MALTESE FISHERIES AND THE SUSTAINABILITY OF RESOURCES AROUND THE MALTESE ISLANDS

by

MATTHEW CAMILLERI

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ABSTRACT

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MATTHEW CAMILLERI

Despite the socio-cultural importance of Maltese fisheries, a very limited number of studies and reports on the industry have been published, and scientific studies on the interaction between the Maltese fishing fleet and the fisheries resources exploited have never been carried out. Data collection schemes to monitor Maltese fisheries were also found to be extremely limited, however, this study has analysed the information arising from recently initiated data collection programmes, coordinated by the author, related to the fleet, its activities and the resources exploited; these programmes were namely a fishing fleet census, catch and effort sampling schemes and trawl surveys.

This study has described the profile of the Maltese fishing fleet and its activities, determined the relative importance of different fisheries, estimated the spatial distribution of fishing effort, addressed the impact of the fishing operations of the Maltese fleet on the demersal fisheries resources within the Maltese Exclusive Fishing Zone (EFZ) and other resources targeted by the fleet, as well as discussed the impact of an increase in fishing activities on the Maltese population involved in the fishing industry. On the basis of the results a theoretical management regime was proposed to ensure the sustainability of Maltese fisheries compliant with the Ecosystem Approach to Fisheries.

The study concludes that both the introduction of industrial fishing methods and any further increase in artisanal fishing would have negative impacts on the Maltese population involved in the fishing industry which is economically, geographically and culturally dependent on artisanal fisheries. In particular, the fishing capacity and related effort associated with demersal fisheries in the Maltese EFZ should not be increased in order to ensure their sustainability and the fishing effort distribution should not be altered, especially in the case of trawling, in order to safeguard the fish "refugia" which exist in the EFZ. On the other hand, the sustainability of large pelagic species in the waters around Malta largely depends on international efforts to manage these fish stocks, and in view of the fact that they account for more than two thirds of the annual value of landings, it is in the country's interest to collaborate and contribute to the regional management process.

The proposed management regime essentially limits the fishing capacity and effort of various fisheries, protects fish refugia and safeguards artisanal fisheries. With these management proposals in place, the Maltese EFZ could, in essence, constitute a large Marine Protected Area (MPA) with sustainable use objectives.

Also, a number of complimentary recommendations for future fishery and biological data collection programmes and studies have been made. The need for support from the Food and Agriculture Organization of the United Nations and the European Union together with the importance of collaboration with scientific institutions from neighbouring countries in order to realistically undertake these tasks within the next ten years was also highlighted.

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AUTHOR'S DECLARATION

At no time during the registration for the degree of Doctor of Philosophy has the author been registered for any other University award without prior agreement of the Graduate Committee.

International scientific seminars and conferences were regularly attended at which work was often presented; some relevant reports and papers have been annexed (annexes X – XV) to this thesis and referred to in various sections of the main body.

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Date....28th March 2005....................................

Chapter 1. Introduction

1.1 Background

Maltese fisheries are of a typically Mediterranean artisanal[1] type which are not species selective and are frequently described as multi-species and multi-gear fisheries, with fishermen switching from one gear to another several times throughout the year. The social and cultural importance of the Maltese fishing industry far outweighs its negligible economic contribution which is $3.47 million equivalent to less than 0.1 percent of the national Gross Domestic Product (MRAE, 2004). The livelihood of most of the local fishermen depends on the sale of highly prized species which are available to the consumer as fresh fish of highest quality caught by traditional artisanal methods during very short fishing trips. The variety and quality of these fish species also give a significant contribution to the important tourism industry since local restaurants boast of high quality seafood which is a significant attraction, along with the colourful traditional fishing vessels (Plate 1.1), to the tourists visiting Malta. It is also worth mentioning that the front cover of several holiday brochures and tourist guides depict Maltese fishing boats.

Despite the general interest in Maltese fisheries, a very limited number of studies and reports on the industry have been published (Department of Fisheries, 1934; Farrugia Randon, 1995). In addition, the interaction between the Maltese fishing fleet and the fisheries resources exploited has never been studied and assessed, at least in any scientific detail, apart from a trawling feasibility survey carried out in collaboration with the Food and Agriculture Organization (FAO) in 1978 (Giudicelli, 1978), which gave production estimates of demersal fisheries. The only relevant data gathered on fisheries resources are

[1] Artisanal fisheries in the Mediterranean context are defined as "Traditional fisheries involving fishing households (as opposed to commercial companies), using relatively small capital and energy, relatively small fishing vessels (if any), making short fishing trips close to shore, mainly for local consumption. Artisanal fisheries can be subsistence or commercial fisheries, providing for local consumption or export and are sometimes also referred to as small-scale fisheries" (GFCM, 2001).

Plate 1.1 Traditional Maltese fishing vessels in the fishing port of Marsaxlokk

landings at the Central Fish Market obtained through sales vouchers. Until very recently, the fishing regulations in force were those drawn up in 1934 (Fish Industry Act; Chapter 138 of the Laws of Malta) with minor changes over the years, reflecting the lack of scientific information and advice to update these regulations appropriately. However, a strict licensing regime, based on general government policy rather than legislation, has been in place for decades and the major fisheries, such as the dolphin fish fishery (see section 3.3.6), have been organised and managed by the fisheries department. Overall, the numerical size of the full time fleet has remained stable over the past century and has largely been dominated by wooden traditional boats (see plate 3.1 and 3.2) which have gradually been replaced in part by fibreglass replicas over recent years. The 1980s also saw the introduction of a very limited number of trawler licenses but for the last 15 years applications for further trawler licenses have been refused along with a trawling ban within the 3 mile zone around the Maltese Islands (see section 3.3.1). In general, licenses have only been issued for small scale fishing operations and drift netting and purse seining have never been licensed; even the expansion of the blue-fin tuna fishery which occurred in the late 1980s took place through the exclusive use of surface longlines. Unlike the full time fleet, however, the number of part-time and recreational fishing vessels have increased considerably in the last few decades, albeit using artisanal gears, and the effect of this increase in fishing activity is addressed in this study (section 4.3.3).

1.2 Management of Mediterranean fisheries by vessel categories

The particular characteristics of the Mediterranean ecosystems and the multi-species and multi-gear fisheries exploiting the living marine resources present complex scenarios which have, to date, hindered the effective implementation of regional fisheries management regimes. It has been agreed at both European Union Diplomatic Conferences (Venice 1996 and 2003) and at numerous GFCM meetings, however, that in most cases an effort control regime accompanied by other technical measures, rather than a catch and quota system, is the most appropriate general management tool in the Mediterranean. In this context, the GFCM has proposed that effort should be managed by categories of vessels or [2]Operational Units (GFCM, 2001; Camilleri *et al.* 2000) each of which would be associated with particular fishing effort parameters which could be regulated accordingly. The type of effort control would vary according to the type of fishing operation associated with each Operational Unit.

The GFCM has also encouraged fisheries scientists to apportion fishing mortality to different Operational Units when carrying out stock assessments in order to draw up appropriate effort control measures for each Unit. This would require information on the relative importance of the different gears or Operational Units in terms of their contribution to the total fishing effort exerted for the exploitation of particular species.

Malta has implemented effort control measures routinely within its waters for several decades, in recognition of the fact that the Maltese fishing grounds have represented the only available source of fresh fish supply to Maltese consumers. The increase in the number of registered fishing vessels in recent years to a total of around 2000 vessels, should not be taken at face value since most of them operate on a small scale and have limited activity (Camilleri, 2003). The number of active vessels varies according to season, with minor ports having practically no active vessels during the winter months and as little as 25 percent of the registered vessels in major ports land fish during this period. The proportion of active vessels operating on any one day seldom reaches high percentages (normally much less than 50 percent) since most of them are owned by part time fishers and it is quite common for full time fishers to own more than one vessel. Static gears and other passive methods are used in almost all fisheries. In this respect, the fishing capacity

[2] "For the sake of managing fishing effort within a Management Unit, an Operational Unit is the group of fishing vessels practising the same type of fishing operation, targeting the same species or group of species and having a similar economic structure. The grouping of fishing vessels may be subject to change over time and depends on the management objectives to be reached" (GFCM glossary)

of the Maltese fleet could be more appropriately measured by using parameters such as vessel size, gear size and effective fishing time, rather than the more commonly used parameters such as engine power and gross tonnage.

1.3 Landings, direct assessment methods and effort distribution

Lembo *et al.* (2002) explained that the multispecific-multigear characteristics of most Mediterranean fisheries, the extremely dispersed landing sites as well as the small fraction of the catch that generally passes through organised fish markets, make catch assessments in the region particularly difficult; this reflects the similar Maltese practice. In addition, they stated that due to the traditional practices of fish sorting and selling, species separation is incomplete and this makes the direct estimation of total amount of landings by species very difficult. Moreover, they added that discarding at sea is a common practice and hence catch and fishing mortality by age, for many species, cannot be estimated if the size composition and an estimate of the amount of discards are not available. However, when available, catch trends have been used for the analysis of the current status of various fisheries (Lleonart, 1999) or for short term catch forecasting (Stergiou *et al.*, 1997; Lloret *et al*, 2000). Data on landings by the Maltese fleet at the Central Fish Market by species or group of species are available electronically covering a period of more than twenty years and, at least for some species, may give an insight into the sustainability of the stocks.

In the Mediterranean, Catch per Unit Effort (CPUE) in each distinct fishery is frequently used as an index of abundance, however, accurate partitioning of effort by gear or vessel category is necessary in order to estimate catch rates and fishing effort by individual assemblages. In Malta, schemes to obtain catch and effort data for various fisheries have been introduced in 2002 and other discussed in detail later on in various sections of this document.

Considering the difficulties of sampling commercial catches described above, programmes based on the collection of fishery independent data (trawl-surveys, echo-surveys, eggs and larvae surveys) have been promoted at national and European level to estimate biomass and to obtain biological data, significantly increasing the knowledge on the distribution, abundance and population structure of several marine species (Lembo *et al.* 2002). The Mediterranean Trawl Survey programme (MEDITS) (Bertrand *et al.*, 2000) started in 1993 and obtained useful information for mapping the spatial distribution of demersal species and provided indices of relative abundance on a temporal and spatial scale. Malta has participated in MEDITS since the year 2000 (through the assistance of the Italian National Research Council), and although the number of samples are few (5 hauls in 2000, and 9 hauls in 2001) and the time series is extremely short[3], comparisons of abundance of species in the Maltese EFZ with that of adjacent areas is indicative of the state of demersal resources within the former.

Information on the spatial distribution of abundance indices, if coupled with analysis of the geographical distribution of the fishing effort, could assume importance in stock assessment, allowing some variant application of the composite production models (Munro, 1980; Caddy & Garcia, 1982). Such an approach could help in the evaluation of the status of resources exploitation along the Mediterranean coasts, where abundance data have been collected for many years (Relini, 2000; Bertrand *et al.*, 2000); however, long data series of catch and effort data are generally not available.

1.4 Aims of this study

Responsible fisheries management at optimum levels (as required by the United Nations Convention on the Law of the Sea, UNCLOS) is highly dependent on the scientific

[3] Up to the time of writing, only data from the 2000 and 2001 trawl surveys had been processed exclusively for the Maltese EFZ. Surveys conducted after 2001 followed a different data processing protocol in which Maltese data had been processed in combination with other sub-regional data and the specific data of the former has not been made available to date.

monitoring of the fisheries resources and the fleets and gears which exploit them, whilst tracking sustainability indicators and establishing reference points in a reliable and timely desired outputs. In fact, in its role to monitor the sustainable development and management of fisheries in the Mediterranean, the General Fisheries Commission for the Mediterranean (GFCM) embarked on the development of a Mediterranean Fishery Statistics and Information System (MedFISIS), which is expected to contribute to the sound management of living marine resources of the Large Marine Ecosystem (LME) of the Mediterranean (GFCM, 2001).

In the context of the above, this study aims to:

i) to categorise the Maltese fishing fleet and its activities;

ii) to determine the relative importance of different fisheries;

iii) to estimate the spatial distribution of fishing effort;

iv) to assess the impact of the fishing operations of the Maltese fleet on the demersal fisheries resources within the Maltese Exclusive Fishing Zone (EFZ)[4] (Figure 1.1) and other resources targeted by the fleet;

v) to evaluate the impact of an increase in fishing activities on the Maltese population involved in the fishing industry

vi) to propose a future management regime to ensure the sustainability of Maltese fisheries considering abiotic, biotic, ecological, economic and social aspects compliant with the Ecosystem Approach to Fisheries (FAO, 2003a)

Until the time of this study, information and data on Maltese fisheries to address the above aims was found to be extremely limited. The only time series of data were those of fish market landings with no measures of effort and which accounted for the landings of mainly full time fishers. Even data on the fishing vessels and their activities were very scanty,

[4] This 25nm EFZ has been renamed Fisheries Conservation Zone on Malta's accession to the European Union in May 2004, following negotiation. It will however continue to be referred to as an EFZ in this study since most of it was undertaken before the accession date.

with the only available source of information being a "manual card register" of vessels which held unreliable and outdated information.

