trammel nets caught larger specimens and in a more restricted length range than longlines. On the other hand, longlines caught smaller individuals and in a wider range of lengths (Fig. 3). The Kolmogorov-Smirnov test showed that those distributions were significantly different ($P<0.001$).

Discussion

Analysis of the catch compositions and catch rates of both fishing gears showed that catches of sharks with the semi-pelagic longlines are very high. The fact that most of these catches consist of deep-water sharks that are especially sensitive to exploitation may be cause for concern. On the other hand, trammel nets essentially capture rays (*Raja undulata*) that may also have the same low productivity problems that deep-water sharks have, but are landed for sale.

In the case of these discarded deep-water sharks, official fisheries statistics may contain significant errors. In fact, most of these animals are discarded to the sea, either dead or with severe injuries and are never accounted for the official fisheries statistics that are based mainly on fishes sold at auction. Although these species are characterized by very slow growth rates and low fecundities, making them particularly sensitive to over exploitation, none is listed in the IUCN Red List for endangered species, and no management programs exist in Portugal.

The length frequency analyses of the small-spotted catshark represent very interesting results showing that trammel nets generally captured larger specimens than the semi-pelagic longline. If we consider the fact that trammel nets operate in much shallower waters than the semi-pelagic longlines, these results might contradict the traditional generalization that larger specimens occur at greater depths. However, it is important to note that sampling took place with different fishing gears, leading to the possibility that the differences in length distributions occurred not due to depth, but due to different gear selectivity. If this is the case, then we must conclude that small *S. canicula* specimens occur in shallow waters, but are not fully selected by the trammel nets.

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Table 1. Catches in number with the respective length characteristics of elasmobranchs captured with both fishing gears.

Gear	Species	n	Length caracteristics (cm)				
			mean	sd	Min	Max	Range
Semi pelagic longline	*Galeus melastomus*	1383	48.9	11.5	18.5	89.9	71.4
	Etmopterus pusillus	474	34.0	5.1	20.3	51.0	30.7
	Scyliorhinus canicula	310	41.3	8.3	21.0	59.5	38.5
	Prionace glauca	6	77.3	16.9	60.5	103.0	42.5
	Chimaera monstrosa	4	88.0	10.9	78.0	99.7	21.7
	Mustelus mustelus	2	143.0		143.0	143.0	
	Raja clavata	2	69.1	3.7	66.5	71.7	5.2
Trammel nets	*Raja undulata*	260	65.8	11.9	36.5	84.5	48.0
	Scyliorhinus canicula	61	52.3	4.3	41.9	74.0	32.1
	Raja clavata	55	66.2	12.9	39.5	86.5	47.0
	Raja asterias	53	61.4	10.6	39.3	93.0	53.7
	Raja brachyura	50	58.6	16.4	30.5	93.5	63.0
	Torpedo marmorata	33	40.5	10.4	17.5	61.0	43.5
	Torpedo torpedo	33	35.1	6.7	21.0	54.5	33.5
	Raja miraletus	31	43.6	12.1	19.7	56.5	36.8
	Pteromylaeus bovinus	7	78.7	8.0	64.0	91.0	27.0
	Prionace glauca	3	106.7	5.5	101.0	112.0	11.0
	Raja oxyrinchus	3	123.5	44.5	92.0	155.0	63.0
	Isurus oxyrinchus	2	88.3	3.8	85.6	91.0	5.4
	Torpedo nobiliana	2	33.5	1.1	32.7	34.3	1.6
	Galeorhinus galeus	1	137.5		137.5	137.5	
	Myliobatis aquila	1	54.0		54.0	54.0	
	Raja naevus	1	65.5		65.5	65.5	

Table 2. Fate of elasmobranchs captured with both fishing gears. For each species, it is indicated the number of specimens that was either commercialized or discarded, followed by the respective percentage in brackets. The commercial category includes fish that was both sold in the market and consumed by the fishermen.

