

LIFE  
**Yelkouan Shearwater**  
PROJECT



# REPORT

by

**MALTA CENTRE FOR FISHERIES SCIENCES**

Fort San Lucjan, Marsaxlokk, Malta

**ACTION A1**

**Identifying Maltese fishing grounds**



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# 1. Brief

## ACTION A1 - Identify Maltese fishing grounds

The Action is a review to identify Maltese fishing grounds by fish type and area, analyse Maltese fisheries activities, in order to map specifically the types of fishing activities undertaken in different fishing grounds, and how these factors vary during the year. (Ref: SPA Site and Sea Actions Saving *Puffinus yelkouan* in Malta – Revised Proposal - Action A1)

### 1.1 Data used

Fishing fleet data

Source: Fisheries database (Census 2006 for year of activity 2005)

- Number and size of boats
- Fishing gear used

To quantify fishing effort:

Unit of effort (e.g. no. of hooks x fishing trips)

Landings

Source: Fish market data (2001-2005) – to analyse trends

Fish market data (2005) – for in depth study on seasonality and activity

# 2. Introduction

## General Description of the Fishing Fleet and Fishing Activity

### 2.1 The Fleet

The Maltese fishing fleet as at 31<sup>st</sup> December 2005 was composed of 2,251 vessels of which 19% and 44% were commercial full-time and part-time vessels respectively, the remaining 37% made up of 826 vessels, which operated recreational fishing gear and fish caught were not commercialized.

The length of vessels ranges from 3 metres to 37.7 metres, with 77% and 99% of the full-time and part-time commercial vessels respectively measuring less than 12 metres. The fleet operates predominantly in a small scale artisanal manner and half of the vessels are of a traditional type of craft (*luzzu* and *kajjik*). However most of the landings originate from the vessels larger than 12m. A total of 16 demersal trawlers operate on a full-time basis.

## **2.2 Landings**

The Maltese Mediterranean fleet landed in excess of 80 species with the total landings (TAL) reaching 1,385 tons. Dolphin fish (*Coryphaena hippurus*) landings reached 447 tons, equivalent to about 32% of the TAL and were mostly derived from the *kannizzati* – Fish Aggregating Device (FAD) fishery. The bluefin tuna (*Thunnus thynnus*) and swordfish (*Xiphias gladius*) surface longline fisheries contributed to about 25% and 23% of the TAL respectively. The two most important demersal fisheries were bottom otter trawling and bottom longlining which together landed 12% of the TAL. Catches originating from trammel nets, traps, trolling lines and other minor gear, particularly popular with the smaller vessels operating in coastal waters, contributed to about 7% of the TAL (Annual Report 2005).

## **2.3 Seasonality**

The pattern of fishing activity followed by the commercial fishermen is dictated by the migratory habits of the main commercial species. The *kannizzati* fishery opens in mid August and runs till the end of December or into January (weather permitting). The tuna season though of shorter duration (end of April to mid-July) and yielding lower landings, contributes significantly to the earnings of fishers on account of the high value obtained for this resource on the international market (mainly Japan). During the winter months (in between seasons), bottom longlining for high quality fish (*Pagrus pagrus* – common seabream and *Epinephelus* spp. – groupers) is the main activity. In fact with the exception of the trawler fleet, which operate as such all the year round, most of the other vessels are Multi-Purpose Vessels (MPVs) carrying out multi-gear fisheries. A small number of fishers target swordfish (*Xiphias gladius*) all the year round (Fig. 1). During the Lampuki season, this activity is restricted to the “swordfish corridor”.

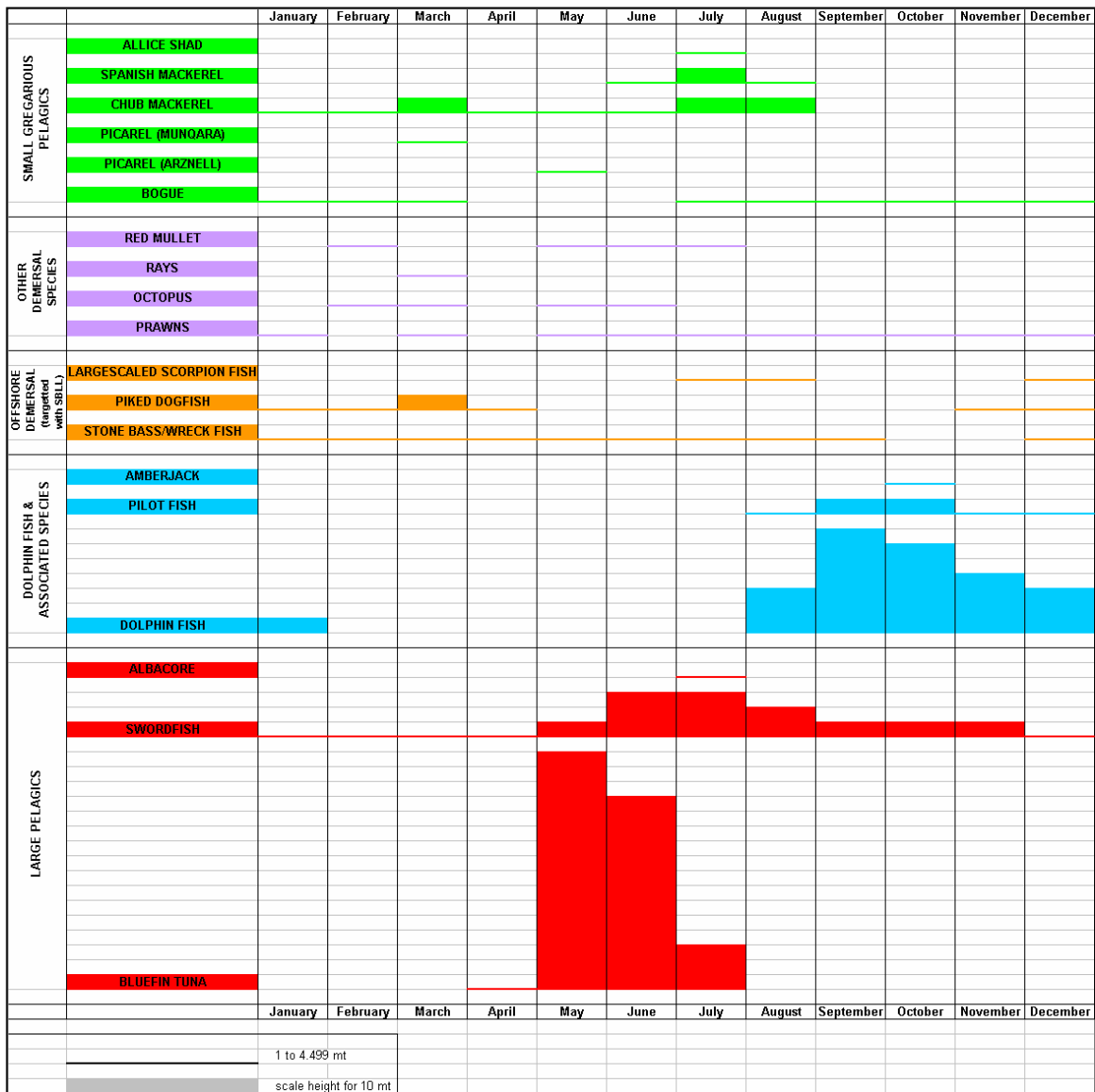


Fig 1. Seasonality of the main fisheries in Malta

### 3. Methodology and results

The year 2005 was selected as the basic reference year for this analysis as complete sets of data (fleet, landings etc.) on all the individual components considered necessary for this study were available.

Fishing gears under investigation are: longlining, both surface/drifted and set bottom which are considered to have a negative effect on sea-bird populations (Martí, 1998; Cooper et al., 2000; Valeiras and Camiñas, 2000; SPA Site and Sea Actions Saving *Puffinus yelkouan* in Malta – Revised Proposal - Action C1); and trawling, which might have a positive effect in terms of discarded by-catch serving as a food source for

fledglings (Oro and Ruiz, 1998; Abelló *et al.*, 2000; Martinez-Abraín *et al.*, 2002; Furness, 2003).

The area to be investigated includes all the Central Mediterranean, this corresponds to the area where the Maltese fleet is operating. The GPS positions of the limits of the area under study are listed in table 1.

Table 1: GPS positions of the area under study.

<b>N latitude</b>	<b>E longitude</b>
37°00	12°00
37°00	16°00
34°00	16°00
34°00	12°00

### **3.1 Detailed description of the fleet by gear**

#### **3.1.1 Longlines**

As the name implies, a longline is basically a long line (the main line) with hooks attached at intervals by means of a branch-line (snood). Longlines are classified mainly by where in the water column they are set i.e. surface, or bottom. Lines can be either “set” (anchored) or drifting. Census data shows that 321 vessels have this gear.

#### **3.1.2 Drifting surface longlines**

These are used mainly in the tuna and swordfish fisheries but which have slightly different characteristics, these being in the thickness of the snood and the size of the hook which in the case of the tuna longline are double the strength of swordfish longlines.

#### **3.1.3 The Tuna longline**

This longline is rigged up as follows: Mainline of monofilament 1.8mm, with snoods 7 metres long of double monofilament (1.3mm), set at 50 metre intervals. The number of hooks varies from 1,000 to 3,000 depending on the size of the boat. A typical longline of over 1,000 hooks would be up to 45 miles long. These are baited with Atlantic Mackerel (*Scomber scombrus*) and / or Japanese Squid (*Illex coindetti*). The lines are shot during the afternoon and this operation normally ends at around 8 pm which fishermen reckon is the prime time for the fish to bite. The lines start being retrieved from 10.30pm onwards.

### 3.1.4 The Tuna fleet

The Tuna fleet consists of 91 vessels, of which only 74 were operational in 2005, the other 17 had a licence but did not land any tuna (Data submitted to ICCAT). Out of the operational vessels, 66 have a length over all (LOA) of less than 20 metres, the other 8 being over 20 metres. A more detailed breakdown of the fleet is given below.

Table 2: Length range and number of professional fishermen category vessels (MFA-fulltime fishermen and MFB-part-time fishermen) using surface longlines (SLL) to target Bluefin tuna (*Thunnus thynnus*).

		0 - 12m	Average LOA	12m >	Average LOA	Sub-Total	Total
SLL	MFA	24	10.25	45	16.17	69	74
	MFB	4	9.4	1	13.1	5	

Fishing for Bluefin tuna is carried out exclusively in the Tuna Season (end of April to mid-July), which coincides with the migration pattern of this species through the Central Mediterranean.

### 3.1.5 The Swordfish longline

The fishing technique is similar to that of tuna, the only difference being in the gear, which is rigged with lighter filament and different hooks. The mainline being of 1.6mm monofilament can be up to 45 miles long. Snoods are of double monofilament (1 - 1.2mm) with hooks which may vary in size at different times of the year depending on the size of swordfish expected. The number of hooks varies according to vessel size and range. The larger vessels which venture beyond 25 mile zone and may remain at sea for up to 5 days may set as many as 2,000 - 2,500 hooks at a time, weather permitting, whilst the smaller craft do not normally stay out more than two days at sea, and set a maximum of 1,500 hooks per operation. The size of the bait which is exclusively Atlantic Mackerel is selected according to the size of the swordfish usually present at particular times of the year.

### 3.1.6 The Swordfish fleet

Though 321 vessels have surface drifting longlines, and thus the capability to fish for swordfish, only 187 were operational (landed swordfish in 2005), the others did not land any swordfish. Out of the operational vessels, the vast majority (172) have a length (LOA) of less than 20 metres, the other 15 being over 20 metres. A more detailed breakdown of the fleet is given below.



Table 3: Length range and number of professional fishermen category vessels (MFA and MFB) using surface longlines (SLL) to target Swordfish (*Xiphias gladius*).

		0 - 12m	Average LOA	12m >	Average LOA	Sub-Total	Total
SLL	MFA	73	8.42	55	17.29	128	187
	MFB	58	6.58	1	13.3	59	

Apart from being landed as a by-catch of the tuna fishery, swordfish are targeted by around 20 to 30 vessels during the Lampuki Season, when this activity is restricted to the “Swordfish Corridor”. Apart from further sporadic activity in between the main fishing seasons, there are also a small number of vessels targeting swordfish all the year round.

### 3.1.7 Set bottom longlines

The set bottom long line is one of the most prevalent gears, with 1,492 vessels claiming to have the gear/capability to set bottom longlines. Of these, only 861 are professional fishermen, with just 246 being full-timers. The gear described below is that used by the full-time professional section of the fleet, with part-timers utilizing less hooks. Number of hooks cast is usually also related to length of vessel (LOA) as this is an indication of capacity to operate under less favourable conditions, and range of fishing activity, with larger vessels being able to venture further a field.

Table 4: Length range and number of professional fishermen category vessels (MFA and MFB) utilizing set bottom longlines (BLL).

		0 - 12m	Average LOA	12m >	Average LOA	Sub-Total	Total
BLL	MFA	195	7.27	51	16.61	246	861
	MFB	605	6.19	10	15.22	615	

The gear used for this fishery is the set bottom longline. Depending on the prevailing meteorological conditions, as many as 6 longlines containing 500 hooks each, may be set at any one time, with hooks set at 8 meter intervals. Usually these longlines are set in deep rocky areas near a slope, at depths of 200m or more. The bait used is usually mackerel, but may vary depending on target species. The size of the hooks is No. 9, and normally an 80/90 mm monofilament line is used for the snood, except when larger fish such as Wreckfish (*Polyprion americanus*) and Groupers (*Epinephelus* spp.) are targeted, in which case the line may be of 100mm. Apart from these, this fishery targets various other demersal species, namely Sea bream (*Sparidae* spp.), Scorpion fishes (*Scorppaenidae* spp.) Hake (*Merluccius merluccius*), Gurnards (*Triglidae* spp.) and Dogfish (*Squalus* spp.).