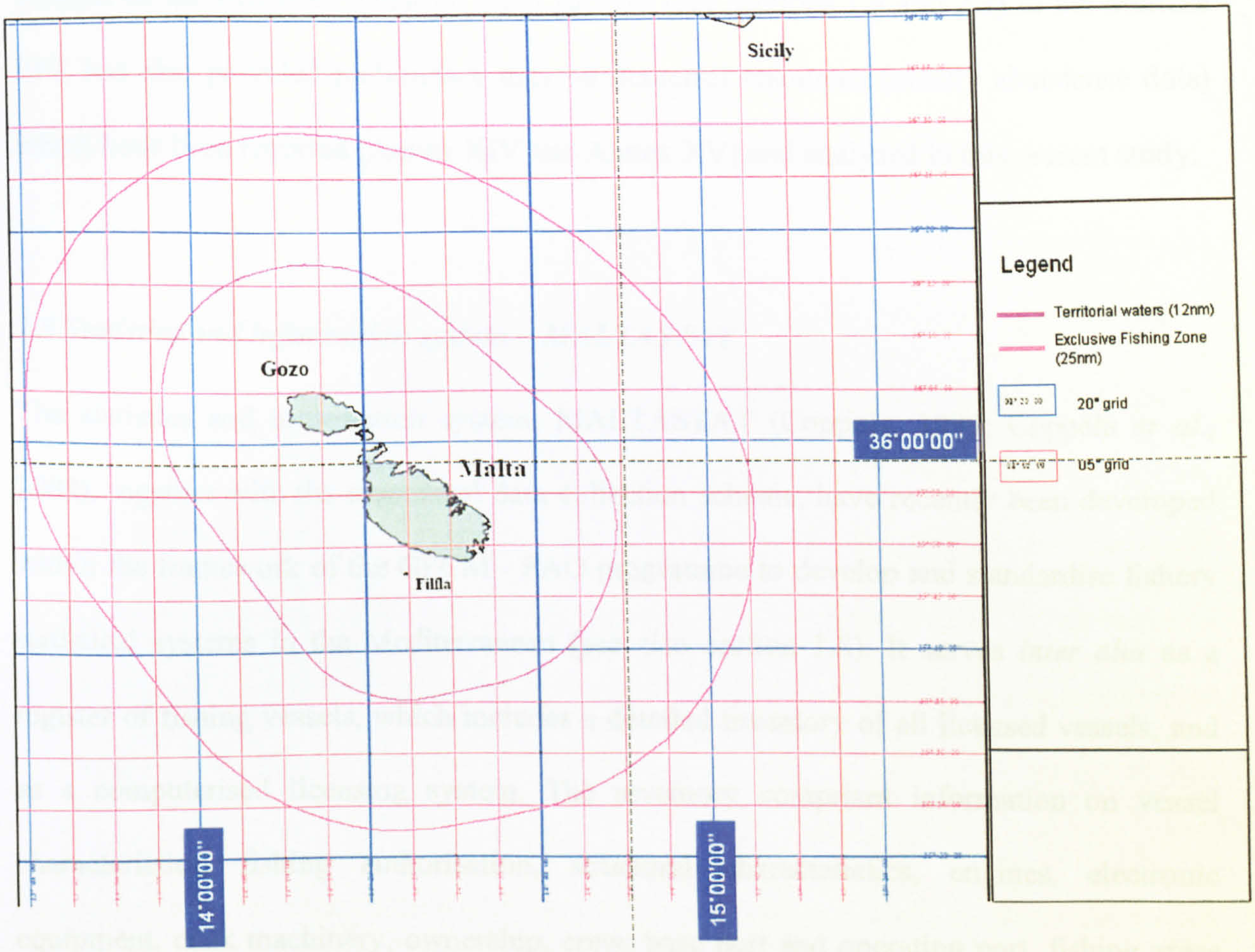

Figure 1.1 The Maltese Islands with illustrations of the boundaries of their territorial waters and the 25 mile Exclusive Fishing Zone.

Fisheries assessments and management depend on sound data collection programmes which involve both directed surveys as well as field recording schemes in ports, fish markets and on board. However, the foundation of these scientific programmes and processes is the development of a reliable fleet statistics data collection scheme which describes and monitors the fisheries activities (Bazigos *et al.* 1984; Cingolani *et al.* 1986; Coppola and Cingolani 1987; Cingolani *et al* 1998). In this context, the author of this study has coordinated[5] the development of a data collection programme for fisheries statistics to compile an electronic fleet inventory (see section 1.5, 1.8 and 2.1) as well as to monitor the

[5] In collaboration and with the support of the Food and Agriculture Organization of the United Nations.

catches and effort of the small scale fleet (see sections 1.8 and 2.5). This study has made the best use of the available time series of landings data to assess the status of the main fisheries resources landed (see section 1.8), however, the involvement of the author[6] in the conduct of the first ever scientific trawl surveys (see sections 1.8 and 2.7) in the Maltese EFZ has also provided preliminary data on demersal resources (mostly abundance data) which have been reported (Annex XIV and Annex XV) and analysed in this present study.

1.5 Statistics and information system – MALTASTAT

The statistics and information system, MALTASTAT (Coppola, 1999; Coppola *et al.*, 2003), together with the associated data collection scheme, have recently been developed within the framework of the GFCM - FAO programme to develop and standardise fishery statistical systems in the Mediterranean (see also section 1.8). It serves *inter alia* as a register of fishing vessels, which includes a detailed inventory of all licensed vessels, and as a computerised licensing system. The inventory comprises information on vessel characteristics, fishing authorisation, structural characteristics, engines, electronic equipment, deck machinery, ownership, crew, base port and operating port, fishing areas and periods, gear, species caught, preservation equipment, safety equipment and other equipment.

MALTASTAT has an automatic reporting facility providing a selection of reports on the structure of the fishing fleet and its activities. Standard reports requested by national and international bodies have been included in the list of automatic reports, which could be changed or increased from time to time so as to satisfy internal and external obligations. Moreover, browse and search options provide the facility for downloading spreadsheet reports from a combination of over 200 fields that make up the inventory. This tool is very

[6] Within the framework of the European Union priority 1 programme MEDITS (Regulation EC1639/2001).

useful in carrying out studies on various aspects and segments of the fishing fleet including fishing effort distribution.

1.6 Introduction to the Sicily Channel: general physical and oceanographic features

1.6.1 Bathymetry and resources

The Maltese Islands and their shelf lie (Figure 1.2) within a distinct geological (tectonic) province and, with other isolated and distant islands of the Sicily Channel, (Pantelleria and Linosa) are characterised by Morelli (1973) as horsts (raised blocks of land bordered by geological faults) – in this case bordered by the deep water of the Pantelleria trough. To the north of Malta this drops to 200-400m, and this deep water plain extends some nautical miles distant from the nearest land mass, the south eastern tip of Sicily. To the east and south, the shelf eventually drops off to 600m and more, while to the north west it continues as a ridge running parallel with the Sicilian coast.

The bathymetric configuration would suggest that for shelf resources, or those that spawn in shelf and slope waters, the Maltese shelf constitutes the main offshore area where spawning could be carried out for a significant proportion of the Maltese EFZ demersal resources. Even for deep water species such as hake which occurs down to 800m, their preferred spawning range is from 100 to 300m (Maynou *et al.* 2003; Relini *et al.* 2002; Racasens *et al.* 1998) which is only available locally on the Maltese shelf. As for other deep water demersal resources however, their migration throughout the Sicily Channel area at or below 500m is not discounted, making them, straddling stocks that should be managed jointly with other users within the UNCLOS (1982), UN Fish Stocks Agreement (1985) and the GFCM context.

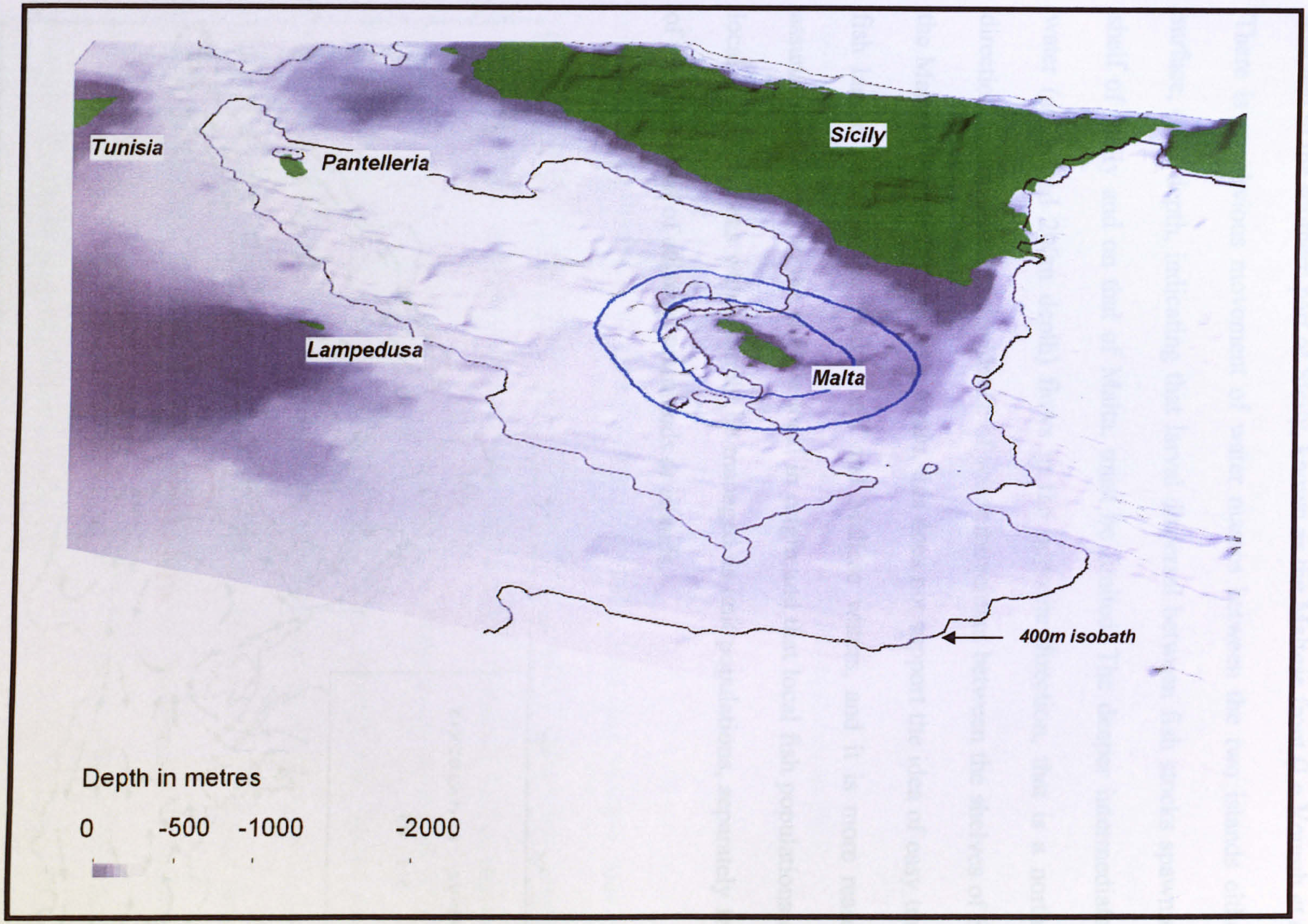

Figure 1.2 A 3D image of the bathymetric features around the Maltese Islands (Source: Mapping Unit, Malta Environment and Planning Authority)

1.6.2 Oceanography and larval dispersal

The current system flowing past the Maltese Islands is characterised (Lacombe 1973) by water masses from the Western Mediterranean flowing Southeast, parallel to the south coast of Sicily (Figure 1.3) with a thermal front between cooler and warmer waters attached to the southern part of Sicily, known as the Maltese front (Le Vourch *et al.* 1992). There is no obvious movement of water masses between the two islands either on the surface, or at depth, indicating that larval dispersal between fish stocks spawning on the shelf of Sicily and on that of Malta, must be limited. The deeper intermediate layer of water (at around 200m depth) flows in the opposite direction, that is a north-westerly direction, again, with little evidence of water movement between the shelves of Sicily and the Maltese Islands (Figure 1.4). Again, this does not support the idea of easy transport of fish larvae between the Sicily shelf and Maltese waters, and it is more reasonable to assume recruitment to the shelf is local in origin and that local fish populations constitute local separate stocks which should be managed as unit populations, separately from those of the shelf areas of adjacent mainlands or islands.

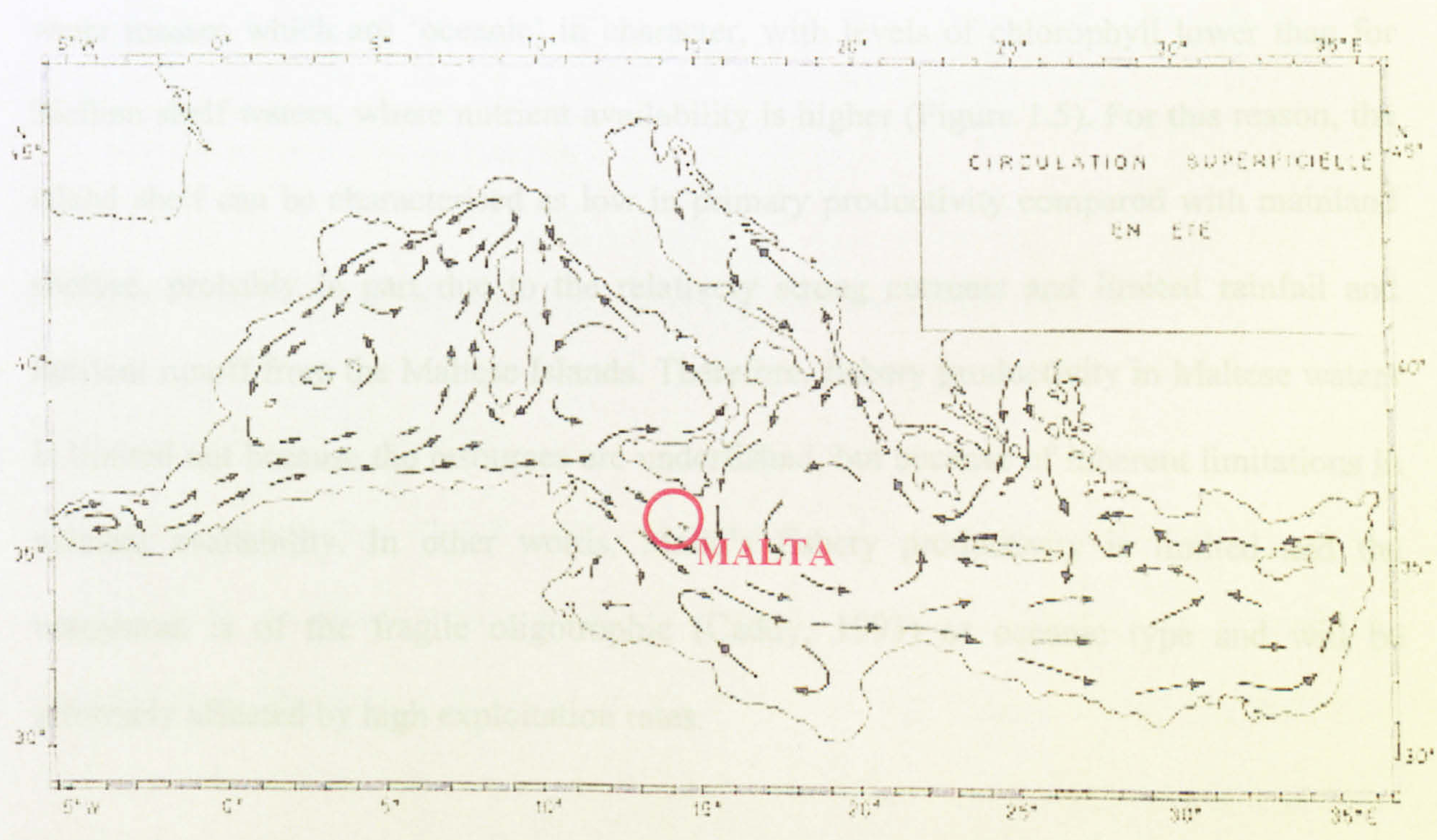

Figure 1.3 Surface current system in the Mediterranean (Lacombe, 1973)