Gear	**Species**	**n**	**Fate**	
			Commercial	**Discard**
Semi pelagic longline	*Galeus melastomus*	1383	646 (46.7%)	737 (53.3%)
	Etmopterus pusillus	474	-	474 (100.0%)
	Scyliorhinus canicula	310	32 (10.3%)	278 (89.7%)
	Prionace glauca	6	6 (100.0%)	-
	Raja sp.	4	4 (100.0%)	-
	Chimaera monstrosa	4	-	4 (100.0%)
	Mustelus mustelus	2	2 (100.0%)	-
	Raja clavata	2	2 (100.0%)	-
	Total	**2185**	**692 (31.7%)**	**1493 (68.3%)**
Trammel net	*Raja undulata*	260	254 (97.7%)	6 (2.3%)
	Scyliorhinus canicula	61	59 (96.7%)	2 (3.3%)
	Raja clavata	55	50 (90.9%)	5 (9.1%)
	Raja asterias	53	52 (98.1%)	1 (1.9%)
	Raja brachyura	50	47 (94.0%)	3 (6.0%)
	Torpedo marmorata	33	32 (97.0%)	1 (3.0%)
	Torpedo torpedo	33	32 (97.0%)	1 (3.0%)
	Raja miraletus	31	27 (87.1%)	4 (12.9%)
	Pteromylaeus bovinus	7	-	7 (100.0%)
	Prionace glauca	3	3 (100.0%)	-
	Raja oxyrinchus	3	3 (100.0%)	-
	Isurus oxyrinchus	2	2 (100.0%)	-
	Torpedo nobiliana	2	2 (100.0%)	-
	Galeorhinus galeus	1	1 (100.0%)	-
	Myliobatis aquila	1	-	1 (100.0%)
	Raja naevus	1	1 (100.0%)	-
	Raja sp.	1	-	1 (100.0%)
	Total	**597**	**565 (94.6%)**	**32 (5.4%)**

