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NOTE

Skate and ray species composition in mainland Portugal from the commercial landings

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Abstract – Skates and rays constitute important resources for several fishing fleets of mainland Portugal with total annual landings around 1500 tons. Regardless of their commercial interest, landed specimens are not differentiated at species level. To get a preliminary insight into the species diversity of landings, a pilot sampling program on skates and rays composition was executed in the two ports of mainland Portugal with the highest landings of this group– Matosinhos and Peniche. Sampling was carried out once a month in each port between January and April 2001. Based on the information obtained, a new sampling plan was established for the artisanal fishery (gillnet fleet), at each landing port. This sampling program was conducted until the end of 2001. A total of eight species were identified. *Raja brachyura* and *Raja clavata* were the most common species found in the landings of each port, while *Raja miraletus* was only occasionally recorded. Rajidae landings in mainland Portugal are mainly by-catch of the artisanal segment of the commercial fishing fleet.

Key words: Fisheries / Rajidae / Sampling / Species composition / Atlantic Ocean

1 Introduction

Skates and rays have contributed more than 40% in weight to the reported landings of Elasmobranchs in the NE Atlantic. Despite their high importance, statistical information by species is limited, as most European countries do not differentiate between species in landings and they are collectively recorded (Walker 1999). The combined skates and rays landings statistics usually exhibit more stable trends than those of other Elasmobranch fisheries (Dulvy et al. 2000). However, this stability can be apparent as these species present different levels of resilience, causing fisheries exploitation to produce adverse effects on the abundance and distribution of the most sensitive species (Walker and Heessen 1996; Dulvy et al. 2000). The different impacts of fisheries in skates and rays individual species have been verified by Walker and Heesen (1996) in the North Sea, Dulvy et al. (2000) – who reported the disappearance of the long-nose skate (*Dipturus oxyrhinchus*), bottlenosed skate (*Rostroraja alba*) and common skate (*Dipturus batis*) off the British Isles – Rogers and Ellis (2000) in British coastal waters and more recently Garofalo et al. (2003) in the Strait of Sicily. In mainland Portugal, skates and rays are landed under the generic group *Raja* spp. and constitute by-catches from different fisheries (Heessen et al. 2003). Since 1991, annual landings have been around 1500 tons with high market price values, ca. 3 euros per kg in 2002. Despite their increasing commercial interest, nearly no references exist on the diversity on rays and skates occurring in Portuguese waters. This note presents the first results on the species diversity of skates and rays landed by the commercial fleet on the Portuguese coast. The data were collected during 2001 in the two major ports (Matosinhos and Peniche) with landings of Rajidae (from ICES division IXa). The information from the period between January and April was used to define an optimised sampling plan, which was later executed until the end of 2001.

2 Material and methods

Sampling occurred in 2001 at the fishing ports of Matosinhos and Peniche, where the major landings of Rajidae in mainland Portugal occur, respectively 115 and 306 tonnes in 2002. The selection of these ports was based on the analysis

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of landing records from the Portuguese Aquaculture and Fisheries General Directorate, between 1991 and 2000. The pilot sampling program was carried out between January and April 2001 and included one monthly visit to each landing port. The sampling procedure comprised: a) Selection of 10 fishing vessels (if possible) with landings of Rajidae; b) Random selection of at least three fish boxes per vessel; c) Identification of all specimens per box; d) For each specimen, record the total and disc lengths (to the nearest millimetre), the total weight (only in Matosinhos) and sex; e) Interview (if possible) of the crew of each vessel concerning different aspects of the fishing activity: area, depth, duration, gear characteristics and target species. 457 specimens were examined during this program – 64 in Matosinhos and 393 in Peniche from a total of 41 vessels sampled. The analysis of the acquired data led to the determination of optimum sample sizes, i.e. number of boxes to be collected per month, considering a small budget as well as a restriction on human resources for sampling. The numbers obtained were 12 in Matosinhos and 16 in Peniche; the corresponding levels of significance and magnitudes of error adopted were 20%, 0.05 and 10%, 0.1, respectively. Accordingly a new sampling plan was established for the artisanal gillnet fishery. For each landing port it included: i) one monthly visit; ii) a random selection of vessels (minimum three); iii) a random selection of boxes in order to sample a total of: 16 boxes (Peniche) and 12 boxes (Matosinhos). This new program was executed, until the end of 2001, at each port. The latest data were further analysed to update the optimum sample sizes.