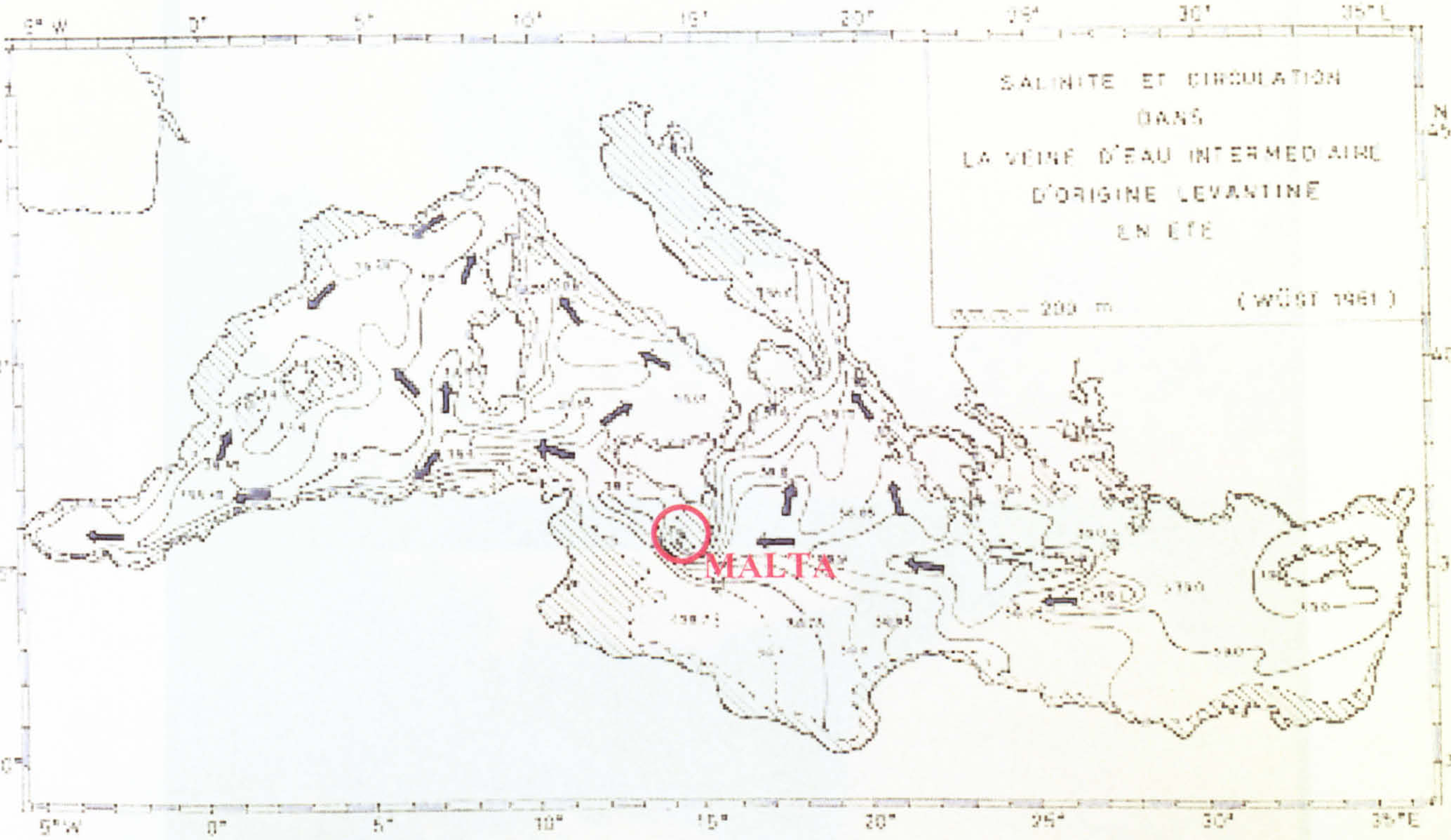

Figure 1.4 Movement of intermediate layer of water in the Mediterranean (Lacombe, 1973)

1.6.3 Productivity

Remote sensing imagery (Barale and Filippi 1997) shows that Malta is surrounded by water masses which are 'oceanic' in character, with levels of chlorophyll lower than for Sicilian shelf waters, where nutrient availability is higher (Figure 1.5). For this reason, the island shelf can be characterised as low in primary productivity compared with mainland shelves, probably in part due to the relatively strong currents and limited rainfall and nutrient runoff from the Maltese Islands. Therefore, fishery productivity in Maltese waters is limited not because the resources are underfished, but because of inherent limitations in nutrient availability. In other words, Malta's fishery productivity is limited and the ecosystem is of the fragile oligotrophic (Caddy, 1993) or oceanic type and will be adversely affected by high exploitation rates.

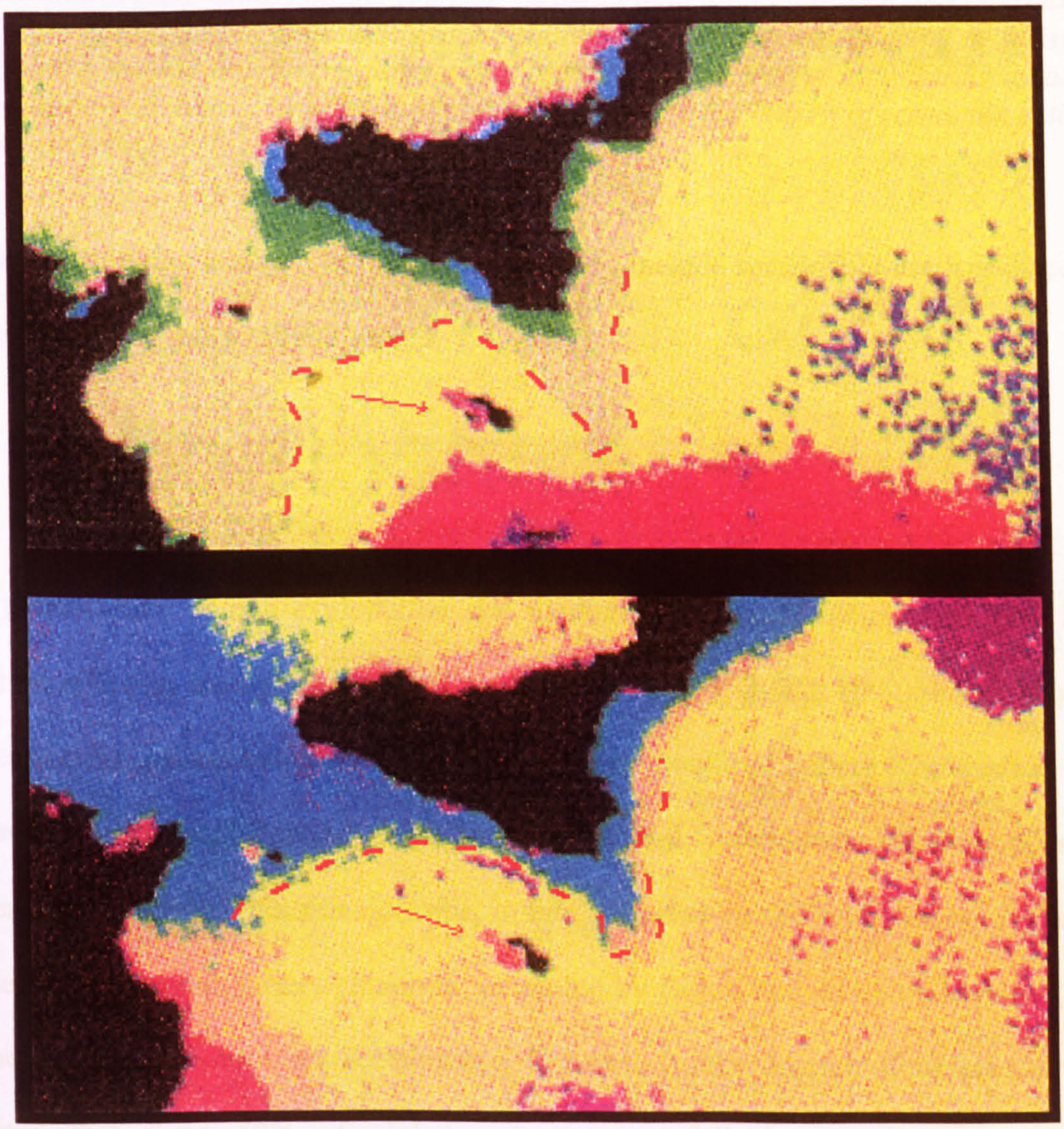

Figure 1.5 Remote sensing images (Barale and Filippi, 1997) showing ocean colour (top image) and temperature (bottom image). The red arrow points to the Maltese Islands and the dotted red line highlights the boundaries between two water masses with different characteristics. The images are illustrated in arbitary colour coding to highlight different sea surface water classes; they are derived from a combination of annual composites of CZCS (1979-1985) pigment concentration in mg/m^3 and of AVHRR (1982-1990) temperature in °C (top and bottom images respectively).

1.7 Sustainability of fisheries: global and Mediterranean perspectives

1.7.1 Definition of sustainability

The term "sustainable development" or in short "sustainability" (according to FAO glossary) has a large number of definitions and frequently depends on disciplinary interpretation. However, according to the author of the present study, the definition adopted by the GFCM sub-committee on stock assessment is well balanced and highlights the key principles which need to be addressed to ensure the sustainability of fisheries:

"Development integrating into the relevant sectorial policies, at national and international level, the implications of economic growth on the environment, and seeking to satisfy the needs of the present and future generations equitably, in particular by allotting a value to environmental resources in order to identify and evaluate the impact of economic activities on the environment"(GFCM glossary)

Other related terms included in the GFCM glossary include sustainable use, sustained use, sustainable yield and sustainable catch.

1.7.2 Status of global fisheries

The globalization of fish exploitation and marketing is largely believed to have had a negative effect on the sustainability of world fisheries (INCO-DC, 1999). It has helped to perpetuate the general belief on the ever-continuing growth of fisheries production at the expense of the depletion of important stocks and ecosystems (Vasconcellos and Chuenpagdee, 2000). This situation was, in fact, reflected by the FAO review of the state of the world's marine fishery resources, presented by Garcia and de Leiva Moreno (2001) at the FAO Conference on Responsible Fisheries in the Marine Ecosystem[7], which reported that about 50% of global resources are fully exploited, 25 percent are overexploited and about 25% could support higher exploitation rates. Garcia and de Leiva Moreno (2001) stated that while the proportion of overfished stocks seems to have increased much less than in the past, reaching an asymptote in the 1990s, the historical trend towards more overfishing observed since the early 1970s has not yet reversed. They added that whilst the fisheries contribution to economic development and food security is very significant, overcapacity seems pervasive and is jeopardizing the economic and social performance of the sector, as well as its sustainability in a number of cases.

[7] Reykjavik, Iceland; 1-4 October 2004

To address this issue, FAO (2001) published guidelines to support the implementation of the Code of Conduct for Responsible Fisheries in which the need for a system of indicators to monitor the sustainable development of fisheries was highlighted. The publication identifies four dimensions of sustainability - ecological, economic, social and institutional – and considers the socio-economic environment in which fisheries operate. The guidelines also stress the importance of common conventions for the purpose of joint reporting at national, regional and global level, particularly in relation to international fisheries, or transboundary resources, and suggest the establishment of a Sustainable Development Reference System (SDRS).

According to Cochrane (2000) the global state of fisheries and fish resources is a result of the failure to attain sustainable utilization, economic efficiency and equity in access to resources. He identified a number of factors which contribute to failure of fisheries management including high biological uncertainty, conflict between the constraint of sustainability and social and economic priorities, poorly defined objectives, and institutional failures related to access rights and participation in management by users. He explained that this complexity of fisheries management could be addressed through principles which are well understood and, if properly considered in fisheries management systems, would lead to improved performances. He added that responsible management will, however, only be effective if there is a genuine desire to achieve the objectives. He also stated that fishing capacity frequently reflects the dependency of users on fisheries resources and that it is commonly in excess of the sustainable production of the resources. In this context, Cochrane (2000) suggested that responsible management requires political will, setting of unambiguous objectives and management measures in cooperation with users and other interest groups, together with a strategy inscribed into legislation to ensure transparency and accountability and to constrain decision-makers.

1.7.3 Sustainable development of fisheries in the Mediterranean

1.7.3.1 Review of Mediterranean fisheries

According to a review on Mediterranean fisheries drawn up by the FAO sub-regional project COPEMED (1999), the Mediterranean Sea has, over the past twenty years, experienced an increase in the exploitation of its fisheries resources, producing about 1.3 million tonnes of fish annually, consisting of a great variety of species. The fleets involved are described as generally being artisanal in nature, operating in coastal areas, using a diversity of gears, and which are expanding in capacity, improving in efficiency and are in a modernization process. It is also reported that the Central Mediterranean (Malta is in the heart of this region) is considered to be the most productive after the Adriatic with the continental shelf off Sicily and off Tunisia supporting an important trawl fishery, predominantly by industrial scale Italian vessels. However, the review also mentions that assessments carried out on demersal resources in the Sicily Channel indicate a general state of overexploitation.

The views of Farrugio (1996) on the measures for sustainable conservation of Mediterranean fisheries resources are reflected in the COPEMED review mentioned above. One of the key measures suggested is related to the introduction of a "systemic concept of fisheries" which essentially involves the scientific monitoring of Mediterranean marine ecosystems, rather than just the resources, and ensuring their long-term sustainability for new generations. Sub-regional cooperation in data collection schemes, research, capacity building, networking, standardization of scientific methodologies, data and results, along with a general consolidation of the advisory processes are other priority measures identified in relation to the sound management of resources in the Mediterranean.