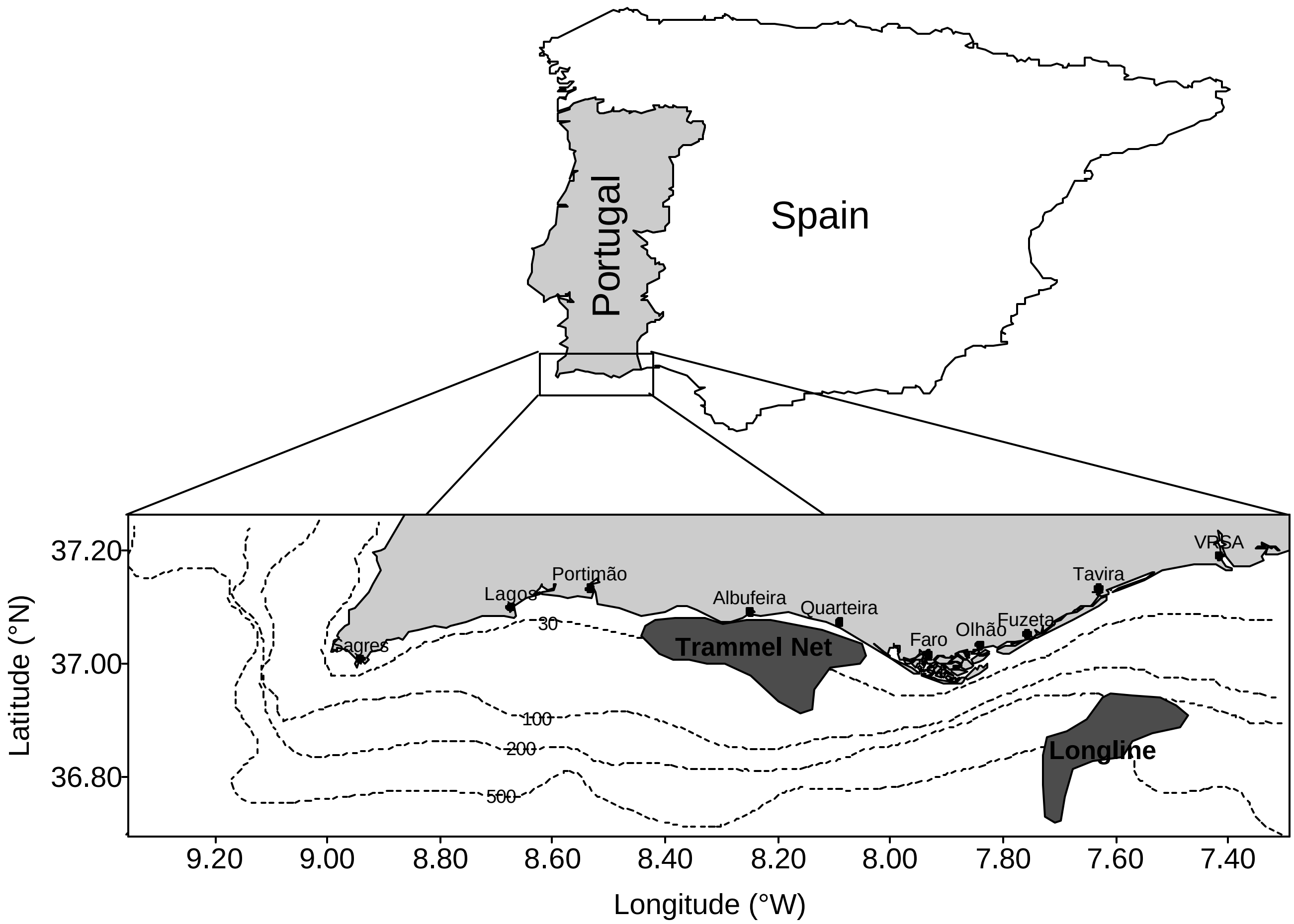

Fig. 1. Map of the Algarve coastline with the location of the fishing grounds of both the trammel nets and the longlines used in this study.