### 3.1.8 Trawlers

There are 16 bottom otter-trawlers with an average length of 24.53 metres.

### 3.1.9 Bottom Trawling

The gear used is the Mazzara type of net, which is towed along the bottom. Although the trawling fleet is active all the year round, trawling grounds of different depths are fished at particular times of year, targeting specific species.

Trawling results in a considerable amount of discards (fish and invertebrates of little or no commercial value, See Annex II for a list of species from the Maltese Islands; Dimech & Schembri 2005, Dimech *et al.*, 2006). These discards are usually discarded back into the sea after each haul has been sorted. Large numbers of sea birds follow trawlers to feast on this rich food source.

## 3.2 Landings

The total annual landings for 2005 as estimated from fish landed at the Wholesale Fishmarket in Valletta, and Authorised Tuna Landing Point is given in Annex 1 (Data supplied by Fishmarket Scheme FMS). In excess of 80 species were landed with total landings reaching 1,337 tons. As tuna are gilled and gutted at sea, the actual live weight of fish caught is in the region of 1,385 tons.

### 3.2.1 Trend over 5 years

#### 3.2.1.1 Main species

For the five year period under review, over 78% of landings are attributed to the three main species: dolphinfish, tuna and swordfish (Fig. 2)

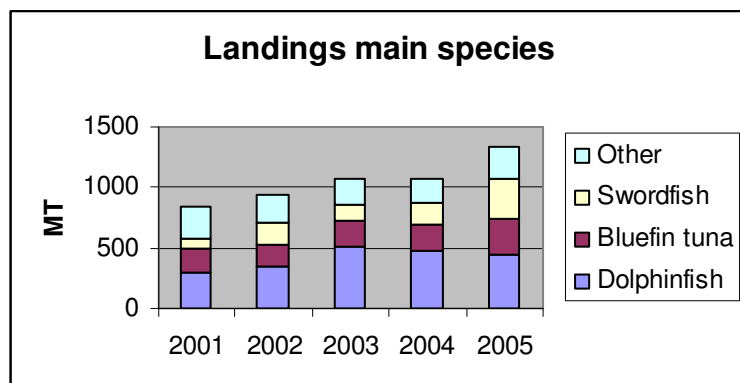


Figure 2. Landings (MT) main species 2001-2005

This clearly shows that the Maltese fleet is mainly targeting highly migratory species; the large pelagics tuna and swordfish, and the dolphinfish (Fig 3.)

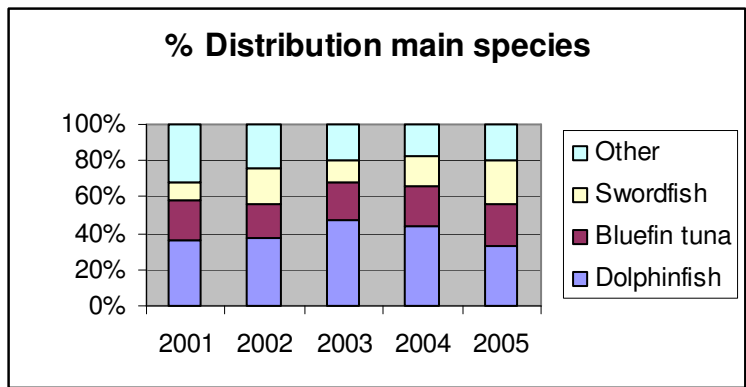


Figure 3. Percentage distribution main species

Though there is a slight fluctuation in total landings of the main species over the period, the percentage distribution confirms the above observation.

For comparative purposes one should note that both tuna and swordfish are landed and weighed gilled and gutted with the result that actual live weight would be considerably more (16% mark up for tuna).

**3.2.1.2 Indicator species**

The next 6 most landed species are shrimps/prawns (*Natantia* spp.), stone bass/wreckfish (*Epinephelus* spp., *Polyprion americanus*), dogfish (*Squalus* spp.), large-scaled scorpion fish (*Scorpaena scrofa*), bogue (*Boops boops*) and mackerel (*Trachurus* spp.), which together contribute to an average of 12% of the total landings. Whereas shrimps/prawns are caught exclusively by trawlers, stone bass, dogfish and large-scaled scorpion fish are mainly caught by bottom long lining. On the other hand, in the case of small pelagics, mackerel are fished mostly with a purse-seine utilizing the “lampara” method, while bogue are caught by a variety of mostly artisanal fishing methods. Examining how these landings vary over a period of years gives an indication of the state of the various stocks, and which resources are being targeted by Maltese fishers between the main fishing seasons (Fig 4.).

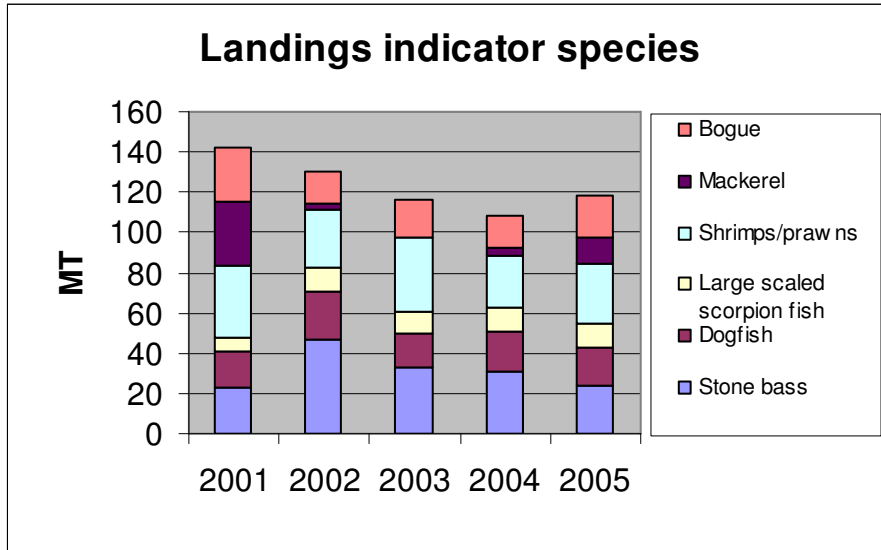


Figure 4. Landings indicator species

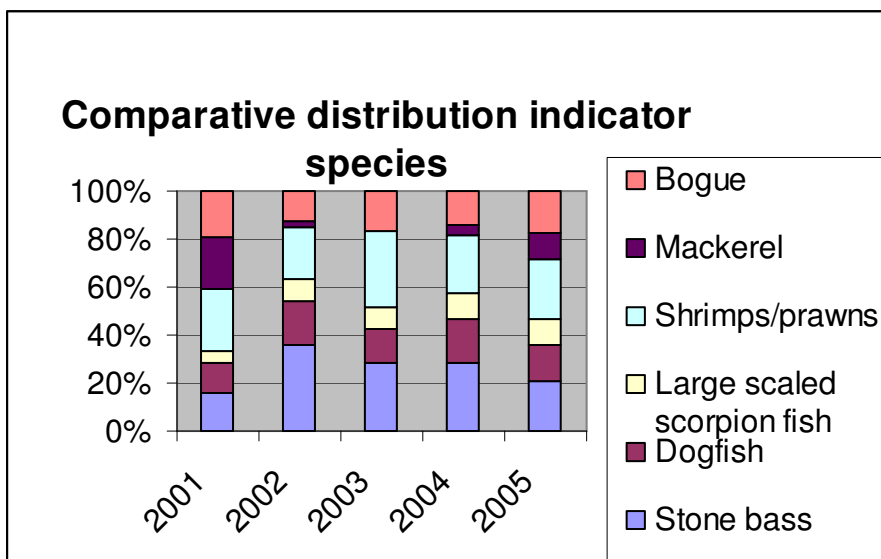


Figure 5 Comparative distribution indicator species

With the exception of mackerel, which showed some extreme fluctuations (low catch in 2003), on the whole one can discern a regular pattern in secondary fishing activity.

In conclusion over a five year period, analysis of landings of the main species shows a regular profile. Thus for an in depth study of fishing activity by quarter, one may focus on a particular year, in this case 2005 so as to be able to co-relate landings data with fleet data and fishing effort.

### 3.2.2 Landings by Quarter 2005

Table 5: Landings by quarter 2005

English Name	Scientific Name	1st Quarter	2nd Quarter	3rd Quarter	Last Quarter	Total
Dolphin Fish	<i>Coryphaena hippurus</i>	10060	1760	301330	133945	447095
Swordfish	<i>Xiphias gladius</i>	8244	63713	141116	110241	323314
Dog Fish	<i>Squalus acanthias</i>	7639	5637	3111	2223	18610
Shrimps/Prawns	<i>Pandalus</i> spp.	4940	9935	9974	5297	30146
Bogue	<i>Boops boops</i>	3541	6101	6397	5049	21088
Stone Bass	<i>Epinephelus aeneus</i>	3294	7599	5143	969	17005
Frigate Mackerel	<i>Auxis thazard</i>	3031	1271	11	60	4373
Mackerel	<i>Scomber japonicus</i>	2668	1848	4263	3364	12143
Skate	<i>Raja</i> spp.	1998	2274	1224	1001	6497
Common Sea Bream	<i>Pagrus pagrus</i>	1722	2529	966	632	5849
Large Scale Scorpion Fish	<i>Scorpaena scrofa</i>	1669	4715	4067	1532	11983
Six-Gilled Shark	<i>Hexanchus griseus</i>	1268	987	687	542	3484
Conger	<i>Conger conger</i>	1213	565	210	239	2227
Hake	<i>Merluccius merluccius</i>	1014	2011	2468	1374	6867
Scorpion Fish	<i>Scorpaena</i> spp.	1005	2021	1862	1145	6033
Wreckfish	<i>Polyprion americanus</i>	884	5374	801	106	7165
Squid	<i>Loligo vulgaris</i>	826	909	1430	1251	4416
White Bream	<i>Diplodus sargus</i>	714	469	640	672	2495
Octopus	<i>Octopus vulgaris</i>	654	2136	2349	1665	6804
Other species		543	2456	10805	1536	15340
Amberjack	<i>Seriola dumerili</i>	467	1564	2128	935	5094
Picarel	<i>Spicara</i> spp.	467	119	31	33	650
Cuttle Fish	<i>Sepia officinalis</i>	458	774	1085	1190	3507
Ling	<i>Molva molva</i>	454	972	611	256	2293
Little Tunny	<i>Euthynnus alletteratus</i>	453	118	30	734	1335
Blue-Spotted Bream	<i>Pagellus acarne</i>	419	417	849	244	1929
Dentex	<i>Dentex dentex</i>	404	280	226	480	1390
Atlantic Bonito	<i>Sarda sarda</i>	353	391	188	113	1045
Barracuda	<i>Sphyraena sphyraena</i>	325	1176	538	84	2123
Red Mullett	<i>Mullus</i> spp.	293	433	1846	610	3182
Pandora	<i>Pagellus erythrinus</i>	286	408	584	190	1468
Rough Shark	<i>Centrophorus granulosus</i>	283	66	150	29	528
Small Spotted Dog Fish	<i>Scyliorhinus canicula</i>	265	415	129	187	996
Gurnard	<i>Trigla</i> spp.	238	602	66	154	1060
Saddled Bream	<i>Oblada melanura</i>	224	359	233	103	919
Moray Eels	<i>Muraena helena</i>	216	489	720	92	1517
Comber	<i>Serranus cabrilla</i>	181	556	662	125	1524
Horse Mackerel	<i>Trachurus mediterraneus</i>	162	2163	1043	433	3801
Scourer	<i>Ruvettus pretiosus</i>	140	1006	974	329	2449
Allice Shad	<i>Alosa alosa</i>	138	145	684	0	967
Gilthead Bream	<i>Sparus aurata</i>	132	17	5	82	236
European Sea Bass	<i>Dicentrarchus labrax</i>	131	6	7	0	144
Picarel	<i>Spicara</i> spp.	130	756	0	0	886
Spotted Weaver	<i>Trachinus draco</i>	124	782	302	692	1900
Pellucid Sole	<i>Aphia minuta</i>	122	1712	375	0	2209
Mixed fish		111	24	170	139	444
Gouper	<i>Epinephelus</i> spp.	108	216	245	105	674
Porbeagle Shark	<i>Lamna nasus</i>	100	449	50	9	608
Long Nose Skate	<i>Raja oxyrinchus</i>	84	266	110	43	503