1.7.3.2 Indicators, reference points and other management tools

Like Farrugio (1996), Sainsbury and Sumaila (2003) also considered the importance of incorporating ecosystem objectives into the management of sustainable marine fisheries but added that practical and operational methods should be used to effectively implement this approach. They suggested that this could be addressed through the use of indicators, performance measures and target and limit reference points for fisheries ecosystem objectives, operationally accommodating ecosystem-related objectives in fisheries management. They also elaborated on the use of marine protected areas in combination with management tools and measures to achieve sustainable fisheries and marine ecosystems.

The General Fisheries Commission for the Mediterranean (GFCM) has recently considered the use of indicators and reference points for the sustainable management of fisheries in the Mediterranean (GFCM, 2004). In fact a workshop was convened in April 2004[8] to specifically address this issue and to draw up a plan of action with a view to adopting a novel holistic approach to fisheries management in the region. At the workshop there was concensus that reference points in the Mediterranean have so far been applied only to stock assessment exercises and not used within a management framework. It was noted that most of the papers presented during the workshop focused on biological reference points which needed to be assessed on the basis of their characteristics, for their feasibility and usefulness in the precautionary approach. As far as the participants were aware, only the multicomposite species model has ever been applied in the Mediterranean and problems are being encountered to translate the Ecosystem Approach to Fisheries (FAO, 2003a) and related models to management interventions. On exploring the overall scenario, the participants stated that the establishment of reference points should be an activity carried out by scientists but should be understood by fishers and other stakeholders. It was

[8] Author of the present study was a participant of this workshop and was appointed rapporteur

suggested that they should have three uses: (a) monitoring (b) management implementation (c) determination of the state of stock or "restoration". It was also noted that demersal stocks are the most vulnerable and needed focused attention with defined recovery plans which set target values or reference points.

The GFCM reference points workshop further discussed the unreliability of commercial catch data and the quality of data collected through direct and indirect methods which depended on the sampling strategy employed. There was more support for reference points derived from empirical information as opposed to simulations which tended to be associated with gross uncertainties. Furthermore, the participants expressed concern that the precise values to be used for reference points related to exploitation rates and spawning stock biomass remain unknown. The problem of assessing stocks which have been exploited for many years with no knowledge about the original pristine situation was also highlighted. In addition, the issue of a management process to restore stocks would be highly unrealistic in the absence of a finite "golden age" reference point.

In trying to reach a conclusion, the participants of the workshop suggested that rather than having reference points for different stocks, a specific reference point for each fishery or Operational Unit should be identified which would be understood by all stakeholders. Indicators for reference points could be obtained through catch assessment surveys and direct methods used in estimating the biomass of fish assemblages.

1.7.3.3 The Mediterranean plan

Following the diplomatic conferences in Crete in 1994 and Venice in 1996, fisheries Ministers of Mediterranean countries together with the European Commission convened another conference (Venice, 25-26 November 2003) to discuss and draw up a plan for the sustainable development of fisheries in the Mediterranean.

The Venice Conference drew up a strategy, to be implemented through the GFCM, which is designed to "ensure the sustainable exploitation of migratory and shared stocks". The measures agreed upon include the strengthening of scientific evaluation, the systematic collection and distribution of statistical data on catches and effort, the regulation of fishing effort, zoning and periodic closures to protect spawning and nursery areas, fishing gear selectivity, the continuation of FAO regional scientific programmes as well as the implementation of measures to address Illegal, Unreported and Unregulated fishing (IUU). The Conference also declared that a sustainable policy for the management and conservation of fisheries resources in the Mediterranean could be ensured through the setting up of an appropriate inspection system implemented also by the GFCM.

1.8 The data collection framework of this study

The data collection schemes described in Chapter 2 generally fall within the framework of the following four major programmes in which the author has been involved:

(i) The fleet census and the MaltaStat fishing vessel database and information system

The development of a Maltese fisheries statistical system with the assistance of the FAO sub-regional project COPEMED started in November 1998 when FAO experts visited Malta to assess the existing fleet data collection schemes and to discuss options for their improvements based on national and international requirements (Coppola, 1999). The author of this present study was subsequently nominated as chief and national coordinator of this initiative and has since been working closely with FAO experts and Maltese officers to implement the agreed workplan. He was instrumental in designing the tailor-made interview sheets (Annex I), in the supervision of the data collection and data entry processes as well as in the design, development and testing of the MaltaStat database and information system (see section 1.5 and 2.1). Furthermore, he co-authored a user's manual

(Coppola *et al.* 2003) giving details on the structure and functions of the system together with operating instructions.

(ii) The catch assessment survey (CAS) and the MaltaStat CAS database

In view of the absence of data collection schemes for catches and effort by vessel length class and gear, options for the implementation of such schemes were considered by the author of this study and FAO experts. On the basis of statistics emerging from the MaltaStat fishing fleet database, international requirements including European Union legislation, and after conducting a pilot study (see section 2.5), the team designed a sampling approach for the collection of data for small scale vessels (see section 2.5) and a census approach using logbooks for vessels over 10m in length (Coppola *et al.* 2003b) (the latter has not yet been implemented to date). In parallel with designing the sampling scheme, a database and information system, MaltaStat CAS, was developed to house the data collected, to automatically process the output of catch and effort estimates and produce reports requested by national institutions and international fisheries bodies. The author of this study also co-authored a user's manual for the MaltaStat CAS database and information system (Coppola *et al.* 2003c).

(iii) The Medits trawl survey[9]

The Medits trawl survey (Bertrand *et al.* 2000) is a European Union "priority 1" survey which must be included in national data collection programmes of all Mediterranean EU member states according to EC regulation 1639/2001. Through the assistance of the Italian National Research Council and its fisheries institute in Mazara del Vallo, Sicily, Malta was included in the Medits programme prior to its accession to the EU and the first survey took place in 2000; the author of this study has since acted as national focal point. The marine fishing vessel "*Sant Anna*" (plate 2.1), which is used for surveys in the Straits of Sicily,

[9] http://www.izor.hr/eng/international/medits.html

performed the sample hauls in Maltese waters (see section 2.7) in accordance with the Medits protocol (Medits, 2001). The author was responsible for identifying the sampling sites and joined the *Sant Anna* crew and Italian scientists and technicians in order to participate in the routine data collection work at sea. Following the processing of the raw data by the Medits database (Souplet, 1996) to obtain estimates of abundance for the key commercial species, the reports for the 2000 and 2001 trawl surveys performed in Maltese waters were drawn up by the author and are annexed to this document (Annexes XIV and XV).

(iv) Fish market landings data collection scheme

Although the author was not responsible for the design or implementation of the fish market landings data collection scheme which has been in place since 1980, he made the best use of the data which are routinely collected through sale vouchers by fisheries officers. He processed and manipulated the available data in such a way so as to retrieve relevant information for this study (see sections 2.3 and 2.6).

The four programmes described above have provided the foundation for the scientific analyses contained in this document to be carried out. The following chapter gives details on the specific processes and methodologies used to address the aims of the study listed in section 1.4 which are, in the author's view, the essential elements to be considered in this first scientific document of its kind to be written on Maltese fisheries.

Chapter 2. Materials and methods

As indicated in sections 1.4 and 1.8 the author has been involved in a number of data collection programmes associated with the present study as summarised in Annex XVI. Sections 2.1, 2.2, 2.3 and 2.4 relate mainly to the collection of data through a fleet census and the subsequent processing of fleet data in combination with other available information such as landings data; the latter being analysed solely in detail in section 2.6. Catch and effort assessment surveys as well as trawl surveys coordinated by the author are addressed in sections 2.5 and 2.7 respectively.

2.1 Inventory of fishing vessels

Noting that a fleet census had never been carried out in Malta and information on the fleet was limited (see section 1.4), a questionnaire (Annex I) to collect information on each fishing vessel making up the Maltese fleet was drawn up and a data collection programme was designed on the basis of a review conducted by Coppola (1999). Between the years 1999 and 2000 information was collected through on-site vessel inspections and interviews in ports and in boat houses where vessels may have been temporarily stored. Data was recorded in text, numerical or standard code format. Fishing areas were determined using a grid system (Annex II) whereby fishers indicated in which "boxes" they would normally carry out their fishing operation for different gears and periods throughout the year. The grid level used was 1° x 1° or multiples of this down to 5" x 5", depending on the extent of area fished by each particular vessel.

In order to ensure a minimum level of information collected, compulsory data fields were identified (underlined in Annex I). Misinformation was minimised as much as possible through thorough inspections of vessels by field recorders.

The data collected was entered into the MALTASTAT fishing vessel register database and information system (see section 1.5) which has inbuilt error checks together with an automatic data debugging facility (Coppola *et al.* 2003) to eliminate data entry mistakes and unrealistic data as much as possible. The information system was then used to conduct selected processing exercises as described in the following sections.

2.2 Categorisation of the fleet

2.2.1 General features

The MALTASTAT selective scan facility was used to extract data on the fleet which could be used to describe the fleet in terms of type, hull material, average length, and average horsepower. Data were exported from MALTASTAT to an Excel sheet where aggregation and processing of data was performed.

2.2.2 Fishing gear and fishing zones

Using the selective scan facility in MALTASTAT, data on activity of fishing vessels by gear and fishing area were obtained from section 10 of the inventory database (figure 2.1) and exported to an Excel sheet. Data were aggregated by vessel size class, general gear category[10] and zone (12 mile band, 25 mile band and beyond 25 miles[11]).

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[10] Vessels using more than one type of gear were considered as more than one unit. Dolphin-fish surrounding nets were excluded (see 2.4.2.2, 3.3.6 and Annex X)

[11] Author's discretion was used to determine whether boxes of fishing area grid used in questionnaire (Annex II) fell within the various zones.

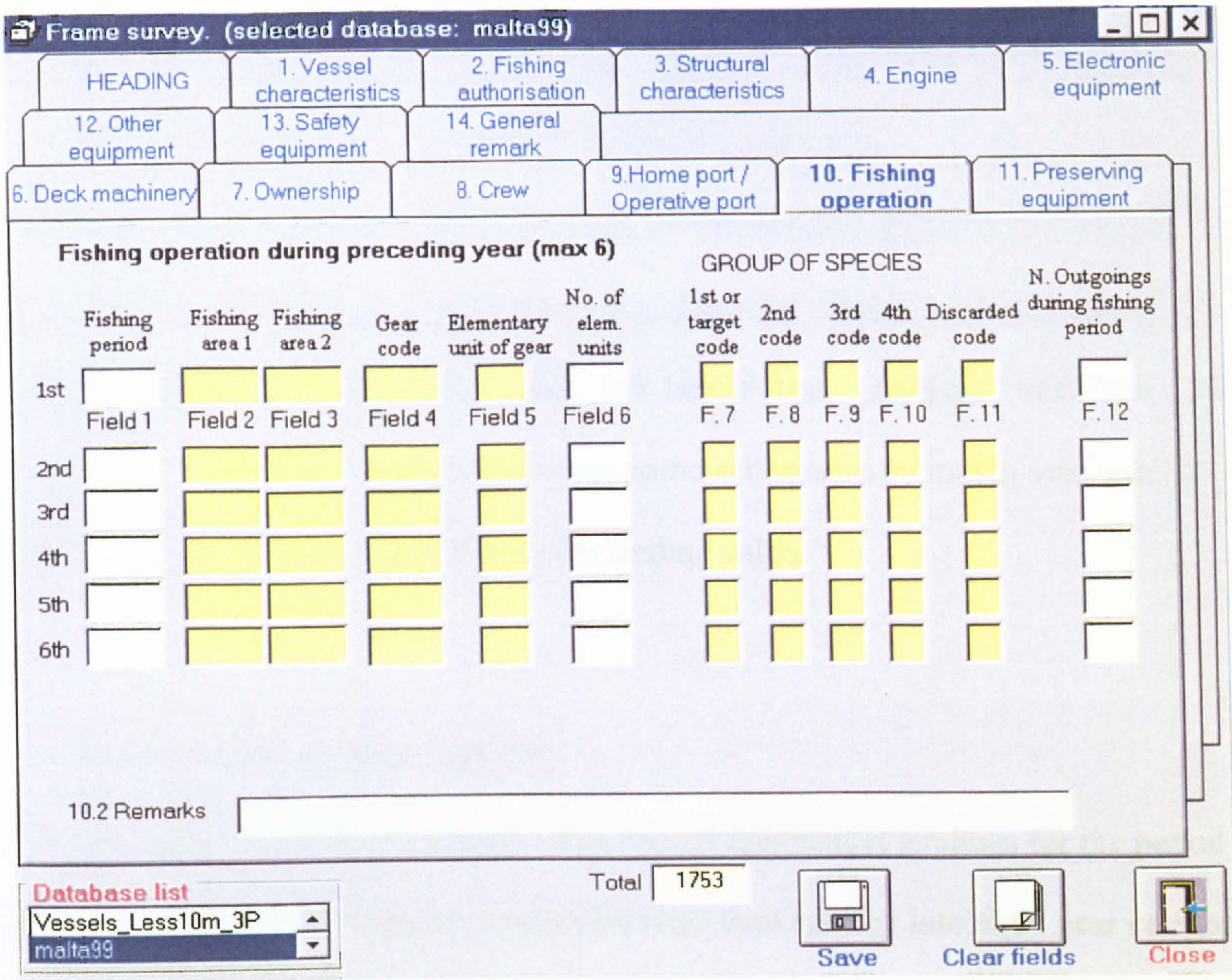


Figure 2.1 Section 10 of the inventory of fishing vessels (MALTASTAT). Selected fields were used in the analysis carried out in 2.2.2

2.2.3 Operational Units and target species

The established GFCM basic parameters for identifying Operational Units (Annex III) were obtained for the Maltese fleet by extracting data using the selective scan facility in MALTASTAT. Extracted data was transferred to an Excel sheet, with vessels using more than one gear at different periods of the year being considered as more than one unit i.e. vessels could belong to more than one Operational Unit. Data was sorted by base port, fishing gear, vessel length, target species and fishing period respectively. For each port, vessels were grouped according to general gear category, general resource name, length class and fishing period. An appropriate general Operational Unit name was assigned to each group and a list of Maltese Operational Units was drawn up on the basis of the general Operational Unit name and general resource name.

2.3 Relative importance of different fisheries

2.3.1 Seasonality and relative importance of landed species[12]

Average data on weight of landings by species and month registered at the Maltese central fish market for the period 1997-2001 was obtained. Species were excluded from the analysis if the average landing value fell below 1mt. Landings were then illustrated (section 3.2.1, fig 3.4) by general resource name and species by month over a calendar year using a height scale corresponding to the landing value.