3 Results

In mainland Portugal, skates and rays are mainly landed by the artisanal and trawl segments of the commercial fleet (Table 1). The artisanal fleet accounts for the highest landing records with an average of 1200 tons per year (about 75% of the total annual landings), comprising different types of fishing gear such as longline and gillnet.

Eight ray species were identified during the pilot sampling program (Table 2): bottlenosed skate *Rostroraja alba* (Lacepède 1803) (only found in Peniche); blonde ray *Raja brachyura* Lafont 1873; small-eyed ray *Raja microocellata* Montagu 1818; thornback ray *Raja clavata* Linnaeus 1758; brown ray *Raja miraletus* Linnaeus 1758; spotted ray *Raja montagui* Fowler 1910; undulate ray *Raja undulata* Lacepède 1802 and cuckoo ray *Leucoraja naevus* (Müller and Henle 1841). The majority of rays landed in the two ports were taken by artisanal gillnet fishing gear as by-catch.

In what concerns the interviews with the fishing vessels' crews, only 21 were conducted. In Matosinhos, the crews of eight vessels from an artisanal gillnet fishery were interviewed. In Peniche, 10 gillnet vessels, one trawler and two longliners were interviewed. In Matosinhos, fishing grounds are located at a distance between 20 and 90 nautical miles from the fishing port and fishing operations have a duration of circa 24 h. Target species vary with season and include European seabass *Dicentrarchus labrax*, turbot *Psetta maxima*, pouting *Trisopterus luscus* and Rajidae species. In Peniche fishing grounds are closer to the fishing port (at a distance of about 10 nmi) and the duration of fishing varies with gear, ranging from 10 to 20 h. Target species also vary with season and comprise European seabass *Dicentrarchus labrax*, European conger *Conger conger*, common sole *Solea solea* and Rajidae species.

During the execution of the new sampling program (May to December of 2001), no new species were identified besides those recorded in the previous sampling period – January to April (Table 2). Samples from May to December were collected from gillnet vessel landings which had pouting and turbot in Matosinhos and European conger and common sole in Peniche as the species with the highest recorded quantities. *R. brachyura* and *R. clavata* were the most frequent species representing 44% and 23% of the total individuals sampled in Peniche and 18% and 37% in Matosinhos. *R. miraletus* was the most infrequent species sampled presenting less than 3% in each port. The former two species are also frequent off North-eastern England, Southwest Wales (Holden 1963), Irish waters (Fahy 1989 *in* Walker 1999) and in the North Sea (Heessen et al. 2002). *R. clavata* together with *R. batis* and *L. naevus* represented 80% of ray landings from French trawlers operating in the west of the British Isles and Celtic sea (Du Buit 1973).

The largest specimens found were sampled in Peniche and belonged to *R. alba* species (Table 2). In Matosinhos, the largest total length recorded (103 cm total length) was from a *R. microocellata* female. *R. brachyura* individuals exhibited the smallest sizes recorded either in Matosinhos and Peniche.

4 Conclusion

This study constitutes a preliminary evaluation of skates and rays species diversity in the landings from mainland Portugal, conducted at the two most important landing ports. The knowledge on the species composition throughout time is particularly important since fisheries are responsible for temporal changes on the abundance and distribution of these species (Walker 1999; Stevens et al. 2000), which are highly susceptible to overfishing (Dulvy and Reynolds 2002; Frisk et al. 2002). In British coastal waters, the long-term effect of commercial fisheries may have been responsible for a decline in large bodied ray species while smaller, non-target species like the spotted ray and cuckoo ray, have become more abundant (Rogers and Ellis 2000). In the North Sea, fisheries caused changes in species composition by favouring species with the lowest length or age of first maturity, namely the starry ray, *Raja radiata* (Donovan 1808) (Walker and Heesen 1996). The findings of these studies reinforce the need for further investigation into the sampling of skates and rays in mainland Portugal. This should be expanded to other fisheries and ports taking into account the results obtained in the present work.

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Table 1. Annual landings (tonnes) of skates and rays in mainland Portugal by port and fishing segment (Tr- Trawl; Ar- Artisanal) between 1991 and 2002.