English Name	Scientific Name	1st Quarter	2nd Quarter	3rd Quarter	Last Quarter	Total
Grey Mullet	<i>Mugil spp.</i>	84	86	21	10	201
Squid	<i>Todarodes sagittatus</i>	78	149	205	214	646
Spotted Dog Fish	<i>Scyliorhinus spp.</i>	67	4	16	8	95
Scabbardfish	<i>Lepidopus caudatus</i>	66	240	17	82	405
Salema	<i>Sarpa salpa</i>	52	531	231	81	895
Angler Fish	<i>Lophius piscatorius</i>	50	308	309	41	708
Common Sting Ray	<i>Dasyatis pastinaca</i>	34	147	202	53	436
Pilot Fish	<i>Naucrates ductor</i>	29	0	5087	4982	10098
Two-banded seabream	<i>Diplodus vulgaris</i>	27	41	228	24	320
Crayfish	<i>Homarus spp.</i>	9	187	18	10	224
Annular Seabream	<i>Diplodus annularis</i>	6	4	0	0	10
Albacore	<i>Thunnus alalunga</i>	2	1206	13352	5	14565
Blue Fin Tuna	<i>Thunnus thynnus</i>	0	270630	30813	0	301443
Blue Fin Tuna juv.	<i>Thunnus thynnus</i>	0	0	2510	1574	4084
Spear-Fish	<i>Tetrapturus belone</i>	0	445	426	101	972
Amberjack juv.	<i>Seriola dumerili</i>	0	0	92	648	740
John Dory	<i>Zeus faber</i>	0	27	195	411	633
Blue Shark	<i>Prionace glauca</i>	0	397	68	14	479
Damsel Fish	<i>Chromis chromis</i>	0	4	355	9	368
Thresher Shark	<i>Hymenocephalus italicus</i>	0	185	0	154	339
Angel Fish	<i>Squatina squatina</i>	0	150	16	36	202
Blotched Picarel	<i>Spicara maena</i>	0	176	0	0	176
Med. Locust Lobster	<i>Scyllarides latus</i>	0	55	27	32	114
Tope	<i>Galeorhinus galeus</i>	0	0	0	38	38
Brown Wrasse	<i>Labrus merula</i>	0	0	21	0	21
Star Gazer	<i>Uranoscopus scaber</i>	0	8	0	4	12
White Skate	<i>Raja alba</i>	0	0	0	9	9

### 3.2.2.1 1<sup>st</sup> Quarter

The landings for the 1<sup>st</sup> quarter were just under 65 tons, which correspond to 5% of total annual landings. This is a lean period owing to various factors:

- Off season for migratory fish
- Possibility of unfavourable weather conditions
- Many vessels undergoing maintenance

As opposed to other times of the year, apart from dolphinfish (16%), which are caught as an extension of the *lampuki* season (weather permitting), and swordfish (13%) which are caught all the year round, no particular species dominates the market (in fact this is the time of year with greatest variety and availability of quality species).

Table 6: Landings (Kg) > 1MT 1<sup>st</sup> Quarter 2005

English Name	Scientific Name	1st Quarter
Dolphin Fish	<i>Coryphaena hippurus</i>	10060
Swordfish	<i>Xiphias gladius</i>	8244
Dog Fish	<i>Squalus acanthias</i>	7639
Shrimps/Prawns	<i>Pandalus spp.</i>	4940

Bogue	<i>Boops boops</i>	3541
Stone Bass	<i>Epinephelus aeneus</i>	3294
Frigate Mackerel	<i>Auxis thazard</i>	3031
Mackerel	<i>Scomber japonicus</i>	2668
Skate	<i>Raja spp.</i>	1998
Common Sea Bream	<i>Pagrus pagrus</i>	1722
Large Scale Scorpion Fish	<i>Scorpaena scrofa</i>	1669
Six-Gilled Shark	<i>Hexanchus griseus</i>	1268
Conger	<i>Conger conger</i>	1213
Hake	<i>Merluccius merluccius</i>	1014
Scorpion Fish	<i>Scorpaena spp.</i>	1005
		<b>53306</b>
	Other <1MT	11393
	<b>Total</b>	<b>64699</b>

Detailed analysis by grouping the species by gear used to target them, and appropriating a fraction of these landings when one species is fished for with different gears, reveals the pre-dominance of bottom long lining during this period. In fact 32% of the landings for this period consist in fish landed with this gear.

Table 7: Actual and estimated(\*) landings (Kg) from Bottom longlining 1<sup>st</sup> Quarter

<b>English Name</b>	<b>Scientific Name</b>	<b>BLL</b>
Dog Fish	<i>Squalus acanthias</i>	7639
Stone Bass	<i>Epinephelus aeneus</i>	3294
Common Sea Bream	<i>Pagrus pagrus</i>	1722
Large Scale Scorpion Fish	<i>Scorpaena scrofa</i>	1669
Conger	<i>Conger conger</i>	1213
Hake	<i>Merluccius merluccius</i>	1014
Wreckfish	<i>Polyprion americanus</i>	884
White Bream	<i>Diplodus sargus</i>	714
Skate	<i>Raja spp.</i>	666*
Ling	<i>Molva molva</i>	454
Blue-Spotted Bream	<i>Pagellus acarne</i>	419
Dentex	<i>Dentex dentex</i>	404
Rough Shark	<i>Centrophorus granulosus</i>	283
Pandora	<i>Pagellus erythrinus</i>	95*
Gurnard	<i>Trigla .</i>	79*
Gouper	<i>Epinephelus spp.</i>	54*
Spotted Weaver	<i>Trachinus draco</i>	41*
Scabbardfish	<i>Lepidopus caudatus</i>	33*
		<b>20678</b>

### 3.2.2.2 2<sup>nd</sup> Quarter

The landings for the 2nd quarter were just under 416 tons, which correspond to 31% of total annual landings. This clearly shows the importance of this period, which is dominated by tuna and swordfish together contributing to over 334 tons, equivalent to over 80% of the landings for the period (these figures do not include the 16% mark-up).

Table 8: Landings (Kg) > 1MT 2nd Quarter 2005

English Name	Scientific Name	2nd Quarter
Blue Fin Tuna	<i>Thunnus thynnus</i>	270630
Swordfish	<i>Xiphias gladius</i>	63713
Shrimps/Prawns	<i>Pandalus</i> spp.	9935
Stone Bass	<i>Epinephelus aeneus</i>	7599
Bogue	<i>Boops boops</i>	6101
Dog Fish	<i>Squalus acanthias</i>	5637
Wreckfish	<i>Polyprion americanus</i>	5374
Large Scale Scorpion Fish	<i>Scorpaena scrofa</i>	4715
Common Sea Bream	<i>Pagrus pagrus</i>	2529
Other species		2456
Skate	<i>Raja</i> spp.	2274
Horse Mackerel	<i>Trachurus mediterraneus</i>	2163
Octopus	<i>Octopus vulgaris</i>	2136
Scorpion Fish	<i>Scorpaena</i> spp.	2021
Hake	<i>Merluccius merluccius</i>	2011
Mackerel	<i>Scomber japonicus</i>	1848
Dolphin Fish	<i>Coryphaena hippurus</i>	1760
Pellucid Sole	<i>Aphia minuta</i>	1712
Amberjack	<i>Seriola dumerili</i>	1564
Frigate Mackerel	<i>Auxis thazard</i>	1271
Albacore	<i>Thunnus alalunga</i>	1206
Barracuda	<i>Sphyraena sphyraena</i>	1176
Scourer	<i>Ruvettus pretiosus</i>	1006
		<b>400837</b>
	Other <1MT	15134
	<b>Total</b>	<b>415971</b>

This period coincides with the bluefin tuna migration in the Mediterranean Sea. The 270,630 Kg landed correspond to 90% of the total annual landings for this species. The swordfish landed during this period, 63,713 Kgs (20% of the total annual landings for this species) are caught mainly as a by-catch of the tuna fishery.

### 3.2.2.3 3<sup>rd</sup> Quarter

With landings exceeding 567 tons (42% of annual landings), the 3<sup>rd</sup> quarter is the most productive. It sees the closing of the tuna season, and the start of the *lampuki* season. This rise in productivity may also be linked to rising surface water temperatures.



Table 9: Landings (Kg) > 1MT 3rd Quarter 2005

English Name	Scientific Name	3rd Quarter
Dolphin Fish	<i>Coryphaena hippurus</i>	301330
Swordfish	<i>Xiphias gladius</i>	141116
Blue Fin Tuna	<i>Thunnus thynnus</i>	30813
Albacore	<i>Thunnus alalunga</i>	13352
Other species		10805
Shrimps/Prawns	<i>Pandalus spp.</i>	9974
Bogue	<i>Boops boops</i>	6397
Stone Bass	<i>Epinephelus aeneus</i>	5143
Pilot Fish	<i>Naucrates ductor</i>	5087
Mackerel	<i>Scomber japonicus</i>	4263
Large Scale Scorpion Fish	<i>Scorpaena scrofa</i>	4067
Dog Fish	<i>Squalus acanthias</i>	3111
Blue Fin Tuna juv.	<i>Thunnus thynnus</i>	2510
Hake	<i>Merluccius merluccius</i>	2468
Octopus	<i>Octopus vulgaris</i>	2349
Amberjack	<i>Seriola dumerili</i>	2128
Scorpion Fish	<i>Scorpaena spp.</i>	1862
Red Mullett	<i>Mullus spp.</i>	1846
Squid	<i>Loligo vulgaris</i>	1430
Skate	<i>Raja spp.</i>	1224
Cuttle Fish	<i>Sepia officinalis</i>	1085
Horse Mackerel	<i>Trachurus mediterraneus</i>	1043
		<b>553403</b>
	Other <1MT	13701
	<b>Total</b>	<b>567104</b>

53% of the landings for this period are contributed by the more than 301 tons of dolphinfish which correspond to 67% of the total annual landings for this species. At over 301 tons, swordfish landings during this period are 25% of the landings for this quarter. This figure is equivalent to 44% of the total annual landings for this species. In fact swordfish landings per month for this period are 45, 53, and 43 tons respectively. This reflects the increased amount of fishing for swordfish which exists between the tuna and *lampuki* season.

### 3.2.2.4 Last Quarter

The 289 tons of fresh fish landed during the last quarter constitute 22% of the annual landings. As in the 3<sup>rd</sup> quarter, the main species are dolphinfish and swordfish, but at 134 and 110 tons respectively they command 84% of the catch during the autumn months.

Table 10: Landings (Kg) > 1MT Last Quarter 2005

English Name	Scientific Name	Last Quarter
Dolphin Fish	<i>Coryphaena hippurus</i>	133945
Swordfish	<i>Xiphias gladius</i>	110241
Shrimps/Prawns	<i>Pandalus</i> spp.	5297
Bogue	<i>Boops boops</i>	5049
Pilot Fish	<i>Naucrates ductor</i>	4982
Mackerel	<i>Scomber japonicus</i>	3364
Dog Fish	<i>Squalus acanthias</i>	2223
Octopus	<i>Octopus vulgaris</i>	1665
Blue Fin Tuna juv.	<i>Thunnus thynnus</i>	1574
Other species		1536
Large Scale Scorpion Fish	<i>Scorpaena scrofa</i>	1532
Hake	<i>Merluccius merluccius</i>	1374
Squid	<i>Loligo vulgaris</i>	1251
Cuttle Fish	<i>Sepia officinalis</i>	1190
Scorpion Fish	<i>Scorpaena</i> spp.	1145
Skate	<i>Raja</i> spp.	1001
		<b>277369</b>
	Other <1MT	11405
	<b>Total</b>	<b>288774</b>

One would expect the dolphinfish landings to be considerably higher than those of swordfish during the lampuki season. A more detailed examination of the landings for this period by month reveals an anomaly:

Table 11: Landings (Kgs)/month for Dolphinfish and Swordfish (Last Quarter)

English Name	Scientific Name	October	November	December
Dolphin Fish	<i>Coryphaena hippurus</i>	64933	7302	61710
Swordfish	<i>Xiphias gladius</i>	43226	60014	7001

The month of November saw a sharp decline in *lampuki* landings (only to reappear in December) and a peak in swordfish landings. It appears that fishing effort shifted from one target species to the other. This could be on account of inclement weather, as fishing for *lampuki* in the Maltese traditional method is only successful in sea conditions up to force 4. Sometimes, dolphinfish which are a highly migratory species seem to disappear. In such a case fishermen switch to fishing for swordfish with longlines in the “swordfish corridor”.

### 3.3 Fishing Grounds

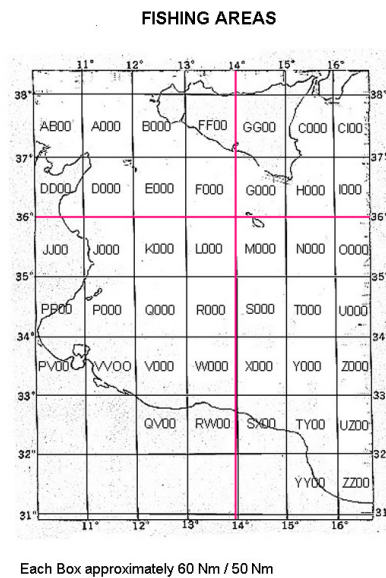
From the previous chapters (seasonality, fleet, landings) it is clear that different sections of the fleet are targeting different resources during specific periods of the year. These different resources (bottom dwelling species, highly migratory species, etc.) are fished for in different areas for a variety of reasons. Using both data submitted in this report, and

drawing on other sources as the case might be, we can identify the Maltese fishing grounds (Action A1).

The main fishing activity per season has been identified, the approach we shall follow is to identify the fishing areas associated with each activity.