2.3.2 Fishing gear annual production

Average annual weight and annual value data of fish market landings for the period 1994-2000 were obtained by species. Quantities were then split by into eight gear categories by assigning "landings gear indices[13]" to each species (indices for each species added up to a total of 1). Multiplying the landings gear index by the average weight and average value for each species gave an annual average landing weight and value for each species by gear category or fishery (equations 2.1 and 2.3). Quantities for each gear category or fishery were added to show their relative importance in terms of annual production (weight and value; equations 2.2 and 2.4). The following equations summarise the procedure described above:

[12] A reference list of the scientific names of the most important commercial species and the corresponding English and Maltese names has been drawn up and attached in Annex VIII

[13] Landing gear index (LGI) is an arbitrary decimal fraction which relates to the probability of a species being landed by a particular gear. If the species is caught only by one type of gear, then the LGI is 1. LGIs were established on the basis of interviews with fishers, giving a fair approximation of the reality in composition of landings by various gears; the splitting of landings data by gear was only possible through the application of these approximate LGIs.

$[(LGI_s)]_g(w_s) = [W_s]_g$.............. equation 2.1

$\Sigma[W_{s1}, W_{s2}.....W_{sn}]_g = P_g$............ equation 2.2

$[(LGI_s)]_g(v_s) = [V_s]_g$................ equation 2.3

$\Sigma[V_{s1}, V_{s2}.....V_{sn}]_g = E_g$.............. equation 2.4

where

LGI = Landings gear index

w = total species average annual landings in weight

W = species average annual gear landings in weight

v = total average annual landings in value

V = species average annual gear landings in value

P = total average annual production of gear in weight

E = total average annual production of gear in value

s = species

g = gear

2.3.3 Production distribution by gear or fishery and zone

Using results obtained from the exercise described in 2.2.2, the relative distribution of fishing effort (all size classes aggregated) for each gear category by zone was then estimated[14] by using equation 2.5:

$$\frac{\Sigma \{[(N)(AF)]_z\}_g}{\Sigma \{[(N)(AF)]_t\}_g} = EDR_g \text{.............equation 2.5}$$

[14] Vessels for which their fishing area was not available were excluded from the exercise, using the vessels for which the fishing area was available as a representative sample of the whole population.

where

N = number of vessels

AF = size class effort adjustment factor[15]

z = zone (12nm, 25nm, including international waters)

t = all zones

g = gear

EDR = Effort Distribution Ratio

Ratios obtained were then multiplied by the average annual weight and value of landings of each related gear category or fishery, obtained from the procedure described in section 2.3.2, to estimate the production distribution by gear category or fishery and zone as follows:

$(EDR_g)(P_g) = [P_g]_z$...............equation 2.6

$(EDR_g)(E_g) = [E_g]_z$...............equation 2.7

where:

$[P_g]_z$ = total average gear annual production by zone in weight

$[E_g]_z$ = total average gear annual production by zone in value

2.4 Determining spatial distribution of fishing effort

2.4.1 Demersal gears

Historical data on trawling grounds within the Maltese Exclusive Fishing Zone and adjacent areas (Giudicelli, 1977) were mapped electronically indicating those within the shelf area, slope or deep water area and protected areas.

[15] size class effort adjustment factor = 1, 6, 12, 24 (for each size class respectively). This adjustment factor assigns an arbitary proportionate strength of fishing effort to vessels depending on their size class; this is based on the assumption that fishing effort is directly proportional to length.

The selective scan facility in MALTASTAT was used to obtain data on fishing areas for bottom longlines, trammel nets and bogue traps representing three major demersal gear categories. Data was exported to an Excel sheet where aggregation of data by fishing area was carried out. A colour scale was established relative to the number of pieces (sets) of nets in the case of trammel netting and the number of vessels in the case of longlining[16] and bogue trapping. The fishing area grid (Annex II) was coloured in appropriately according to the established scale and overlaid onto a map to illustrate the spatial distribution and fishing intensity for each of the studied gears.

2.4.2 Fisheries of highly migratory species

2.4.2.1 Longlining for blue-fin tuna

A similar approach used in 2.4.1 was applied to draw up a grid chart on the spatial distribution and fishing intensity of tuna surface longlining during the period May – July (tuna season).

2.4.2.2 Dolphin fish *Kannizzati* fishery

Information related to the deployment of Fish Aggregating Devices (FADs), locally known as *kannizzati*, was obtained by interviewing all fishers participating in the 2001 fishery. Data was obtained on the distance of the first FAD from the coast, the coordinates of the direction (*rimja* in Maltese; pl. *rimjiet*) along which the FADs were laid, the number of FADs to be laid and the distance between each FAD. This data was plotted electronically onto a map to illustrate the spatial distribution of FADs (see Annex X). FAD *rimjiet* were split into three strata corresponding to those belonging to the district of Gozo and the

[16] Only full time fleet considered, since part time fleet use very short bottom longlines with few hooks; the effort exerted by full time vessels and part time vessels of the same length at any one time are different. Thus, the latter were eliminated from the exercise to avoid false representation. The effort distribution of the part time bottom longline vessels (almost all under 10m in length) is addressed in Annex XII (see also section 2.5).

districts of the western and eastern coasts of Malta. Data on landings were obtained daily from the central fish market by vessel and were assigned to the corresponding *rimja* of FADs. Landings data were aggregated by stratum and month and plotted to illustrate the evolution of landings by stratum. The catch per unit effort (CPUE) by stratum and month in terms of catch per FAD and catch per vessel were calculated using the total number of FADs deployed and the total number of registered vessels respectively.

2.5 Catch and effort survey for small scale (under 10m) fleet

A preliminary study of the activity of the Maltese small-scale fishing fleet was carried out through a port sampling scheme in which data on catches and fishing effort were collected. A total of 923 interviews (see Annex IV for data collection sheet) were obtained over a period of 10 months (2002) in 9 major fishing ports in the Maltese Islands. Data were processed by port, month, type of gear, species and type of vessel. CPUE was expressed in relation to the vessel structure parameters (length, gross tonnage and horse power).

Through a second more complete sampling scheme (Coppola *et al.* 2003b), monthly catch and effort estimates for the small scale fleet were obtained from data collected in 6 representative ports which together accommodate 42.5 percent of the national small scale fleet. Surveys took place in each port for six consecutive fishing days every other month between January and September 2003, on a 12-24 hour basis obtaining a total of 881 interviews. The sampling frame for each port was adjusted each month according to the number of operational vessels. Data on catches, fishing effort, vessel activity and fishing zone were recorded by gear and species using purposely formulated interview and activity record sheets (Annex XII). Fishing zones were recorded using a pre-set geographical grid of 5 minutes by 5 minutes.

Results for each port and the entire country, by day, month, species and gear were obtained by applying time and area raising factors to the sampled data (Coppola *et al.* 2003b). Selections of these results were summarised in order to give a general description of the activity of the small scale fleet. An evaluation of slope (over 200m depth) fisheries was also carried out using the available data.

2.6 Trend in landings of key species

Landings at the central fish market of key species for the period 1980-2002 were plotted (see section 3.5). The trends in landings were interpreted in the light of consumer demand, fleet size and other influencing factors. Trends in landings of demersal species were studied in more detail by grouping semi-pelagic species, deep-water species, valuable shallow species and long-living species.

2.7 Trawl surveys

An estimation of abundance of demersal resources within the Maltese EFZ was carried out within the framework of a Mediterranean Trawl Survey programme (MEDITS) (Bertrand *et al.* 1997; Bertrand *et al.* 2000) on board the Marine Fishing Vessel *Sant Anna* (Plate 2.1)[17]. A total of 5 hauls and 9 hauls were performed using the MEDITS experimental trawl net (IFREMER GOC73[18]) in June 2000 and June 2001 in depths ranging between 10 – 800m according to the standardised MEDITS protocol (Medits, 2001). Reports describing the results in terms of biomass and density indices by species[19] and stratum were drawn up.

[17] Length overall: 32.20m; hull material: steel; GT: 197.06; power of main engine: HP1012
[18] Nylon H.T. braided knotted net (diameter. 2.5/2.0/1/5mm); codend mesh size 10mm k.t.k. made with nylon H.T. knotless net twine (size 210/60); ground rope made in 3 pieces with 120kg of chain (diameter 10mm); floatline made with 40 pieces of floats (diameter 210/1300 MTS).
[19] See Annex VIII for species nomenclature reference list

Plate 2.1 Marine Fishing Vessel *Sant Anna*. Used for trawl surveys in the Straits of Sicily including Maltese waters.

Using data from the 2001 survey a comparison between the M3 sub-regions[20] in relation to abundance by stratum was carried out by selecting the most important commercial species appropriately for each stratum, and by setting the total abundance of these species within Maltese waters to unity. An overall comparison of the first four strata (10-500m) taken together was also performed, leaving out the stratum below 500 m, which effectively shares common fishery resources with those of a similar depth outside the EFZ.

2.8 Conclusion

Within the data collection framework of this study outlined in section 1.8 and described in this chapter, a mass of relevant information to address the aims listed in section 1.4 has been gathered. Through data manipulation, integration and processing, a number of pertinent results were obtained which describe Maltese fisheries and shed light on the issue of sustainability of resources around the Maltese Islands. These results are presented in the following chapter.

[20] M3a: South Tyrrhenian Sea (Volturno River – Capo Suvero), M3b: South Tyrrhenian Sea (Capo Suvero – Capo San Vito); M3c: Sicily Channel; M3d: Maltese Waters

Chapter 3. Results

The results obtained from the data collection and processing methodologies described in Chapter 2 are laid out in the forthcoming sections of this Chapter as well as in Annexes III, V, VII, XIV and XV. In addition, three scientific papers contained in Annex X, XI and XII together with two scientific reports contained in Annexes XIV and XV are also a result of procedures described in various sections in Chapter 2.

3.1 Profile of the Maltese fishing fleet and its activities

3.1.1 Structural characteristics

As illustrated by figure 3.1, the average size of the Maltese fishing vessels (total of 1757 registered vessels at the time of study) is well under 10m in length, with the exception of the trawler type class, using exclusively bottom otter trawls, averaging 22.5m. Most of the vessels are of a traditional structure (Plate 3.1 and 3.2) i.e. *luzzu* and *kajjik* with the latter being more common. The *Multi-Purpose Vessel* (MPV) type class (Plate 3.3), a relatively recent addition to the fleet, makes up more than 35 percent of the fleet and, unlike the *luzzu* which is the most "antique" traditional vessel constructed almost exclusively of wood, the hull material of MPVs is generally fibreglass. This material has also become the preferred choice in the construction of *kajjiks,* which until a couple of decades ago used to be made of wood. The *kajjik* differs from the *luzzu* in being generally smaller and being flat ended at the stern, whereas the *luzzu* is pointed at bow and stern.

The main engine power of the traditional vessel classes and other derivatives ("other" class) is generally very low, but the MPV class has a higher average power reflecting the larger size and different hull structure. The average main engine power of the trawler class is, as expected, very much higher than that of the other vessel types, but is relatively low

Plate 3.1 The *luzzu*

Plate 3.2 The *kajjik*

Plate 3.3 An example of a multi-purpose vessel (MPV)

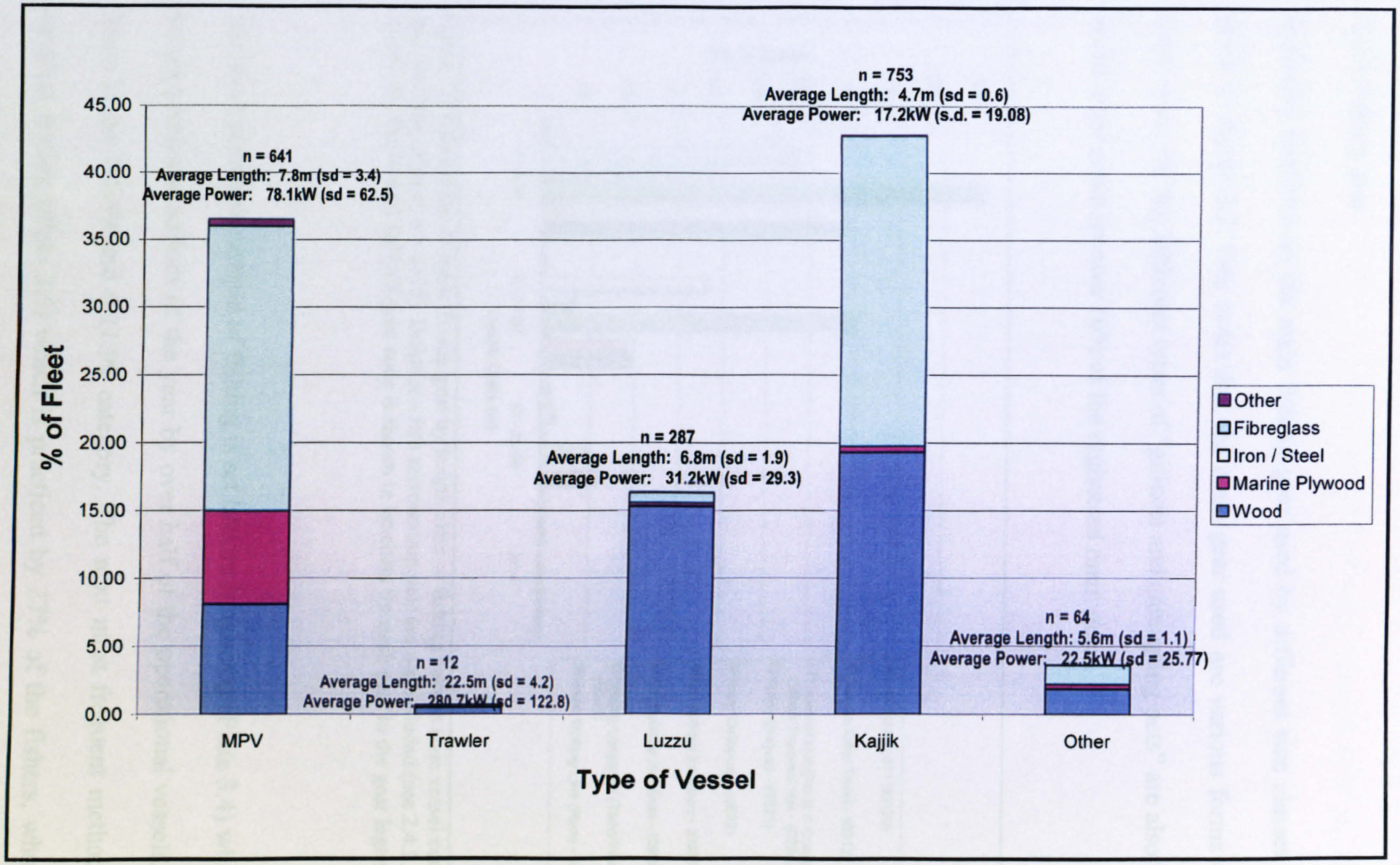


Figure 3.1 Structural characteristics of the Maltese fishing fleet

for the kind of fishing operations they are often engaged in (eg. trawling for prawns at 800m depth).