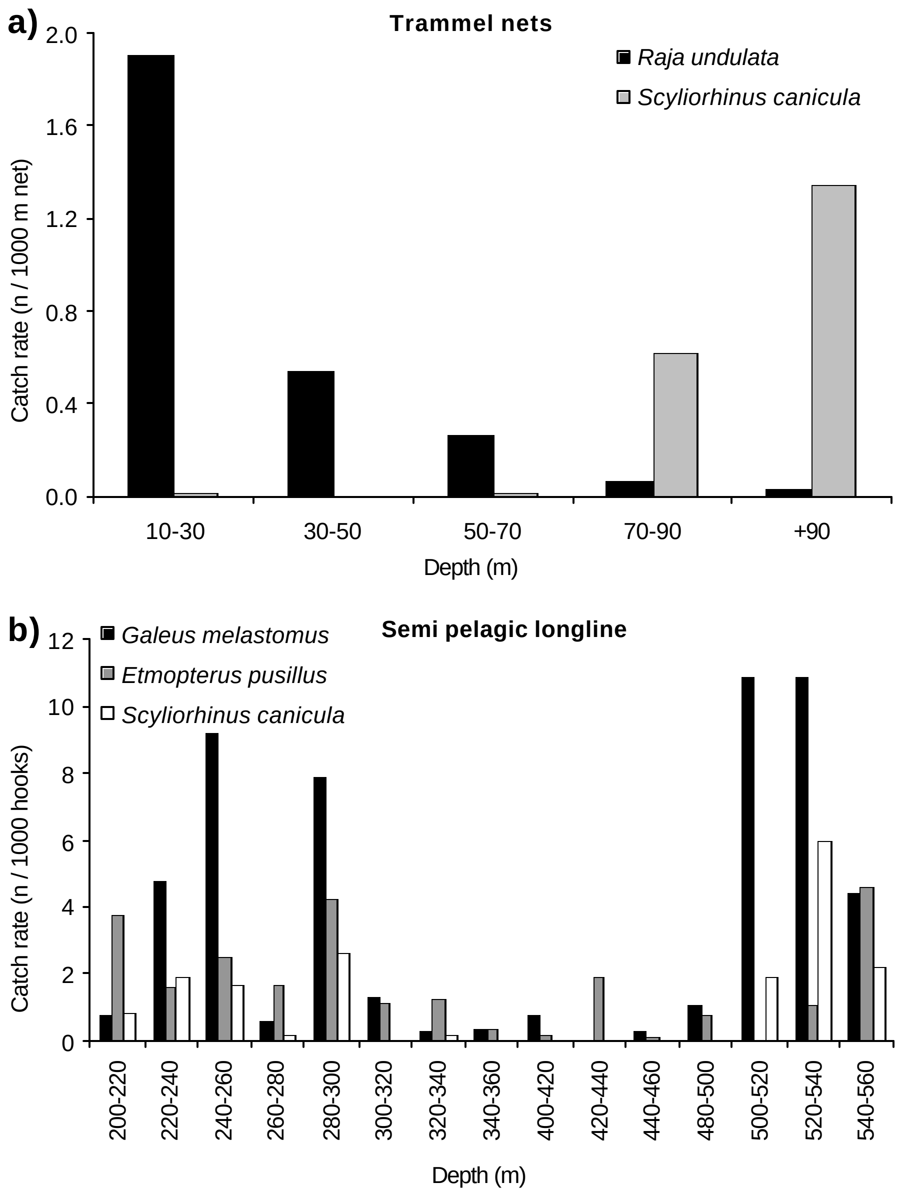

Fig. 2. Variation of catch rates with depth for both trammel nets (a) and semi pelagic longlines (b).

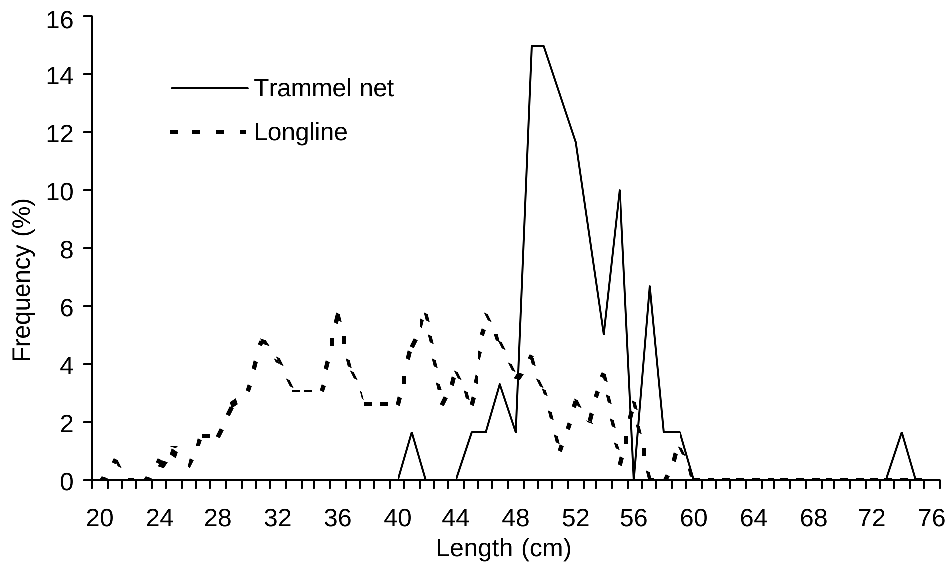

Fig. 3. Length frequency distributions of small spotted catshark, *Scyliorhinus canicula*, captured with both fishing gears.