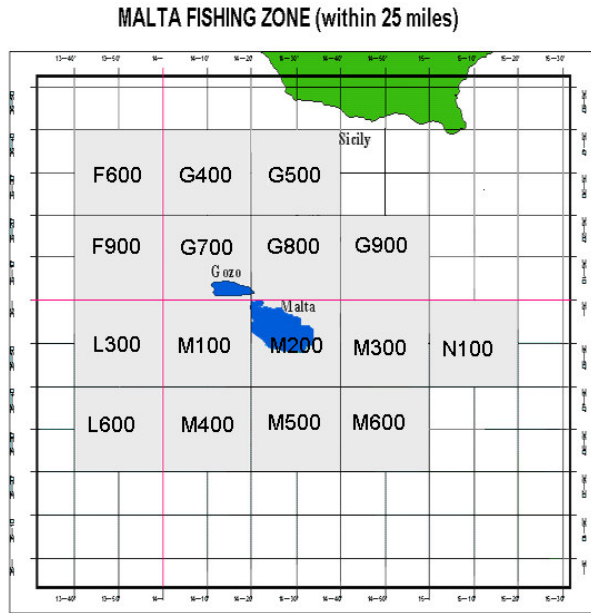
### 3.3.1 Brief Explanation of Fishing Areas Grid

To facilitate collection and analysis of data of the Maltese fishing fleet operating in the Mediterranean Sea, the area has been divided by a grid into areas along the lines of longitude and latitude at one degree intervals (Fig. 6). The Maltese Islands lie at 36 degrees latitude. At this latitude, each area is approximately 60 by 50 nautical miles (Nm). This level of aggregation is used to assess data of vessels which operate either in international waters (out of the Malta Fishing Zone, or whose activity covers a large area as is the case with the *Lampuki* fishery).



*Fig 6. Fishing Areas Grid*

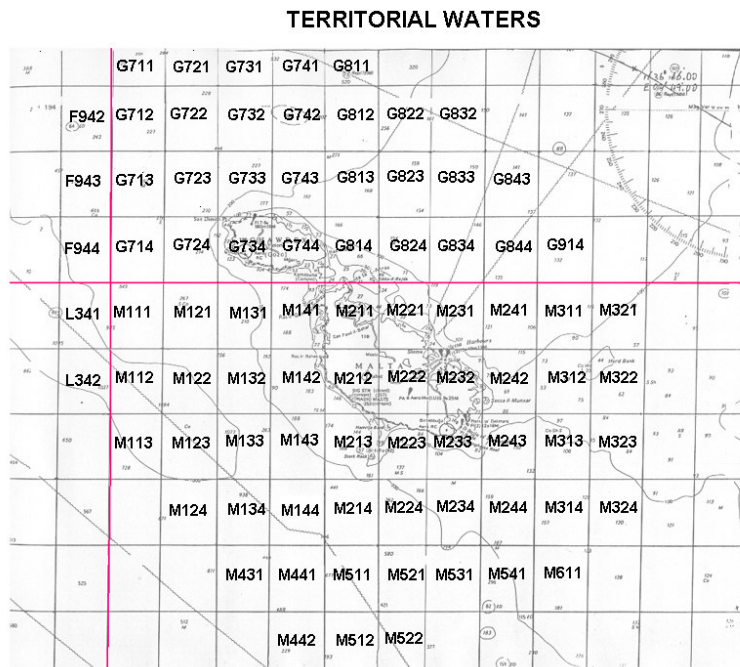
Within the 25 nautical mile fishing zone, each area is sub-divided into nine equal parts, each zone having an approximate area of 20 by 16 Nm (Fig. 7). Data on the fleet which is licensed to operate in this zone is recorded using this grid.



Each box approximately 20Nm / 16Nm

*Fig 7. Malta Fishing Zone (within 25 miles)*

Each of these zones is further sub-divided into 16 parts at five minute intervals, with the result that each of these is approximately 5 by 4 Nm (Fig. 8). This is done to obtain detailed information at the minimum level of desegregation within the Territorial Waters (12Nm).



*Fig 8. Territorial waters*

These three grids can be superimposed to give composite maps of all fishing activity.

### 3.3.2 How Census data on Fishing Area is obtained

During a census, for each different gear used, fishers are asked the following questions:

- Period (by month)
- Number of trips
- Number of units of gear (eg. Hooks)
- Fishing zone (e.g. SW 25 Nm off M'Xlokk)

The experienced enumerators then transpose this information into the appropriate sub-division. Census data is updated on a yearly basis.

### 3.3.3 Note re maps on fishing activity

As each map was made to illustrate the activity of a particular fleet segment with a specific gear, operating for different time scales, so as to compare like with like, the following points must be noted:

- Each map must be interpreted separately
- Units of effort are relative and not absolute

### 3.3.4 Bottom Longlining

To compute the data on Bottom longlining, the unit of fishing effort used for comparative purposes is:

$$\frac{\text{Number of hooks} \cdot \text{Number of fishing trips}}{\text{Area co-efficient}}$$

Note: The area co-efficient has been introduced into the equation to level out data as the areas are of different size, so that the intensity given is a true reflection of effort per unit area. Fig. 9 shows the activity of the bottom longlining fleet within the 25 Nautical Miles Zone.

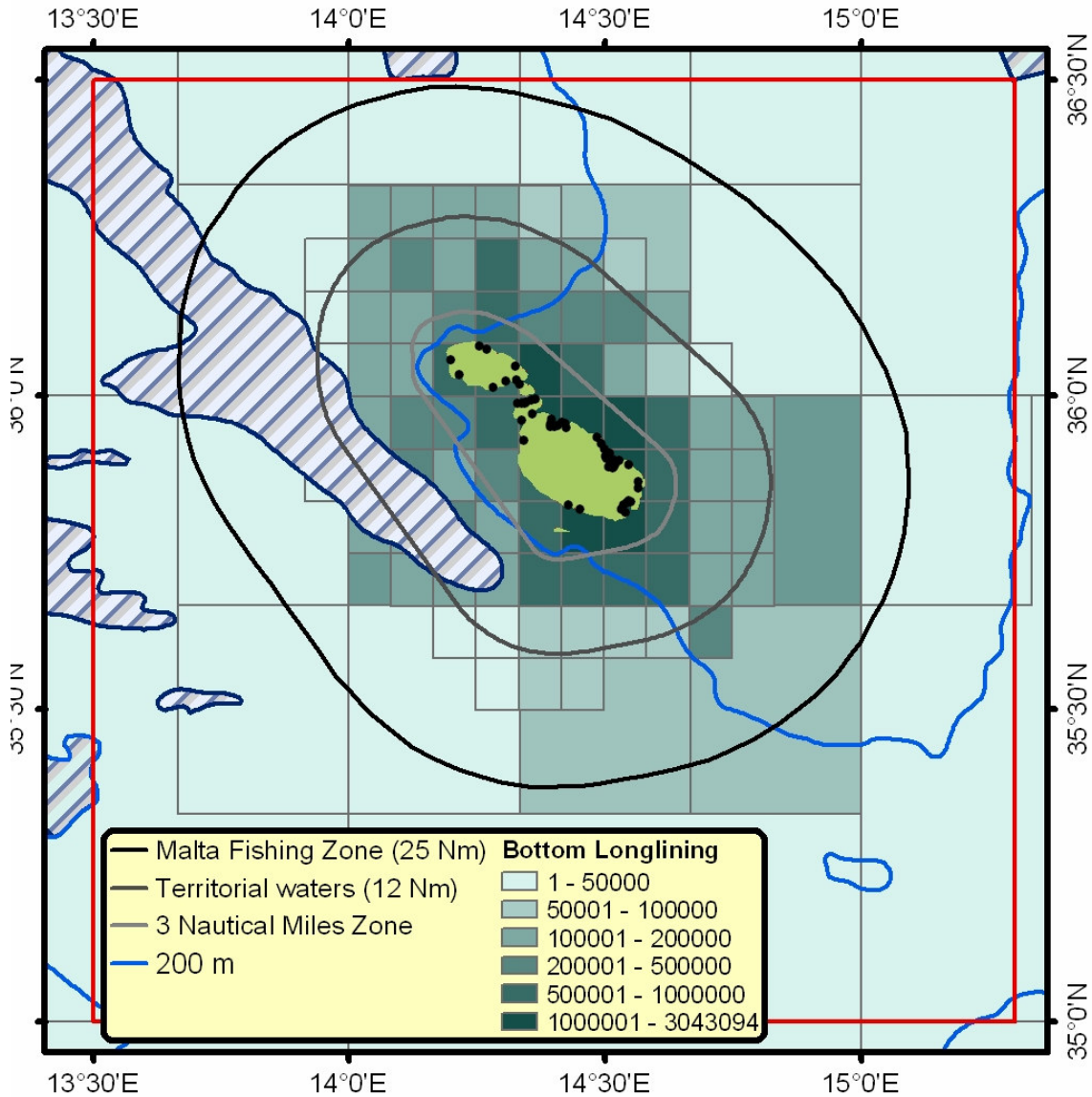


Fig 9. Map showing the fishing effort of the bottom longlining fleet inside the 25 Nautical Mile Zone.

When interpreting this map one must keep in mind certain limitations:

- 1) Data is obtained from a census (the fisherman is giving the data!)
- 2) Number of hooks refers to the total number of hooks at his disposal (this is a maximum figure not necessarily used on every trip.
- 3) Number of trips does not take into account fishing days (some large vessels spend three days at sea casting and retrieving their lines three times).

This last point can create a bias in favour of the smaller vessels operating on a daily basis. To compensate for the fact that the activity of the larger vessels is under represented, when interpreting this map we must take into consideration the following points:

- Fisheries Legislation (as to Fishing Zones for different sized vessels)
- Fleet Data (Length range of Bottom longlining fleet)
- Sample Logbook data to establish ratio No. of hauls per trip (per length class)

This is an image of the Bottom Longlining fishing intensity of a whole year (365days), and as previously explained the effort is not distributed equally all the year round. In fact as explained earlier, this is the main fishing activity during winter.

### 3.3.5 General observations

As is to be expected, the fishing activity is greatest around the coast, particularly in the east/south east of the island, close to the major fishing ports. Intensity decreases gradually as we move to the 5-10 Nm zone. This activity takes place within the 200 metre isobar. On the whole, fishing activity is distributed along the north west axis of the island, with another concentration in the area north west of Gozo. There is another area with considerable effort in the east between the 12Nm Territorial limit, and the 25Nm Fishing Zone demarcation line, this coincides with Hurd Bank.

Table 12: Characterisation of the Bottom longlining main fishing grounds within the 25Nm zone

Zone	Size (Nm)	Description	Depth (metres)	Topog.	Units of Effort		Hooks/ sqKm/day
					per unit area	per day (average)	
M233	5x4	infront of M'Xlokk	<100m	i/shelf	1542085	4225	62
M221	5x4	infront of coastroad 1-2Nm	<100m	i/shelf	1494893	4096	60
M211	5x4	Rdum tal-Madonna - SPB	<30m	i/shelf	1235105	3384	49
G814	5x4	Qala Pnt - Ahrax Pnt	<160m	i/shelf	1083038	2967	43
G743	5x4	N of Marsalforn 5Nm	<270m	slope	950540	2604	38
G742	5x4	N of Marsalforn 10Nm	187*-400m	slope	691190	1894	28
M200	20x16	around Malta approx. 10Nm	<450Nm	sh/slope	607119	1663	24
M122	5x4	SW Gozo 10Nm	1000m	dp slope	333008	912	13
M300	20x16	E/SE Malta 12-25 Nm	200m	o/shelf	122467	336	5
M600	20x16	SE Malta 10-30Nm	200-400m	o/shelf	90704	249	4
M500	20x16	S Malta 10-30Nm	200-400m	o/shelf	50997	140	2

### **3.3.6 Detailed analysis of the Bottom longlining main fishing grounds**

#### M233 – in front of M'Xlokk Harbour

This area lies immediately in front and adjacent to M'Xlokk which is the main fishing port, with the largest number of vessels using it as their base port. Apart from being within easy reach of the port, and thus convenient and economical, it is characterised with having a gentle slope and a small reef (Benghajsja reef) right in the centre. Target species are those associated with coastal waters and inner shelf resources.

#### M221 – in front of coast road

This area lies between the port of St. Paul's Bay (main port in the north of Malta), and Marsamxett and Grand Harbour with their numerous landing points. It is within easy access of the many smaller vessels using these ports as their base port. The topography and resources are similar to those of M233.

#### M211 – Rdum tal-Madonna to St.Paul's Bay

This area encompasses the Project site and so is of particular interest. The bottom is shallow with depth of less than 30 metres. The main attraction is the sandbank Sikka l-Bajda which is popular amongst amateur fishermen (with summer residences in the north of Malta). Species to be found here are restricted to white seabream, pandora, and combers. Small hooks are used to fish these species.

#### G814 – Qala Point to Ahrax Point

This area which lies exactly above the previous one also includes part of the proposed protected area. There is an interesting drop off on the northern edge of Sikka l-Bajda, followed by a slope to 160 metres at the further extremity. These fishing grounds are within easy reach for the smaller vessels which use Mgarr Gozo as their base port. The different depths offer the opportunity to target different species of the inner shelf.

#### G743 – North of Marsalforn

North of Marsalforn, the bottom drops steeply from 50 to 100 metres within one nautical mile of the coast. Within two Nm it reaches a depth of 200 metres, dropping further to 270 metres at the northern rim of this area. Species to be found here are those shelf resources which prefer a slope and include the much sought common sea bream.

#### G742 - North of Marsalforn 10 Nautical miles

The slope of the previous area reaches 400 metres. In the middle of this area there is an elevated area (outcrop/sea mount/plateau) which rises up to 187 metres. These fluctuations in depth are associated with underwater currents, uplifting, increased productivity and aggregations of predatory fish which patrol submarine drop-offs.