3.1.2 Fishing gear

Summary statistics on the main fishing gear used by different size classes of vessels are given in figure 3.2. One notes that the main gear used are various forms of "hooks and lines" (over 60 %). Different types of "gillnets and entangling nets" are also popular (20%) whilst traps make up over 10% of the registered main gear.

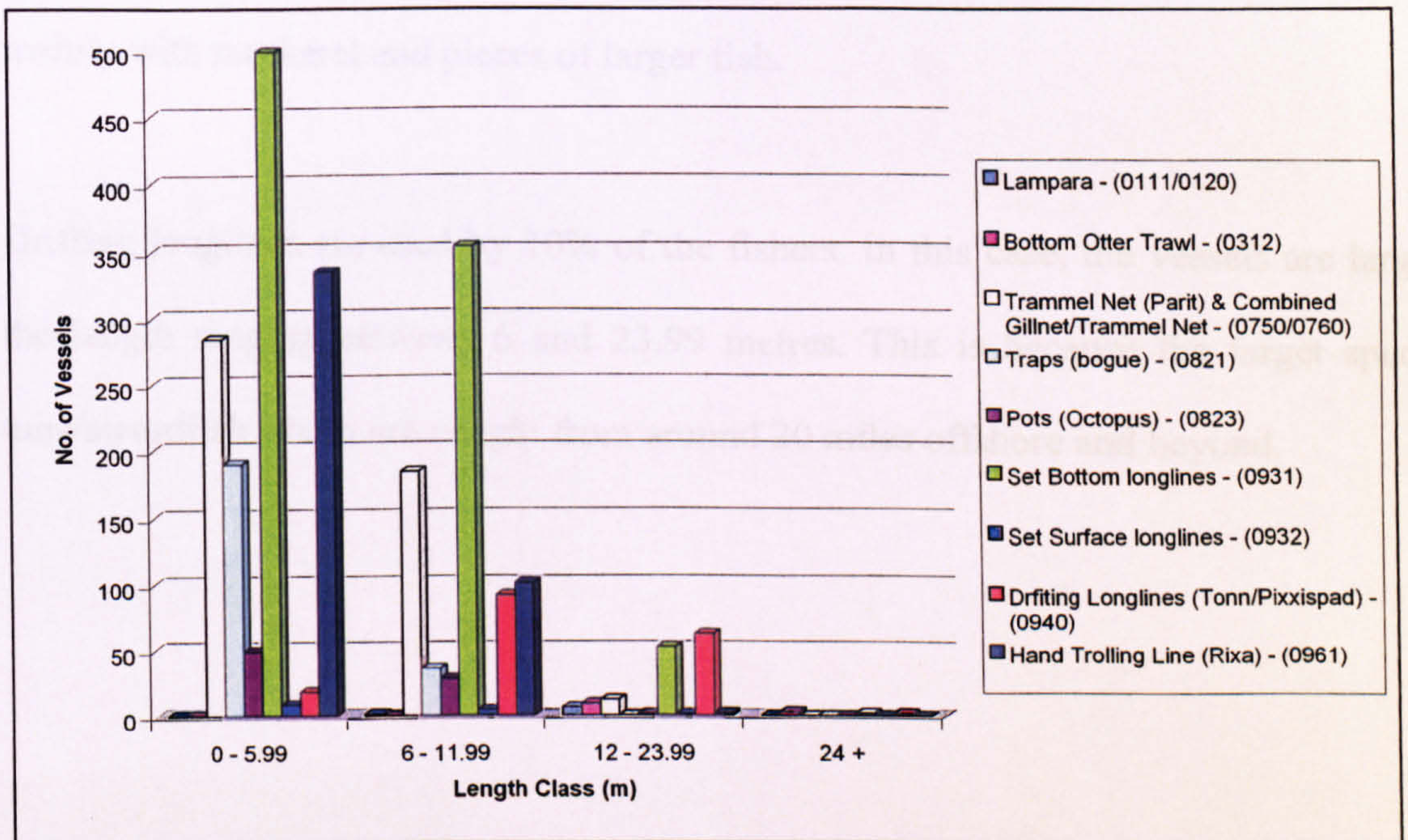


Figure 3.2 Distribution of main fishing gear by length class of fishing vessels (one vessel could use more than one type of gear; n = 2335). Dolphin – fish surrounding nets are not included (see 2.4.2.2, 3.3.6 and Annex X). The MALTASTAT gear code is shown in brackets for each gear in the gear legend.

The most prevalent method of fishing is set bottom longlining (Plate 3.4) which is operated during particular periods of the year by over half of the operational vessels, especially by those in the 0-5.99 and 6-11.99 category. The next most frequent method of fishing is trammel netting (Plate 3.5) which is practiced by 27% of the fishers, who also own the smaller sized craft.

Twenty five percent of the fishers use the hand trolling line (Plate 3.6), locally known as *(rixa)*, which consists of a line and artificial lure, mainly made of heckle-neck feathers covering different sizes of hooks. The main species targeted by the *rixa* are dolphin fish *(Coryphaena hippurus)*, frigate mackerel *(Auxis hazard)* and amberjack *(Seriola dumerili)*. These fishers, the majority of which are part-timers owning vessels under 6m in length, frequently also use bogue traps (Plate 3.7). Octopus traps (Plate 3.8) are used by only 4.5% of fishers who own vessels of up to 12 metres in length.

Bogue traps are made of strips of cane and are baited with balls of bean flour laced with essence of salted herring, whilst octopus traps are made of metal wire and are baited mainly with mackerel and pieces of larger fish.

Drifting longlines are used by 10% of the fishers. In this case, the vessels are larger with the length ranging between 6 and 23.99 metres. This is because the target species are tuna/swordfish which are caught from around 20 miles offshore and beyond.

Plate 3.4 Bottom Longline

Plate 3.5 Trammel net

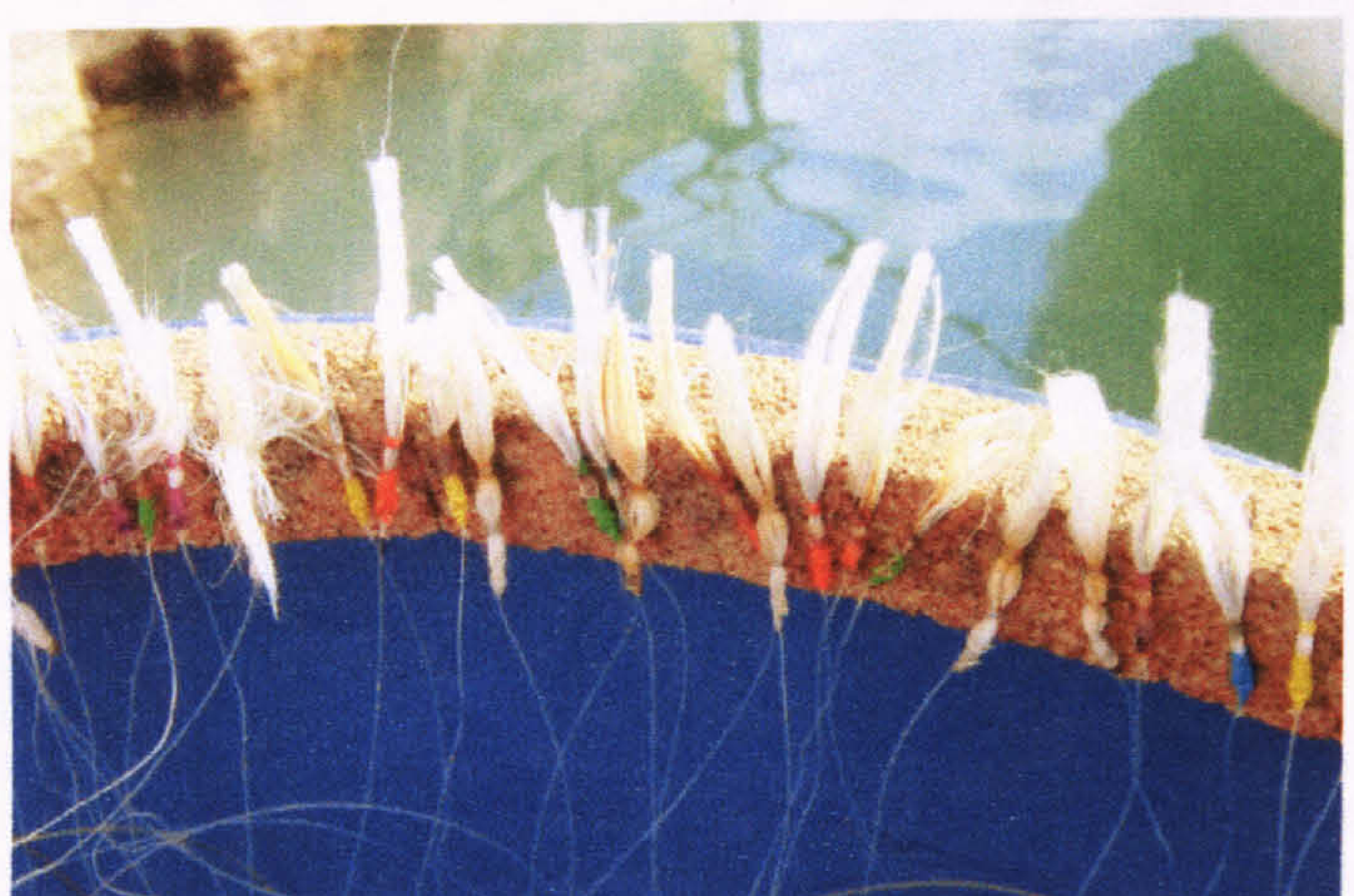


Plate 3.6 Trolling line

Plate 3.7 Bogue trap

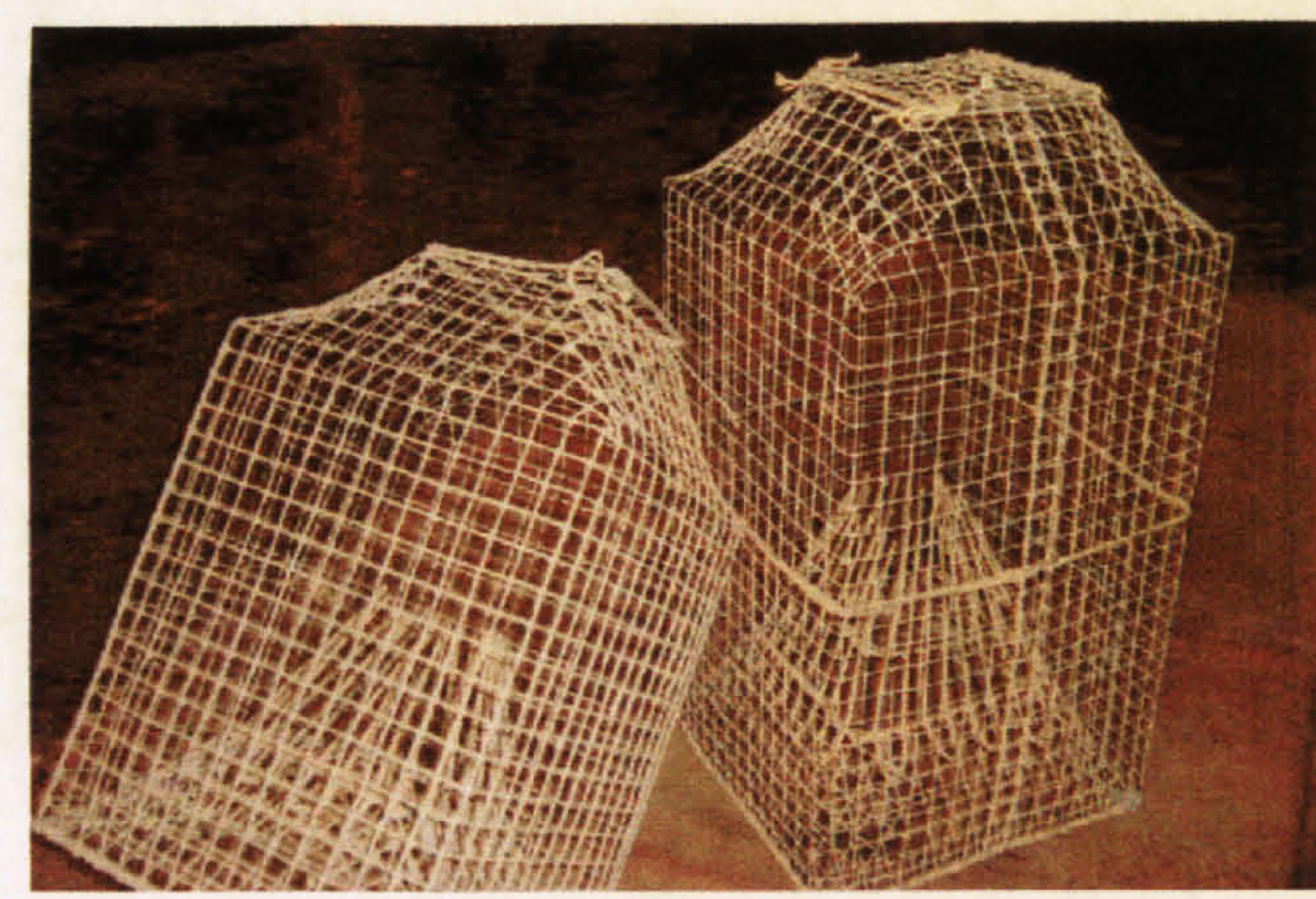


Plate 3.8 Octopus traps

3.1.3 Distribution of fishing activity

Results of the analysis carried out on the distribution of deployment of the main fishing gear by length class of vessels and zone are given in table 3.1.