Year	Matosinhos			Nazaré			Peniche			Sesimbra			Portimão			Olhão			All Ports		
	Tr	**Ar**	**Total**	**Tr**	**Ar**	**Total**	**Tr**	**Ar**	**Total**	**Tr**	**Ar**	**Total**	**Tr**	**Ar**	**Total**	**Tr**	**Ar**	**Total**	**Tr**	**Ar**	**Total**
1991	36	135	175	50	46	97	27	281	367	---	48	48	31	12	51	3	23	32	382	982	1375
1992	22	160	183	61	81	142	14	340	377	---	60	60	15	11	37	5	31	40	343	1202	1553
1993	32	164	199	68	104	176	20	358	384	---	61	61	21	12	47	7	30	42	363	1239	1613
1994	33	132	172	60	88	148	9	225	239	---	45	48	25	6	45	14	41	64	346	1007	1369
1995	29	91	123	57	77	135	9	305	327	---	81	82	27	8	42	22	35	66	358	1062	1433
1996	35	96	134	56	75	131	15	304	338	---	100	101	38	9	66	41	23	80	402	1119	1534
1997	30	76	107	59	68	128	26	342	386	---	99	100	22	7	45	35	24	80	398	1106	1512
1998	33	71	107	47	56	103	14	354	385	---	79	80	22	9	42	37	18	68	354	1119	1485
1999	19	73	94	37	65	103	9	322	339	---	72	72	20	7	28	31	13	53	293	1621	1921
2000	25	78	105	30	85	115	17	301	319	4	65	69	14	7	21	17	17	35	314	1207	1528
2001	38	87	126	32	87	119	28	337	365	3	62	65	31	10	41	17	17	38	352	1210	1571
2002	30	84	115	48	95	143	41	266	306	---	79	80	31	8	40	21	22	48	335	1161	1506

Table 2. Total length (cm) of Rajidae species sampled during 2001 by month and sex in Matosinhos (n = 255) and Peniche (n = 975).

Pilot sampling program

Port	Species	January		February		March		April		May		June		July		August		September		October		November		December		n
		♀	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂	
Matosinhos	*Raja brachyura*				93	54		98	101	39-64	39-90	57	79			38	39-99	67-102	46-96	63		50-51	45-94	44-68	50-67	**47**
	Raja clavata			56	43-74	42-76	41-74	60		62-69	50-76	43-86	56-59	73-91	73-79	55-87	38-78			65-83	48			59-80	53-69	**93**
	Raja miraletus						43						42-48													**6**
	Leucoraja naevus								57-81							55-63	61									**11**
	Raja montagui			50-51										58	59	47-56	48-56									**8**
	Raja undulata			61-90	48-65	63-84	83	55-63	54-74	58-84	43-77	64-76	63-79	68			86	78-85	63	55	60		54-58	86		**52**
	Raja microocellata								69			53-72		103	63-98			48-73	53-70			47-51	50-70	40-74	42-69	**38**
Peniche	*Raja brachyura*	62-110	47-90	40-105	39-96	48-105	42-94	52-101	98	39-90	44-88	56-100	55-94	50-104	50-98	46-107	39-92	38-88	38-88			43-99	36-92	43-79	46-69	**428**
	Raja clavata	45-76	50-63	49-89	47-84	45-62	53-98	49-89	63-84	50-90	54-93	60-79	54-77	50-60	54-57	44-73	48-70	62-87	69-79			58-71	54-62	64-86	68	**227**
	Raja miraletus				46-43					46																**7**
	Leucoraja naevus									50-63	41-62	43-57	41-58						55-57				37			**100**
	Raja montagui	44-50	50-99	52-65	50-61	54-67	37-52				47-57	51-65		53-69	56-57	43-66	40-55	105	77			41-47	48-50			**36**
	Raja undulata	66-93	37-58	53-60	48-73	60-79	52-90	52-91	51-60		55	54	72	51-75	54-82	45-80	54-87	53-90	59			78	56-79	53-85		**66**
	Rostroraja alba			47	70	162					123	124				94	100									**7**
	Raja microocellata	45	44-51	46-83	65-74	59-78	56-70	49-79	45-76	45-83	48	50-82	50-73	43-68	63		63-68	50-78	63-73			49-85	74			**104**

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