#### M200 – around Malta (South east) within a 10 Nautical mile radius

This zone encompasses the island of Malta, and most of the coastal waters (with the exception of the north west coast). Depths vary from the shallow eastern area (50m) linking with Hurd Bank to 400 metres southwest of Filfla. Respondents to the census usually indicate this zone to signify fishing around the coast in a non specific area. Most of these waters lie over the continental shelf.

#### M122 – South west Gozo 10 Nautical miles

In this area, the bottom drops steeply to over 1000 metres. Along this slope one can expect to find deep water fish like hake at up to 750 metres, and blackspot seabream. Six-gilled, and seven-gilled sharks are also caught at these depths with specific longlines (larger hooks).

#### M300 – East southeast Malta 12-25 Nautical miles

This area which lies over Hurd Bank is within easy reach of M'Xlokk. Depths reach 200 metres and the stocks fished here are those typical of the continental shelf.

#### M600 – South east Malta 10-30 Nautical miles

In this area which lies just south of M300, the shelf slopes gradually reaching 400 metres. Consequently one can find species associated with the outer shelf, including the large scaled scorpionfish, and the gulper shark.

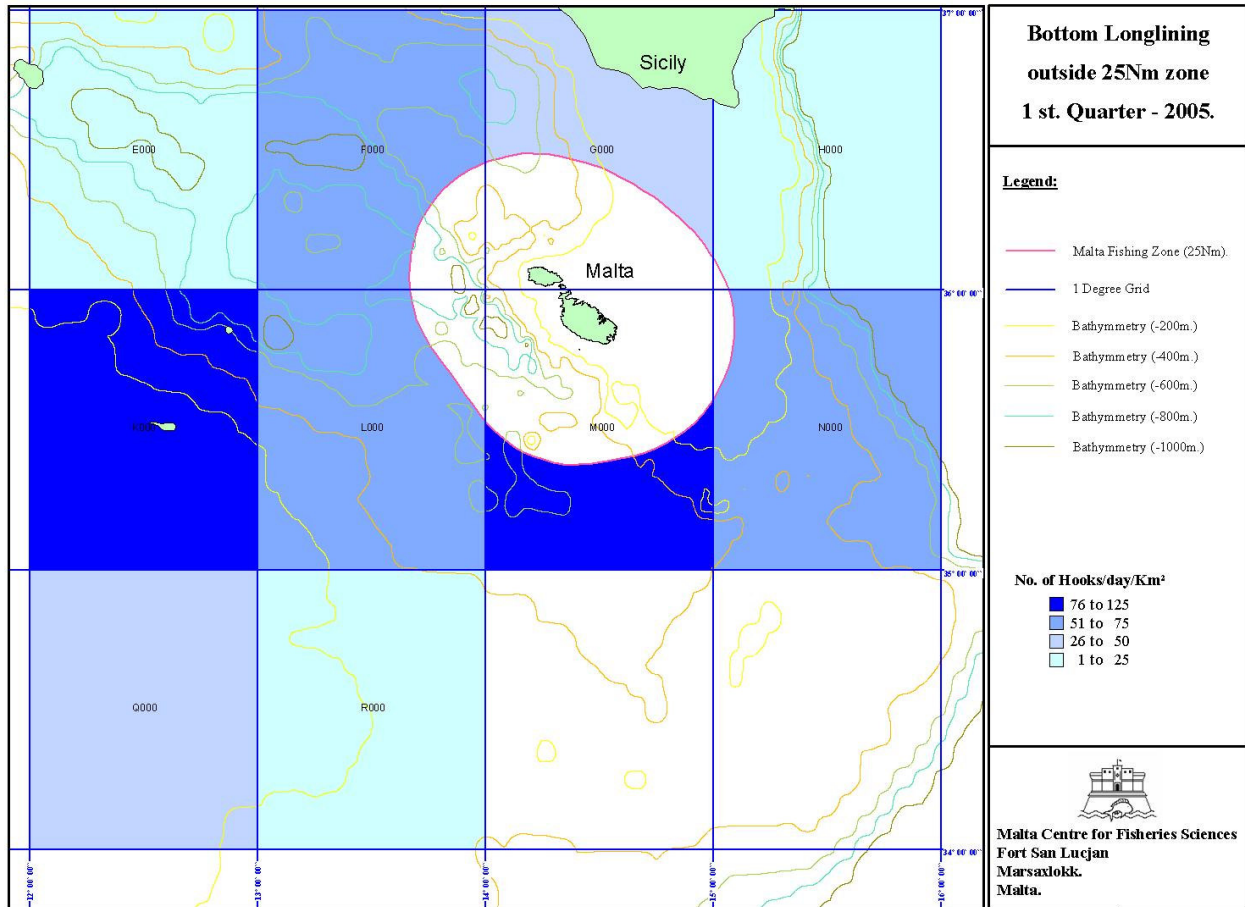
#### M500 - South of Malta 10 -30 Nautical miles

Depth, profile and resources similar to M600.

### **3.3.7 Fishing Grounds outside 25 Nautical mile Zone**

Though in the map above (Bottom Longlining Fishing Activity – Fig. 9), the intensity of fishing in these distant fishing grounds appears less than that of the main fishing grounds described above, if one takes into consideration the limitations and points mentioned above, the picture is slightly different.

Bottom Longlining Fishing Activity outside 25 Nm zone



*Fig 10. Map showing the fishing effort of the bottom longlining fleet outside the 25 Nautical Mile Zone.*

Table 13: Bottom longlining fishing grounds outside 25 Nautical mile Zone

Zone	Description	Distance	Hooks/UA	Units of Effort per day	Hks/dy (1st Quart)	Hks/dy (1st Quart)/sqKm	Hks/dy (1st Quart)/sqKm X no.of hauls
KOOO	l/o Lampedusa	100	15052	41	125	37	110
MOOO	S Malta *		43078	118	359	105	105
LOOO	SW Malta *	50	14782	40	123	36	72
FOOO	NW Gozo *	50	14008	38	117	34	68
NOOO	SE Malta	50	11847	32	99	29	58
GOOO	Channel *		13065	36	109	32	32
QOOO	SW Malta	125	4166	11	35	10	30
ROOO	SW Malta	100	1175	3	10	3	9
HOOO	off SE tip Sicily	50	1119	3	9	3	5
EOOO	up to Pantelleria	100	569	2	5	1	4

The vessels which fish here are those over 12 metres in length (Fisheries Legislation). These are mainly professional full-time fishermen (MFAs) whose fishing activity as spread out throughout the year follows the pattern of seasonality highlighted in the introduction. Thus their fishing trips using bottom longlines are concentrated during the first four months of the year. Thus, the actual hooks per day for this period is greater. Further to this, depending on size of vessel and subsequently distance from port, each trip lasts up to four/five days and lines are shot and retrieved up to three to four times, so effectively number of hooks per day is greater. Looking at the estimated number of hooks per day per square kilometre for this sector of the fleet during this period, the effort is considerable.

Resources are demersal offshore resources corresponding to the bathymetry and topography of these areas. As these areas are approximately 300 square nautical miles (over 1,000 kilometres square), depth and topography varies in the same area and it is not possible to characterize them further.



### 3.3.8 Drifting surface longlines

Note: The same methodology as used in the case of bottom longlining (above) was used to collect, process and analyse data on the fishing grounds and effort of surface longlines.

Whereas swordfish are fished all the year round, the tuna fleet operates from the end of April to mid July.

#### 3.3.8.1 Fishing grounds within 25Nm zone

These are the areas fished by vessels under 12 meters in length. This section of the fleet is targeting mainly swordfish.

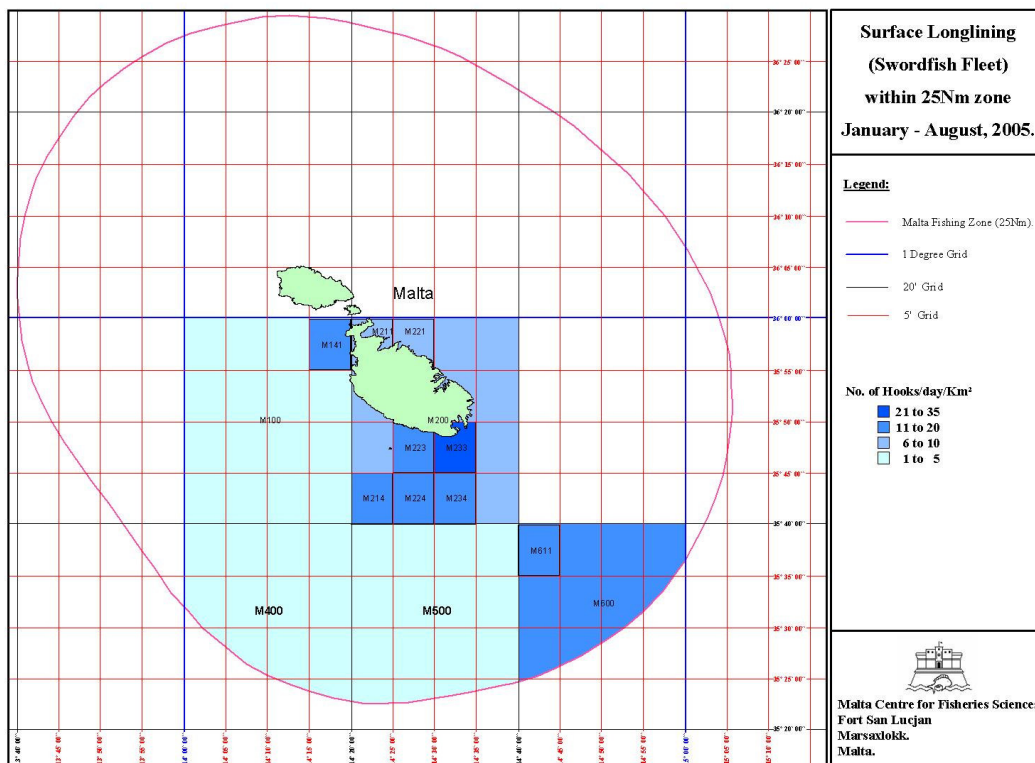


Fig 13. Map showing the fishing effort of the surface longlining fleet inside the 25 Nautical Mile Zone.

Table 14: Hooks/sqKm per day surface longlining within 25Nm

Zone	Size (Nm)	Description	Units of Effort		Hooks/ sqKm/day
			per unit area	per day (average)	
M233	5x4	infront of M'Xlokk	796096	2181	32
M141	5x4	NW Malta	323166	885	13
M224	5x4	S of Wied iz-Zurrieq 8Nm	295796	810	12
M234	5x4	S of M'Xlokk 8Nm	295796	810	12

M223	5x4	Wied iz-Zurrieq -Filfa	292721	802	12
M611	5x4	SE M'Xlokk 12NM	273915	750	11
M600	20x16	SE Malta 10-30Nm	266715	731	11
M214	5x4	S of Fifla	245321	672	10
M221	5x4	infront of coastroad 1-2Nm	228296	625	9
M211	5x4	Rdum tal-Madonna - SPB	203246	557	8
M200	20x16	around Malta approx. 10Nm	133796	367	5
M100	20x16	W of Malta up tp 20Nm	56676	155	2
M400	20x16	SW Malta 10-30Nm	49380	135	2
M500	20x16	S Malta 10-30Nm	49090	134	2

Note: The data used is that of annual activity and thus includes activity during the *lampuki* season when in fact longlining for swordfish is restricted to the swordfish corridor, this creates a positive bias in this area as represented in the map below showing the “swordfish corridor”.

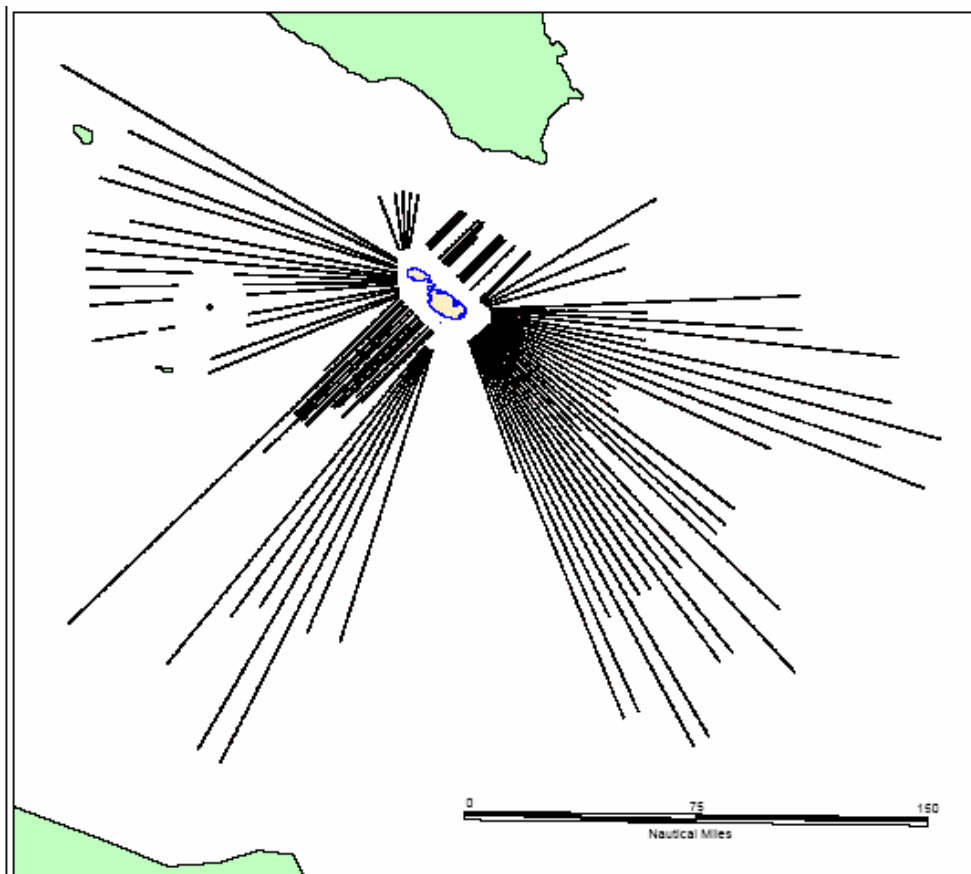


Fig 14. Distribution of FADs and “swordfish corridor” (mid-August to December)

### 3.3.8.2 Fishing Grounds outside 25 Nautical mile Zone

These grounds are fished by vessels over 12 metres in length (due to EU legislation). As the majority of them are targeting different resources at different times of year (see section seasonality) the effort for this gear, in terms of trips and number of hooks is

concentrated during the tuna migration in the central Mediterranean Sea. From the table below it is evident that the greatest fishing activity occurs in the southwest (zone L000 – K000) and south (M000,R000 T000 and S000).