It has been found that over 90 percent of the vessels in the 0-5.99 length class operate within territorial waters with set bottom longlines, hand trolling lines and trammel nets being the most common gears used. Vessels of this length class which venture beyond 12nm are mainly those which use fixed nets and longlines, albeit almost always within 25nm from the Island's baselines.

Vessels in the 6-11.99m length class also generally operate within 25nm with almost 65 percent of the activity occurring up to 12nm. A very small percentage of these vessels operate also in international waters i.e. beyond the 25 mile EFZ. The predominant gears are similar to those used by the smallest length class of vessels.

Fifty percent the larger vessels ranging between 12-23.99m in length operate beyond the Maltese EFZ of 25nm. The gears used by these vessels are almost exclusively drifting longlines and set bottom longlines, with the former mainly targeting swordfish and tuna, species often abundant in waters distant from coast. Only 25 percent of the vessels in this length class operate only in waters within 12nm.

Information on fishing areas was not available for the seven vessels of the 24m and over length class, however, with the exception of the three trawlers which tend to operate more within the Maltese EFZ (see section 3.3.1), it could be assumed that they operate both within 25nm and beyond (mostly) as in the case of the smaller size class up to 23.99m.

Vessels from 0 to 5.99 metres

Gear	Within Territorial Waters (12 nm)	Malta Fishing Zone (up to 25 nm)	Including International Waters	Fishing Area not known	Total
Lampara - (0111/0120)	0	0	0	0	0
Bottom Otter Trawl - (0312)	0	0	0	0	0
Trammel Net (Parit) & Combined Gillnet/Trammel Net - (0750/0760)	231	21	0	32	284
Traps (bogue) - (0821)	172	0	0	18	190
Pots (Octopus) - (0823)	47	0	0	2	49
Set Bottom longlines - (0931)	375	79	0	45	499
Set surface longlines - (0932)	8	0	0	0	8
Drifting longlines (Tonn/Pixxispad) - (0940)	9	5	2	2	18
Hand Trolling line (Rixa) - (0961)	289	15	1	30	335
TOTAL	1131	120	3	129	1383
% activity*	90.19	9.57	0.24		

Vessels from 6 to 11.99 metres

Gear	Within Territorial Waters (12 nm)	Malta Fishing Zone (up to 25 nm)	Including International Waters	Fishing Area not known	Total
Lampara - (0111/0120)	1	0	0	0	1
Bottom Otter Trawl - (0312)	0	0	0	0	0
Trammel Net (Parit) & Combined Gillnet/Trammel Net - (0750/0760)	109	50	1	24	184
Traps (bogue) - (0821)	33	0	0	3	36
Pots (Octopus) - (0823)	23	0	0	5	28
Set Bottom longlines - (0931)	194	117	14	29	354
Set surface longlines - (0932)	4	0	0	0	4
Drifting longlines (Tonn/Pixxispad) - (0940)	18	51	9	14	92
Hand Trolling line (Rixa) - (0961)	82	10	2	7	101
TOTAL	464	228	26	82	800
% activity*	64.62	31.75	3.62		

Vessels from 12 to 23.99 metres

Gear	Within Territorial Waters (12 nm)	Malta Fishing Zone (up to 25 nm)	Including International Waters	Fishing Area not known	Total
Lampara - (0111/0120)	3	1	0	2	6
Bottom Otter Trawl - (0312)	2	3	2	2	9
Trammel Net (Parit) & Combined Gillnet/Trammel Net - (0750/0760)	4	4	3	1	12
Traps (bogue) - (0821)	0	0	0	0	0
Pots (Octopus) - (0823)	1	0	0	0	1
Set Bottom longlines - (0931)	8	10	19	15	52
Set surface longlines - (0932)	1	0	0	0	1
Drifting longlines (Tonn/Pixxispad) - (0940)	5	10	29	18	62
Hand Trolling line (Rixa) - (0961)	1	0	0	1	2
TOTAL	25	28	53	39	145
% activity*	23.58	26.42	50.00		

Vessels from 24 metres +

Gear	Within Territorial Waters (12 nm)	Malta Fishing Zone (up to 25 nm)	Including International Waters	Fishing Area not known	Total
Lampara - (0111/0120)	0	0	0	0	0
Bottom Otter Trawl - (0312)	0	0	0	3	3
Trammel Net (Parit) & Combined Gillnet/Trammel Net - (0750/0760)	0	0	0	0	0
Traps (bogue) - (0821)	0	0	0	0	0
Pots (Octopus) - (0823)	0	0	0	0	0
Set Bottom longlines - (0931)	0	0	0	2	2
Set surface longlines - (0932)	0	0	0	0	0
Drifting longlines (Tonn/Pixxispad) - (0940)	0	0	0	2	2
Hand Trolling line (Rixa) - (0961)	0	0	0	0	0
TOTAL	0	0	0	7	7
% activity*					

Table 3.1 Distribution of deployment of main fishing gear (MALTASTAT code in brackets) by length class of vessels and zone. Dolphin-fish fishery was not included in this exercise due to its particular characteristics (see section 2.4.2.2, 3.3.6 and Annex X). *Vessels for which the fishing area was unknown were not considered when estimating % activity.

3.1.4 Target species

As can be seen from table 3.2, the main target species are demersal offshore species, caught specifically with set bottom longlines. Demersal inshore species are also highly targeted generally with trammel nets. Eighteen percent of the annual fishing activity focuses on *Coryphaena hippurus* (locally known as *lampuka*) as the main target species, with the majority of fishers in this case being part-timers using hand trolling lines. This activity takes place during the *lampuki* season i.e. from August to December.

Species group	% of fishing vessels
Small gregarious pelagic (01)	11.08
Large pelagic (02)	8.56
Demersal inshore (03)	22.16
Demersal offshore (04)	38.52
Sessile organisms (05)	0.08
Special fish, monospecies and similar (06)	0.84
Dolphin fish (07)	18.09
Octopus (08)	0.67

Table 3.2 Fishing activity by target species (n = 2383)

Eleven percent of the fishing activity targets small gregarious pelagics with the preferred gear being bogue *(Boops boops)* traps, deployed in inshore waters. On the other hand, large pelagics are targeted at sea by 9 percent of vessels, mainly with drifting longlines. Longlining for swordfish is carried out throughout the year, whilst tuna are targeted during May, June and July when this fish migrates through the Mediterranean.

3.1.5 Operational Units

Data on parameters used to identify Maltese Operational Units are included in Annex III. Thirteen Operational Units were identified within the Maltese fleet of which seven could be classified as artisanal and contain more than 86 percent of the fishing units (figure3.3). Other major Operational Units are those related to the dolphin fish FAD fishery, swordfish longlining and drifting longlining for other large pelagic fish such as tuna. Very few fishing units make up the lampara and trawling Operational Units.

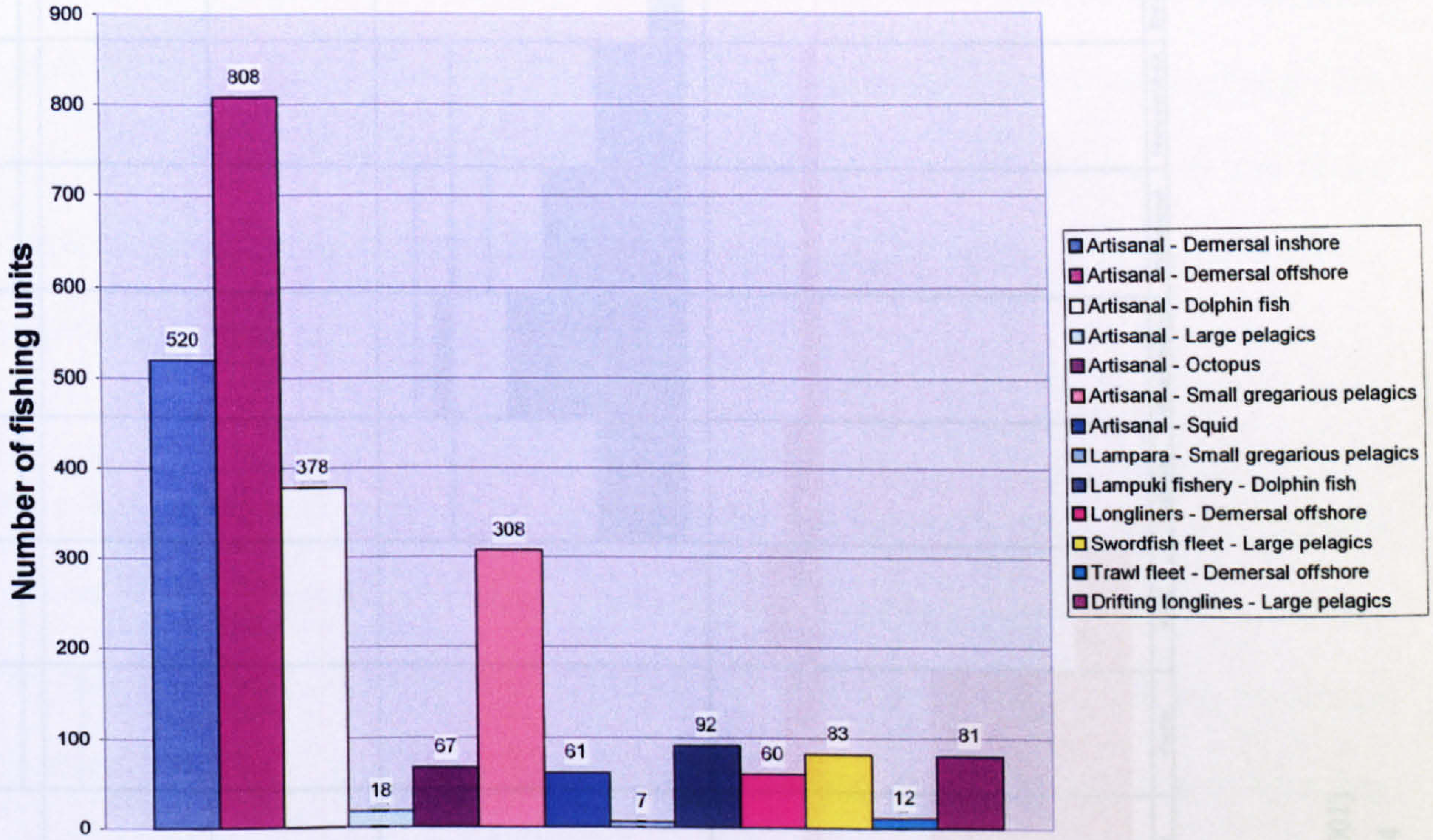


Figure 3.3 Operational Units of the Maltese fishing fleet

3.2 Relative importance of different fisheries

3.2.1 Seasonality and landings

Figure 3.4 illustrates the average monthly landings (1997-2001) for species whose landings are in excess of 1 metric tonne. This figure clearly shows that annual landings are highest for the highly migratory species tuna, dolphin fish and swordfish, but particularly in the former two species the landings are seasonal.

Figure 3.4 Average monthly landings of species exceeding 1 metric ton (1997 – 2001)

Between the months of April to July the market is dominated by landings of bluefin tuna with the second most available species being the swordfish. Both these species are targeted with the same method i.e. pelagic drifting longlines but which have slightly different characteristics. These are mainly 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. This is due to the fact that tuna are stronger than swordfish and in fact, before these characteristics were introduced loss of fish was as high as 70 percent through the breaking of both lines and hooks.

Swordfish is the third most landed species annually in terms of weight and it is the only species with landings of more than 1mt per month throughout the year. It is targeted throughout the year, albeit in varying degrees and for different reasons. During the winter months (December - April) most boats target lucrative demersal species prior to reverting to tuna longlining which catches swordfish and albacore as a secondary species. The peak fishing period for swordfish is between May and August.

Landings of lampuki occur mainly between August and December mostly by the FAD fishery but if weather conditions remain favourable the season drags on into January. Other major species associated with the dolphin fish fishery are pilot fish, amberjack and small blue fin tuna, which are caught as secondary species found in considerable concentrations under FADs.

No seasonal trend in landings of small gregarious pelagic and demersal species is evident from figure 3.4 and, except in the case of mackerel; the species in these groups are landed in quantities less than 5mt per month. Bogue appears to be the most landed small pelagic species caught mostly by traditional traps made out of cane strips followed by mackerel. The landings of prawns originate exclusively from trawling which takes place throughout the year with quantities reducing in winter months due to unfavourable weather. Landings of other demersal species originate from trawling, longlining and fixed netting operations.

3.2.2 Annual production

Data on landings for the period 1994 – 2001 together with landings gear indices (LGIs) are included in Annex V and VI respectively. The relative importance of each gear category or fishery in terms of annual production (weight and value) is summarised in table 3.3.

Over 65 percent of the annual landings (925 metric tonnes) originate from the tuna and dolphin fish fisheries and contribute to almost 56 percent of the total annual value. Trawling, bottom longlining and swordfish longlining have similar importance in terms of both weight and value.

3.2.3 Relative importance of 25 mile Exclusive Fishing Zone

It has been estimated that fifty percent in terms of weight and 56 percent in terms of value of the total annual landings are extracted from within the EFZ. The 25nm zone is relatively far more important for all demersal gears which mostly target fish within the zone.

Gear or Fishery	Annual landings (kg)	% of total annual landings	Value of annual landings (Lm)	% of total annual value
Trawls	68274	7.38	167802	11.05
Trammel nets	8608	0.93	10082	0.66
Bottom longlines	89899	9.72	211275	13.91
Other demersal gears	19604	2.12	23003	1.51
Tuna surface longlines	275152	29.76	494701	32.58
Swordfish surface longlines	90270	9.76	217185	14.30
Surface longlines and other pelagic gears	39049	4.22	39224	2.58
FAD fishery	333833	36.10	355178	23.39
Total	924688		1518450	

Table 3.3 Annual landings (average 1994 – 2001, weight and value) by gear category or fishery.