As bluefin tuna is a pelagic species, whose migration pattern is influenced mainly by surface temperature and currents the bottom contours and bathymetry are irrelevant.

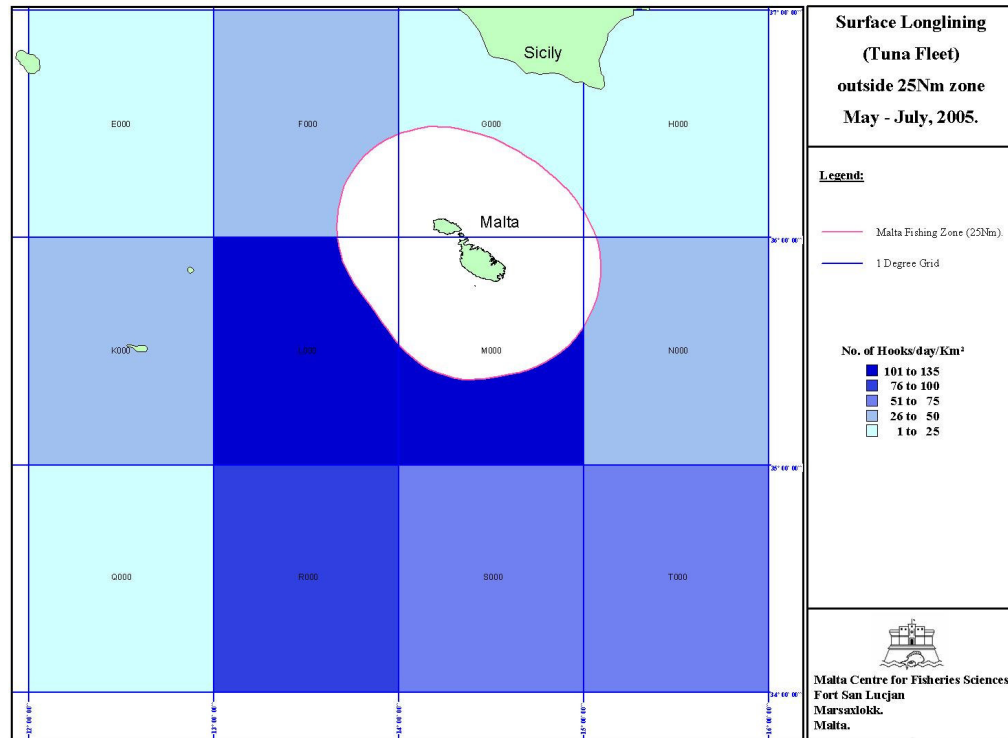


Fig. 15 Map showing the fishing effort of the surface longlining fleet outside the 25 Nautical Mile Zone.

Table 15: Hooks/sqKm per day surface longlining outside 25Nm\_zone May-July

Zone	Description	Distance	Hooks/UA	Units of Effort per day	Hks/dy (May-July)	Hks/dy (May-July)/sqKm	Hks/dy (May-July)/sqKm X no.of hauls
L000	SW Malta *	50	20617	56	229	67	134
M000	S Malta *		33899	93	377	110	110
R000	SW Malta	100	8807	24	98	29	86
T000	SE Malta	100	6604	18	73	21	64
S000	S Malta *	75	6878	19	76	22	56
K000	l/o Lampedusa	100	5056	14	56	16	49
F000	NW Gozo *	50	5388	15	60	17	35
N000	SE Malta	50	4361	12	48	14	28
G000	Channel *		4770	13	53	15	15
Q000	SW Malta	125	556	2	6	2	5
E000	up to Pantelleria	100	392	1	4	1	4
H000	off SE tip Sicily	50	233	1	3	1	2

### 3.3.8.3 Surface longlining for swordfish – *lampuki* season (mid-August to December)

From mid-August to December, the majority of commercial fisherman fish for dolphinfish (*Coryphaena hippurus*) using Fish Aggregating Devices and a special net. This activity is not considered to have any effect on birdlife and therefore for the scope of this report is not considered further. However it is relevant to note that during this period a small number of fishermen continue to target swordfish (with longlines).

So as to avoid conflict between fishermen fishing for *lampuki* and those fishing for swordfish, the laying of surface longlines for swordfish during this period is restricted to the so called “swordfish corridor”, to the south of Malta.

### 3.3.9 Trawling

Trawling in Malta is undertaken both during the day or night for purely operational reasons. Due to the complexity of the local market, trawling is also seasonal, in the sense that certain species fetch good prices at particular periods of the year. In actual fact, three different types of trawling activities are undertaken during the year:

a) Deep sea trawling (during the day) in 600m deep and over, where king prawns (*Aristeomorpha foliacea* and *Aristeus antennatus*) are targeted. When fishing king prawns there is almost no by-catch, except for small marketable by-catches of forkbeard (*Phycis blennoides*), hake (*Merluccius merluccius*) and common sole (*Solea vulgaris*). King prawns are found in depths of over 500 meters throughout the year at all hours of the day since daylight does not penetrate that depth. The trawling grounds are found in an area about eight miles to the North West of Malta. Since the terrain is composed of mud, and free from obstacles, the duration of each trawl is at least 4 hours. Consequently advantage is taken of the long daylight in the summer as at least 3 trawls a day can be undertaken.

b) Trawling in depths of between 150/200 m, (during the day) where the terrain is mainly mud and clay, yields shrimps (*Parapeneus longirostris*), hake (*Merluccius merluccius*), red mullet (*Mullus surmuletus* and *Mullus barbatus*), octopus (*Octopus vulgaris*), Japanese squid (*Todarodes sagittatus*), cuttlefish (*Sepia officinalis*) and marketable by-catches of dogfish, spotted dogfish, skate and rays (*Raja* spp.), bogue (*Boops boops*) and scad (*Trachurus mediterraneus*). These species are fished very close to land (3/4 miles) and the activity is mainly carried out in winter, when the weather does not allow to fish in deeper waters.

c) Trawling at night in depths of between 50 and 150 meters where the bottom is hard and rocky, yields red mullet (*Mullus barbatus*), comber (*Serranus* spp.), Pandora (*Pagellus* spp.), squid, cuttlefish and weaver (*Trachinus* spp.). This type of trawling is undertaken all along the Northern side of the island but the main zone is on and around Hurd Bank where stocks are more abundant. Trawl time can never be longer than one hour, since the



rough terrain will put too much strain on the trawl nets and damage them. This allows for several trawls to be carried out during the dark.

In all cases the nets used are the Mazara type otter trawls which are adjusted according to the type of terrain in which operations are being conducted.

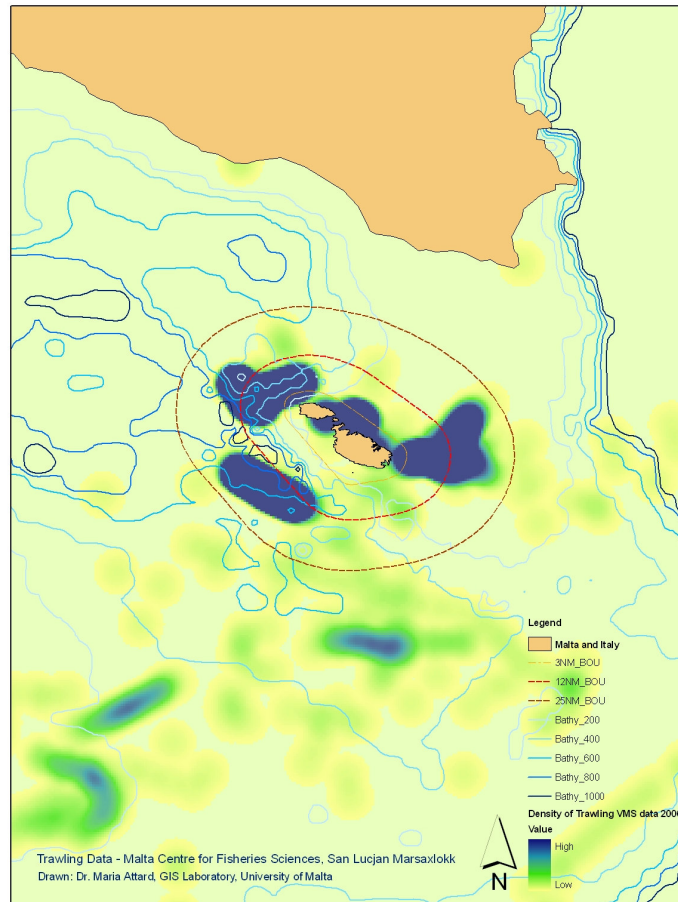


Fig 16. Map showing the trawling effort inside and outside the 25 Nautical Mile Zone.

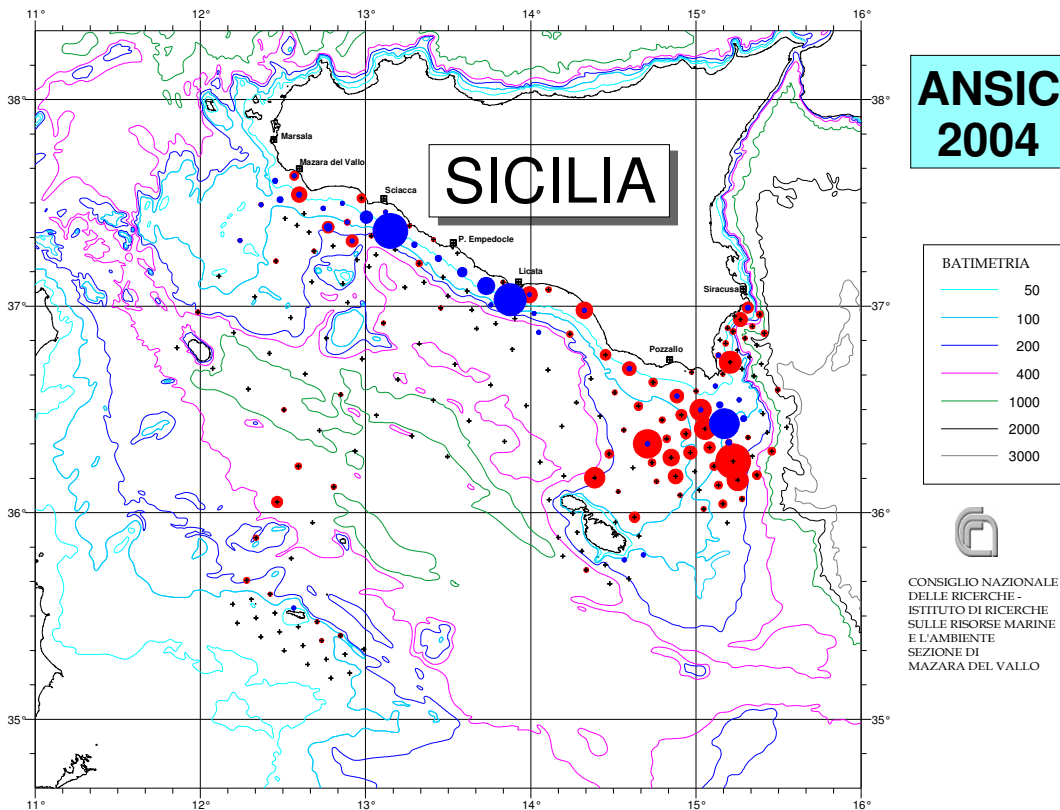
As shown by Fig 16 trawling by the Maltese fleet occurs mostly inside the 25 nautical mile zone, in four distinct areas. The areas on the North-West and South West of Malta are fished for the deep water species (400 -800m), while the area on the North and East are fished for relatively shallow water species (50 – 150m)

### 3.3.10 Fishing for small pelagics

Coastal pelagic fishing in the Maltese Islands has been practiced for a very long time; since at least 1930 when ‘*lampara*’ fishing was first introduced locally. Up to a few years ago the fisheries of small pelagics constituted a very important part of the total national fishing effort when landings of chub mackerel (*Scomber japonicus*), Atlantic mackerel (*Scomber scombrus*), horse mackerel (*Trachurus trachurus*), scad (*Trachurus*

*mediterraneus*), bogue (*Boops boops*), allice shad (*Alosa alosa*), pilchard (*Sardina pilchardus*) and anchovy (*Engraulis encrasicolus*) were quite abundant and used to constitute 30% of the total fishing effort. However, since the 60's the effort became minimal and subsequent catches are insignificant. The main importance of sardines and anchovy in particular was because they were bought by fishermen to use as bait. Also, before the advent of large scale targeting of swordfish and tuna and the introduction of demersal species such as hake and red mullet on a large scale, the local market used to absorb all the catches, especially chub mackerel, which was then, along with the dolphin fish, one of the most sought after species.

At present only six purse seiners based in Marsaxlokk (Malta) and Mgarr (Gozo) partake in this fishery with the main targeted species being the chub mackerel which is still marketable to a certain degree. Anchovy and sardines are fished with "lampara" seines. The term "lampara" is used because fishermen use strong lights to attract fish, which are then caught by purse seining. The boats used for this fishery are in the 10-15 meters length category. The purse seine is between 400 to 450 meters long and about 105 meters high. "Lampara" fishing takes place all along the North side of the island but the main zone is around a shallow area covering about 5 square miles, known as Hurd bank. The depth is between 35 and 44 meters with the intermediate area descending to a maximum of 100 meters. "Lampara" fishing is undertaken throughout the year except for the period from September to December when these boats target the dolphin fish.



Blue circles: anchovy egg density. Maximum value: 392.6 eggs m<sup>-2</sup>.  
 Red circles: anchovy larval density. Maximum value: 68.6 eggs m<sup>-2</sup>.

Fig 17. Map showing the distribution of the anchovy egg and larval density.

## 4. Summary and conclusions

### 4.1 *Main fishing grounds as identified by the activity of the fleet*

From the analysis carried out it results that the main fishing grounds as defined by intensity of activity in terms of “Hooks/Square Km/day” are on the high seas in international waters.

Namely and in sequence of most fished are:

- 1) The waters up to 100 Nautical miles to the south, and south west of the island which are fished for tuna from May to mid July (See Fig. 15, pg. 28).
- 2) These same waters, including areas more to the west are also heavily fished by bottom longliners during the first quarter (See Fig. 10, pg. 23).
- 3) Bottom longlining activity in coastal waters, on an annual basis is greatest in the east south-east of the island (See Fig. 9, pg. 19).
- 4) There is also a significant (but to a lesser degree) amount of bottom longlining in the coastal waters to the east north-east of Malta (See Fig. 9, pg. 19).
- 5) Trawling occurs mostly in four areas with two distinct depth ranges (See Fig. 16, pg. 30).

### 4.2 *Possible impacts of the fishing activity on the bird populations.*

- Though the actual impact of longlining on bird populations still has to be assessed, as the most fished areas (1 and 2 above) are very distant from the project area, it might be safe to assume that this impact is minimal.
- Again area 3) is not within the immediate vicinity of the *P. yelkouan* nesting area.
- As the fishing grounds in area 4) lies adjacent to and in close proximity to Rđum tal-Madonna, though the actual fishing intensity is not great, and the hook size used is small, the impact of this activity on *P. yelkouan* should be investigated further.

- As one of the trawling grounds lies close to Rdum tal-Madonna the discards generated from these grounds may be important as a food source for the shearwater colony.

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# Annex I

## Total annual landings for 2005

English Name	Scientific Name	January	February	March	April	May	June	July	August	September	October	November	December	Total
Dolphin Fish	<i>Coryphaena hippurus</i>	10060	0	0	24	143	1593	778	119601	180951	64933	7302	61710	447095
Swordfish	<i>Xiphias gladius</i>	5301	1995	948	7544	21576	34593	44709	52908	43499	43226	60014	7001	323314
Blue Fin Tuna*	<i>Thunnus thynnus*</i>	0	0	0	3024	192498	75108	30603	210	0	0	0	0	301443
Shrimps/Prawns	<i>Pandalus</i> spp.	887	637	3416	3269	3033	3633	3685	3434	2855	2768	2379	150	30146
Bogue	<i>Boops boops</i>	1143	603	1795	564	1755	3782	3978	1605	814	1222	2915	912	21088
Dog Fish	<i>Squalus acanthias</i>	1285	2248	4106	2914	1887	836	957	522	1632	919	1023	281	18610
Stone Bass	<i>Epinephelus aeneus</i>	456	576	2262	3824	2464	1311	2894	1067	1182	598	136	235	17005
Other species		0	0	543	348	1294	814	624	9325	856	659	588	289	15340
Albacore	<i>Thunnus alalunga</i>	0	0	2	0	46	1160	5758	7442	152	0	5	0	14565
Mackerel	<i>Scomber japonicus</i>	0	0	2668	208	1538	102	2811	1362	90	491	1630	1243	12143
Large Scale Scorpion Fish	<i>Scorpaena scrofa</i>	383	74	1212	675	1704	2336	1485	1670	912	980	454	98	11983
Pilot Fish	<i>Naucrates ductor</i>	29	0	0	0	0	0	0	655	4432	3692	1082	208	10098
Wreckfish	<i>Polyprion americanus</i>	0	683	201	0	1860	3514	762	30	9	36	47	23	7165
Hake	<i>Merluccius merluccius</i>	0	0	1014	362	1102	547	1078	481	909	781	567	26	6867
Octopus	<i>Octopus vulgaris</i>	155	192	307	492	992	652	1056	645	648	923	515	227	6804
Skate	<i>Raja</i> spp.	0	247	1751	1225	877	172	260	256	708	155	375	471	6497
Scorpion Fish	<i>Scorpaena</i> spp.	103	100	802	504	818	699	948	553	361	295	394	456	6033
Common Sea Bream	<i>Pagrus pagrus</i>	60	241	1421	1024	606	899	728	108	130	101	450	81	5849
Amberjack	<i>Seriola dumerili</i>	5	189	273	95	491	978	187	242	1699	495	270	170	5094
Squid	<i>Loligo vulgaris</i>	161	186	479	536	373	0	98	762	570	314	368	569	4416
Frigate Mackerel	<i>Auxis thazard</i>	65	2594	372	1211	60	0	0	0	11	20	0	40	4373
Blue Fin Tuna juv.	<i>Thunnus thynnus</i>	0	0	0	0	0	0	0	0	2510	1348	149	77	4084
Horse Mackerel	<i>Trachurus mediterraneus</i>	0	0	162	451	683	1029	484	409	150	79	157	197	3801
Cuttle Fish	<i>Sepia officinalis</i>	0	81	377	273	474	27	150	504	431	861	166	163	3507
Six-Gilled Shark	<i>Hexanchus griseus</i>	0	0	1268	438	422	127	436	94	157	91	420	31	3484
Red Mullett	<i>Mullus</i> spp.	181	0	112	141	263	29	506	348	992	249	206	155	3182

English Name	Scientific Name	January	February	March	April	May	June	July	August	September	October	November	December	Total
White Bream	<i>Diplodus sargus</i>	230	272	212	157	164	148	160	284	196	94	217	361	2495
Scourer	<i>Ruvettus pretiosus</i>	140	0	0	0	335	671	314	192	468	329	0	0	2449
Ling	<i>Molva molva</i>	0	80	374	279	451	242	284	199	128	165	91	0	2293
Conger	<i>Conger conger</i>	35	128	1050	240	240	85	146	44	20	123	108	8	2227
Pellucid Sole	<i>Aphia minuta</i>	0	0	122	88	594	1030	280	95	0	0	0	0	2209
Barracuda	<i>Sphyraena sphyraena</i>	44	75	206	67	559	550	399	96	43	5	28	51	2123
Blue-Spotted Bream	<i>Pagellus acarne</i>	30	183	206	61	278	78	189	274	386	160	84	0	1929
Spotted Weaver	<i>Trachinus draco</i>	0	0	124	626	107	49	97	122	83	644	48	0	1900
Comber	<i>Serranus cabrilla</i>	0	0	181	171	345	40	6	149	507	125	0	0	1524
Moray Eels	<i>Muraena helena</i>	0	50	166	200	142	147	8	594	118	5	71	16	1517
Pandora	<i>Pagellus erythrinus</i>	0	10	276	177	136	95	189	212	183	73	62	55	1468
Dentex	<i>Dentex dentex</i>	73	220	111	22	181	77	34	65	127	131	168	181	1390
Little Tunny	<i>Euthynnus alletteratus</i>	210	0	243	67	22	29	26	4	0	122	407	205	1335
Gurnard	<i>Trigla</i> spp.	15	38	185	77	266	259	16	24	26	26	82	46	1060
Atlantic Bonito	<i>Sarda sarda</i>	230	75	48	120	207	64	83	95	10	0	27	86	1045
Small Spotted Dog Fish	<i>Scyliorhinus canicula</i>	0	108	157	170	188	57	81	12	36	90	82	15	996
Spear-Fish	<i>Tetrapturus belone</i>	0	0	0	0	166	279	332	94	0	19	33	49	972
Allice Shad	<i>Alosa alosa</i>	0	0	138	18	102	25	465	219	0	0	0	0	967
Saddled Bream	<i>Oblada melanura</i>	68	83	73	67	146	146	83	128	22	8	9	86	919
Salema	<i>Sarpa salpa</i>	0	0	52	32	397	102	62	113	56	25	44	12	895
Picarel	<i>Spicara</i> spp.	0	0	130	744	12	0	0	0	0	0	0	0	886
Amberjack juv.	<i>Seriola dumerili</i>	0	0	0	0	0	0	0	0	92	648	0	0	740
Angler Fish	<i>Lophius piscatorius</i>	0	0	50	91	179	38	139	75	95	0	41	0	708
Gouper	<i>Epinephelus</i> spp.	0	0	108	44	94	78	111	87	47	53	27	25	674
Picarel	<i>Spicara</i> spp.	0	0	467	110	9	0	0	0	31	33	0	0	650
Squid	<i>Todarodes sagittatus</i>	0	0	78	51	81	17	25	72	108	98	108	8	646
John Dory	<i>Zeus faber</i>	0	0	0	21	4	2	187	6	2	357	54	0	633
Porbeagle Shark	<i>Lamna nasus</i>	0	100	0	122	182	145	50	0	0	0	0	9	608
Rough Shark	<i>Centrophorus granulosus</i>	0	0	283	0	10	56	150	0	0	7	22	0	528
Long Nose Skate	<i>Raja oxyrinchus</i>	0	34	50	39	164	63	91	11	8	8	35	0	503
Blue Shark	<i>Prionace glauca</i>	0	0	0	0	242	155	34	34	0	14	0	0	479

English Name	Scientific Name	January	February	March	April	May	June	July	August	September	October	November	December	Total
Mixed fish		0	99	12	16	8	0	24	60	86	88	6	45	444
Common Sting Ray	<i>Dasyatis pastinaca</i>	0	0	34	75	31	41	61	111	30	19	22	12	436
Scabbardfish	<i>Lepidopus caudatus</i>	0	0	66	28	186	26	2	15	0	24	54	4	405
Damsel Fish	<i>Chromis chromis</i>	0	0	0	4	0	0	314	0	41	9	0	0	368
Thresher Shark	<i>Hymenocephalus italicus</i>	0	0	0	100	25	60	0	0	0	0	0	154	339
Two-banded seabream	<i>Diplodus vulgaris</i>	0	0	27	23	9	9	202	4	22	11	5	8	320
Gilthead Bream	<i>Sparus aurata</i>	0	50	82	17	0	0	5	0	0	8	2	72	236
Crayfish	<i>Homarus spp.</i>	0	0	9	113	49	25	5	2	11	1	8	1	224
Angel Fish	<i>Squatina squatina</i>	0	0	0	77	73	0	4	6	6	36	0	0	202
Grey Mullet	<i>Mugil spp.</i>	0	67	17	62	6	18	12	0	9	0	2	8	201
Blotched Picarel	<i>Spicara maena</i>	0	0	0	0	105	71	0	0	0	0	0	0	176
European Sea Bass	<i>Dicentrarchus labrax</i>	0	55	76	0	6	0	0	7	0	0	0	0	144
Med. Locust Lobster	<i>Scyllarides latus</i>	0	0	0	3	2	50	18	8	1	0	3	29	114
Spotted Dog Fish	<i>Scyliorhinus spp.</i>	0	0	67	4	0	0	12	0	4	0	8	0	95
Tope	<i>Galeorhinus galeus</i>	0	0	0	0	0	0	0	0	0	0	38	0	38
Brown Wrasse	<i>Labrus merula</i>	0	0	0	0	0	0	21	0	0	0	0	0	21
Star Gazer	<i>Uranoscopus scaber</i>	0	0	0	6	0	2	0	0	0	4	0	0	12
Annular Seabream	<i>Diplodus annularis</i>	0	0	6	0	4	0	0	0	0	0	0	0	10
White Skate	<i>Raja alba</i>	0	0	0	0	0	0	0	0	0	9	0	0	9
		<b>21,349</b>	<b>12,373</b>	<b>30,977</b>	<b>33,535</b>	<b>243,466</b>	<b>138,970</b>	<b>109,696</b>	<b>207,746</b>	<b>249,662</b>	<b>128,807</b>	<b>83,608</b>	<b>76,359</b>	<b>1,336,548</b>

\* gilled and gutted



## Annex II

### List of species caught during trawling operations in the Maltese islands

Taxonomic group	Target/bycatch	Commercial	Discarded Yes/No	Comment
<b>Elasmobranchs</b>				
<i>Centrophorus granulosus</i>	Bycatch	Yes	Yes/No	1
<i>Chimaera monstrosa</i>	Bycatch	No	Yes	
<i>Dalatias licha</i>	Bycatch	No	Yes	
<i>Dasyatis pastinaca</i>	Bycatch	Yes	Yes	2
<i>Etmopterus spinax</i>	Bycatch	No	Yes	
<i>Galeus melastomus</i>	Bycatch	Yes	Yes/No	3
<i>Heptranchias perlo</i>	Bycatch	Yes	Yes/No	1
<i>Hexanchus griseus</i>	Bycatch	Yes	Yes	4
<i>Mustelus asterias</i>	Bycatch	Yes	Yes/No	4
<i>Mustelus mustelus</i>	Bycatch	Yes	Yes/No	4
<i>Myliobatis aquila</i>	Bycatch	No	Yes	
<i>Oxynotus centrina</i>	Bycatch	No	Yes	
<i>Raja circularis</i>	Bycatch	Yes	Yes/No	4
<i>Raja clavata</i>	Bycatch	Yes	Yes/No	2
<i>Raja melitensis</i>	Bycatch	Yes	Yes/No	4
<i>Raja miraletus</i>	Bycatch	Yes	Yes/No	4
<i>Raja oxyrinchus</i>	Bycatch	Yes	Yes/No	4
<i>Raja radula</i>	Bycatch	Yes	Yes/No	4
<i>Scyliorhinus canicula</i>	Bycatch	Yes	Yes/No	4
<i>Scyliorhinus stellaris</i>	Bycatch	Yes	Yes/No	4
<i>Squalus blainvillei</i>	Bycatch	Yes	Yes/No	4
<i>Torpedo marmorata</i>	Bycatch	No	Yes	
<b>Teleosts</b>				
<i>Acantholabrus palloni</i>	Bycatch	No	Yes	
<i>Argentina sphyraena</i>	Bycatch	Yes	Yes/No	2
<i>Arnoglossus laterna</i>	Bycatch	Yes	Yes/No	4
<i>Arnoglossus rueppelli</i>	Bycatch	Yes	Yes/No	4
<i>Aspitrigla cuculus</i>	Bycatch	Yes	Yes/No	4
<i>Bathypterois mediterraneus</i>	Bycatch	No	Yes	
<i>Blennius ocellaris</i>	Bycatch	No	Yes	
<i>Boops boops</i>	Bycatch	Yes	No	
<i>Caelorhynchus caelorhynchus</i>	Bycatch	No	Yes	
<i>Capros aper</i>	Bycatch	No	Yes	5
<i>Centrolophus niger</i>	Bycatch	No	Yes	
<i>Cepola macrophthalmia</i>	Bycatch	No	Yes	
<i>Chelidonichthys gurnardus</i>	Bycatch	Yes	Yes/No	6
<i>Chelidonichthys lastoviza</i>	Bycatch	Yes	Yes/No	6
<i>Chlorophthalmus agassizi</i>	Bycatch	No	Yes	5
<i>Citharus linguatula</i>	Bycatch	Yes	No	

<i>Conger conger</i>	Bycatch	Yes	No	
<i>Coris julis</i>	Bycatch	No	Yes	
<i>Dactylopterus volitans</i>	Bycatch	Yes	No	
<i>Deltentosteus quadrimaculatus</i>	Bycatch	No	Yes	
<i>Dentex macrophthalmus</i>	Bycatch	Yes	No	
<i>Engraulis encrasicolus</i>	Bycatch	Yes	Yes/No	
<i>Epigonus telescopus</i>	Bycatch	No	Yes	
<i>Epinephelus aeneus</i>	Bycatch	Yes	No	
<i>Gadiculus argenteus</i>	Bycatch	Yes	Yes/No	3
<i>Glossanodon leioglossus</i>	Bycatch	No	Yes	
<i>Gnathophis mistax</i>	Bycatch	No	Yes	
<i>Helicolenus dactylopterus dactylopterus</i>	Bycatch	Yes	No	6
<i>Hoplostethus mediterraneus</i>	Bycatch	No	Yes	
<i>Hymenocephalus italicus</i>	Bycatch	No	Yes	
<i>Lampanyctus crocodilus</i>	Bycatch	No	Yes	
<i>Lepidopus caudatus</i>	Bycatch	Yes	Yes/No	4
<i>Lepidorhombus boscii</i>	Bycatch	Yes	No	
<i>Lepidorhombus whiffjagonis</i>	Bycatch	Yes	No	
<i>Lepidotrigla cavillone</i>	Bycatch	Yes	No	
<i>Lophius budegassa</i>	Bycatch	Yes	No	
<i>Lophius piscatorius</i>	Bycatch	Yes	No	
<i>Macrorhamphosus scolopax</i>	Bycatch	No	Yes	5
<i>Merluccius merluccius</i>	Bycatch	Yes	No	6
<i>Microchirus ocellatus</i>	Bycatch	Yes	No	6
<i>Micromesistius poutassou</i>	Bycatch	Yes	No	
<i>Molva dipterygia</i>	Bycatch	Yes	No	
<i>Mora moro</i>	Bycatch	Yes	No	
<i>Mullus barbatus</i>	Target	Yes	No	
<i>Mullus surmuletus</i>	Target	Yes	No	
<i>Myctophidae spp</i>	Bycatch	No	Yes	
<i>Nettastoma melanurum</i>	Bycatch	No	Yes	
<i>Nezumia sclerorhynchus</i>	Bycatch	No	Yes	
<i>Notacanthus bonaparte</i>	Bycatch	No	Yes	
<i>Pagellus acarne</i>	Bycatch	Yes	No	
<i>Pagellus bogaraveo</i>	Bycatch	Yes	No	
<i>Pagellus erythrinus</i>	Bycatch	Yes	No	
<i>Pagrus pagrus</i>	Bycatch	Yes	No	
<i>Peristedion cataphractum</i>	Bycatch	Yes/No	Yes/No	4
<i>Phycis blennoides</i>	Bycatch	Yes	No	
<i>Sardina pilchardus</i>	Bycatch	Yes	No	
<i>Sardinella aurita</i>	Bycatch	Yes	Yes/No	3
<i>Scorpaena elongata</i>	Bycatch	Yes	No	
<i>Scorpaena notata</i>	Bycatch	Yes	No	
<i>Scorpaena scrofa</i>	Bycatch	Yes	No	
<i>Serranus cabrilla</i>	Bycatch	Yes	No	
<i>Serranus hepatus</i>	Bycatch	Yes	No	
<i>Sphoeroides pachygaster</i>	Bycatch	No	Yes	
<i>Spicara flexuosa</i>	Bycatch	Yes	No	
<i>Spicara smaris</i>	Bycatch	Yes	No	

<i>Stomias boa</i>	Bycatch	No	Yes	
<i>Symphurus nigrescens</i>	Bycatch	No	Yes	
<i>Synchiropus phaeton</i>	Bycatch	No	Yes	
<i>Syngnathus acus</i>	Bycatch	No	Yes	
<i>Synodus saurus</i>	Bycatch	Yes/No	Yes/No	3
<i>Trachinus draco</i>	Bycatch	Yes	No	
<i>Trachinus radiatus</i>	Bycatch	Yes	No	
<i>Trachurus mediterraneus</i>	Bycatch	Yes	No	
<i>Trachurus picturatus</i>	Bycatch	Yes	No	
<i>Trachurus trachurus</i>	Bycatch	Yes	No	
<i>Trigla lyra</i>	Bycatch	Yes	No	
<i>Trisopterus minutus capellanus</i>	Bycatch	Yes	No	
<i>Uranoscopus scaber</i>	Bycatch	Yes	No	
<i>Zeus faber</i>	Bycatch	Yes	No	
<b>Decapoda</b>				
<i>Aristaeomorpha foliacea</i>	Target	Yes	No	
<i>Aristeus antennatus</i>	Target	Yes	No	
<i>Bathynectes maravigna</i>	Bycatch	No	Yes	
<i>Calappa granulata</i>	Bycatch	Yes	Yes	
<i>Chlorotocus crassicornis</i>	Bycatch	Yes	No	
<i>Dardanus arrosor</i>	Bycatch	No	Yes	
<i>Funchalia villosa</i>	Bycatch	No	Yes	
<i>Geryon longipes</i>	Bycatch	No	Yes	
<i>Goneplax rhomboides</i>	Bycatch	No	Yes	
<i>Homola barbata</i>	Bycatch	No	Yes	
<i>Latreillia elegans</i>	Bycatch	No	Yes	
<i>Liocarcinus depurator</i>	Bycatch	No	Yes	
<i>Medorippe lanata</i>	Bycatch	No	Yes	
<i>Munida intermedia</i>	Bycatch	No	Yes	
<i>Nephrops norvegicus</i>	Target	Yes	No	
<i>Parapenaeus longirostris</i>	Target	Yes	No	
<i>Parmola cuvieri</i>	Bycatch	No	Yes	
<i>Parthenope macrochelos</i>	Bycatch	No	Yes	
<i>Pasiphaea sivado</i>	Bycatch	Yes	No	
<i>Plesionika edwardsii</i>	Bycatch	Yes	No	
<i>Plesionika heterocarpus</i>	Bycatch	Yes	No	
<i>Plesionika martia</i>	Bycatch	Yes	No	
<i>Polycheles typhlops</i>	Bycatch	No	Yes	
<i>Sergestes corniculum</i>	Bycatch	Yes	No	
<b>Mollusca</b>				
<b>Cephalopoda</b>				
<i>Abralia veraniji</i>	Bycatch	No	Yes	
<i>Alloteuthis media</i>	Bycatch	No	Yes	
<i>Alloteuthis subulata</i>	Bycatch	No	Yes	
<i>Bathypolypus sponsalis</i>	Bycatch	No	Yes	
<i>Eledone cirrhosa</i>	Bycatch	Yes	No	

<i>Eledone moschata</i>	Bycatch	Yes	No	
<i>Histioteuthis bonnellii</i>	Bycatch	No	Yes	
<i>Illex coindetii</i>	Bycatch	Yes	No	
<i>Loligo forbesi</i>	Bycatch	Yes	No	
<i>Neorossia caroli</i>	Bycatch	No	Yes	
<i>Octopus salutii</i>	Bycatch	Yes	No	
<i>Octopus vulgaris</i>	Bycatch	Yes	No	
<i>Pteroctopus tetracirrhus</i>	Bycatch	No	Yes	
<i>Rossia macrosoma</i>	Bycatch	No	Yes	
<i>Scaevurgus unicolor</i>	Bycatch	No	Yes	
<i>Sepia elegans</i>	Bycatch	Yes	No	
<i>Sepia orbignyana</i>	Bycatch	No	Yes	
<i>Sepia officinalis</i>	Bycatch	Yes	No	
<i>Sepiola spp</i>	Bycatch	Yes	No	
<i>Todarodes sagittatus</i>	Bycatch	Yes	No	
<i>Todaropsis eblanae</i>	Bycatch	Yes	No	
<b>Bivalvia</b>				
<i>Adissonia eccentrica</i>	Bycatch	No	Yes	
<i>Neopycnodonte choclear</i>	Bycatch	No	Yes	
<i>Tethys fimbria</i>	Bycatch	No	Yes	
<b>Gastropoda</b>				
<i>Anomia ephippium</i>	Bycatch	No	Yes	
<i>Aperiovula adriatica</i>	Bycatch	No	Yes	
<i>Calyptrea chinensis</i>	Bycatch	No	Yes	
<i>Capulus ungaricus</i>	Bycatch	No	Yes	
<i>Cassidaria echinophora</i>	Bycatch	No	Yes	
<b>Anthozoa</b>				
Alcyonacea sp.	Bycatch	No	Yes	
<i>Actinauge richardi</i> (cf.)	Bycatch	No	Yes	
<i>Caryophyllia smithii</i>	Bycatch	No	Yes	
<i>Funiculina quadrangularis</i>	Bycatch	No	Yes	
<i>Pennatula rubra</i>	Bycatch	No	Yes	
<b>Ascidia</b>				
<i>Ascidia spp.</i>	Bycatch	No	No	
<b>Echinodermata</b>				
<i>Antedon mediterranea</i>	Bycatch	No	Yes	
<i>Astropecten irregularis pentacanthus</i>	Bycatch	No	Yes	
<i>Brisingella coronata</i>	Bycatch	No	Yes	
<i>Centrostephanus longispinus</i>	Bycatch	No	Yes	
<i>Cidaris cidaris</i>	Bycatch	No	Yes	
<i>Echinus sp.</i>	Bycatch	No	Yes	

<i>Hacelia attenuata</i>	Bycatch	No	Yes	
<i>Leptometra phalangium</i>	Bycatch	No	Yes	
<i>Spatangus purpureus</i>	Bycatch	No	Yes	
<i>Spharecinus granularis</i>	Bycatch	Yes	Yes	
<i>Stichopus regalis</i>	Bycatch	Yes	Yes	
<i>Tethyaster subinermis</i>	Bycatch	No	Yes	

**Comments:**

1. Large specimens may be retained
2. Retained in other fisheries
3. May be retained subject to freezer capacity
4. All of the above
5. In large quantities
6. Undersize specimens of most species are discarded