Gear or Fishery	Relative distribution of fishing effort*		
	Up to 12 nm	Up to 25 nm	Including international waters
Trawls	0.29	0.43	0.29
Trammel nets	0.69	0.27	0.03
Bottom longlines	0.57	0.32	0.11
Other demersal gears	1.00	0.00	0.00
Tuna and swordfish surface longlines	0.17	0.43	0.40
Surface longlines and other pelagic gears	0.90	0.09	0.01
FAD fishery	0.05	0.10	0.85

Table 3.4 Relative distribution of fishing effort by gear category or fishery and zone (* based on calculation described in 2.3.3)

Gear or Fishery	Vessels operating up to 12nm		Vessels operating up to 25 nm		Vessels operating also beyond 25 nm	
	Annual landings (%)	Value of annual landings (%)	Annual landings (%)	Value of annual landings (%)	Annual landings (kg)	Value of annual landings (%)
Trawls	2.11	3.16	3.16	4.74	2.11	3.16
Trammel nets	0.65	0.46	0.26	0.18	0.03	0.02
Bottom longlines	5.58	7.99	3.08	4.40	1.07	1.52
Other demersal gears	2.12	1.51	0.00	0.00	0.00	0.00
Tuna and swordfish surface longlines	6.91	8.20	16.83	19.97	15.78	18.72
Surface longlines and other pelagic gears	3.79	2.32	0.38	0.23	0.06	0.03
FAD fishery	1.81	1.17	3.61	2.34	30.69	19.88
Total	**22.97**	**24.81**	**27.31**	**31.86**	**49.72**	**43.33**

Table 3.5 Relative distribution of production by gear category or fishery and zone

3.3 Spatial distribution of fishing effort

3.3.1 Trawling

The trawlable[21] areas within the 25 mile EFZ cover a total area of about 1600km of which about 10 percent lies within 3 nm from the Islands' baselines and has been protected from trawling for more than 15 years (as mentioned in section 1.1). Only about 240km of trawlable area is found in waters deeper than 200m i.e. slope and deep waters. The trawlable areas around the Maltese Islands are illustrated in figure 3.5.

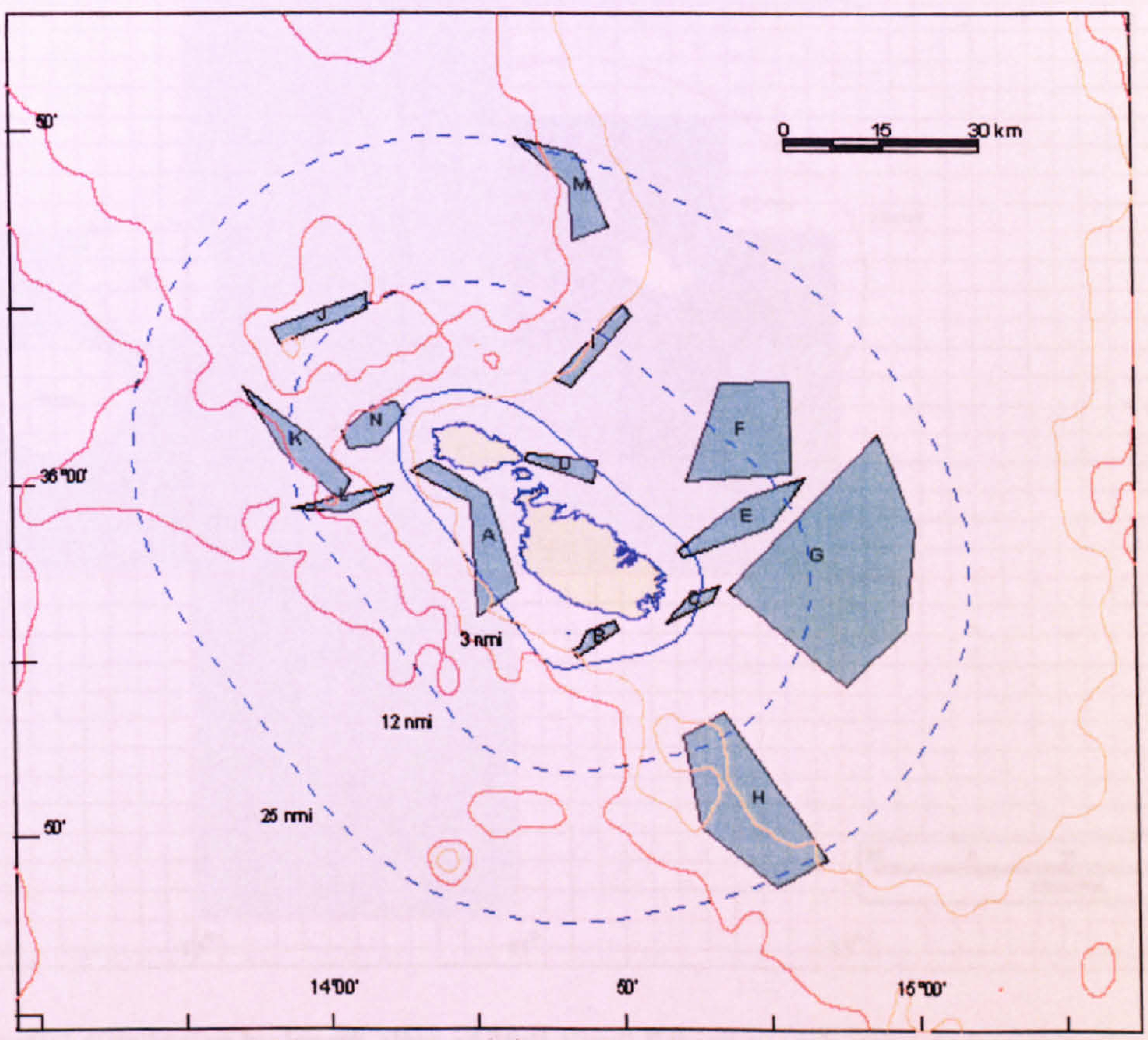


Figure 3.5 Trawlable areas around the Maltese Islands (A, B, C, D – protected; E, F, G, H, I – shelf / shallow; J, K, L, M, N – slope / deep). Adapted from Giudicelli (1978).

[21] The term "trawlable" means that the bottom type allows the commonly used Mediterranean otter trawl (Mazara type) to operate effectively. It is designed to operate on sandy and muddy bottoms with no beams, chains or rock hoppers attached to the ground rope to operate on hard substrates.

3.3.2 Bottom longlining

As demonstrated by figure 3.6, bottom longlining is practised over vast areas which extend beyond the Maltese EFZ; however, the category of vessels between 4 – 7m in length, which make up about 45 percent of the full-time fishing fleet, operate within limited concentrated areas close to their base port.

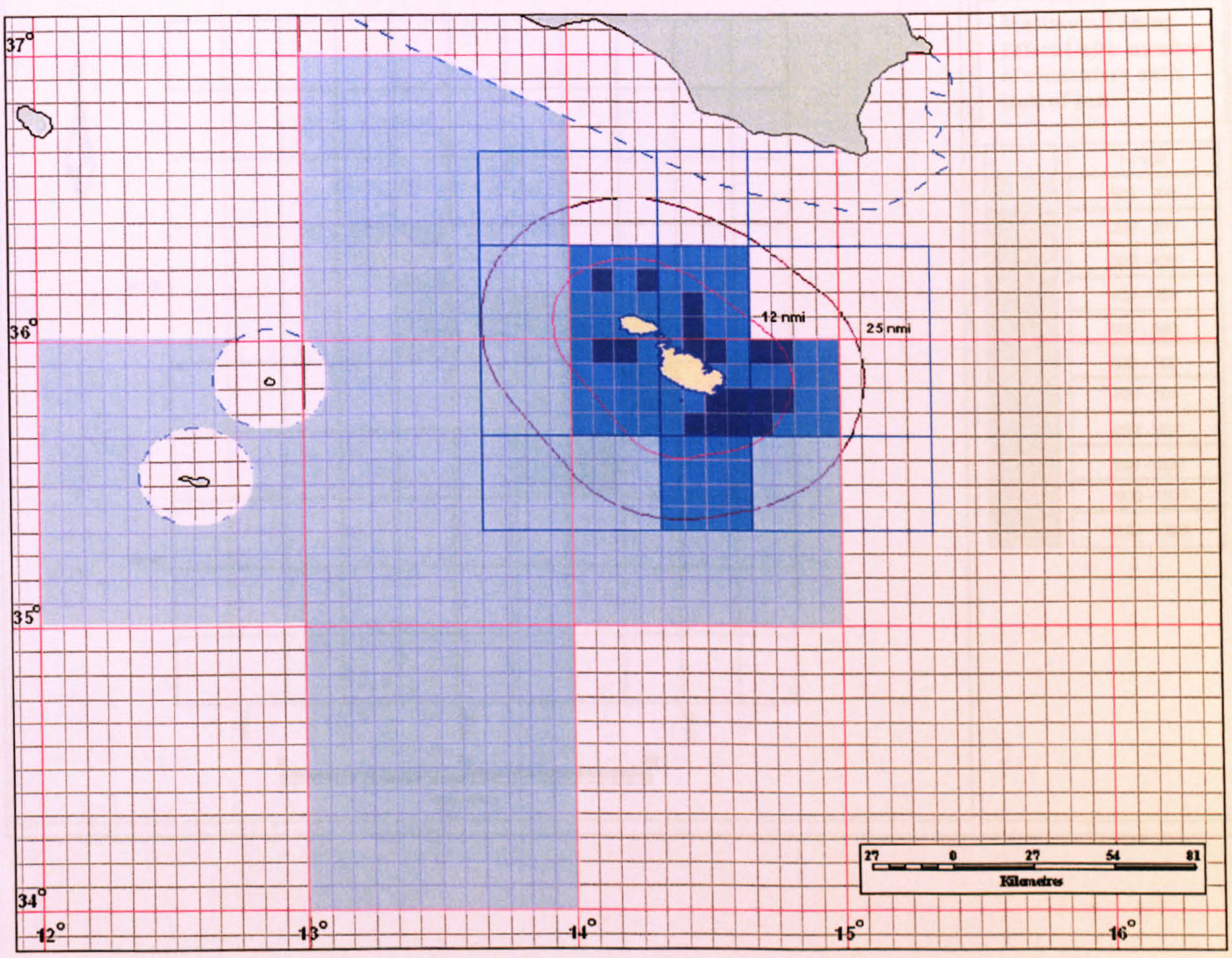
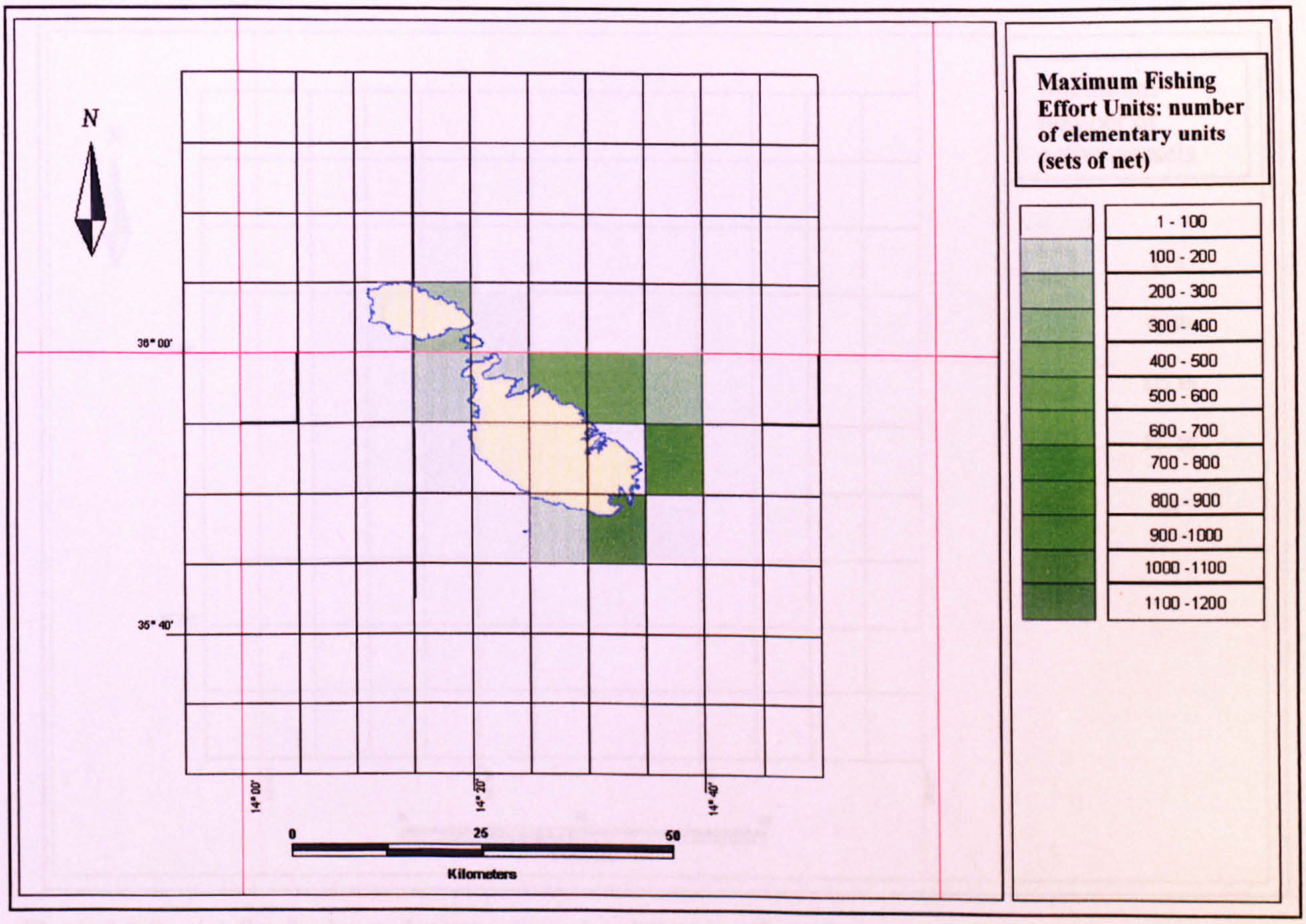


Figure 3.6 Spatial distribution by length class of "full-time" fishing vessels using bottom longlines; ■ = 4-7m vessels; ■ = 7-13m vessels; ■ = 13-25m vessels. Darker colours also denote higher fishing intensity per km^2 in terms of number of vessels.

3.3.3 Trammel netting

From figure 3.7 it is evident that the effort exerted by trammel nets is concentrated within a short radius around the major fishing ports with large areas being very slightly exploited or unexploited.



3.3.4 Bogue traps

As in the case of trammel net fishing, the effort exerted by bogue traps is concentrated within a short radius around the major fishing ports with large areas being very slightly exploited or unexploited (figure 3.8).

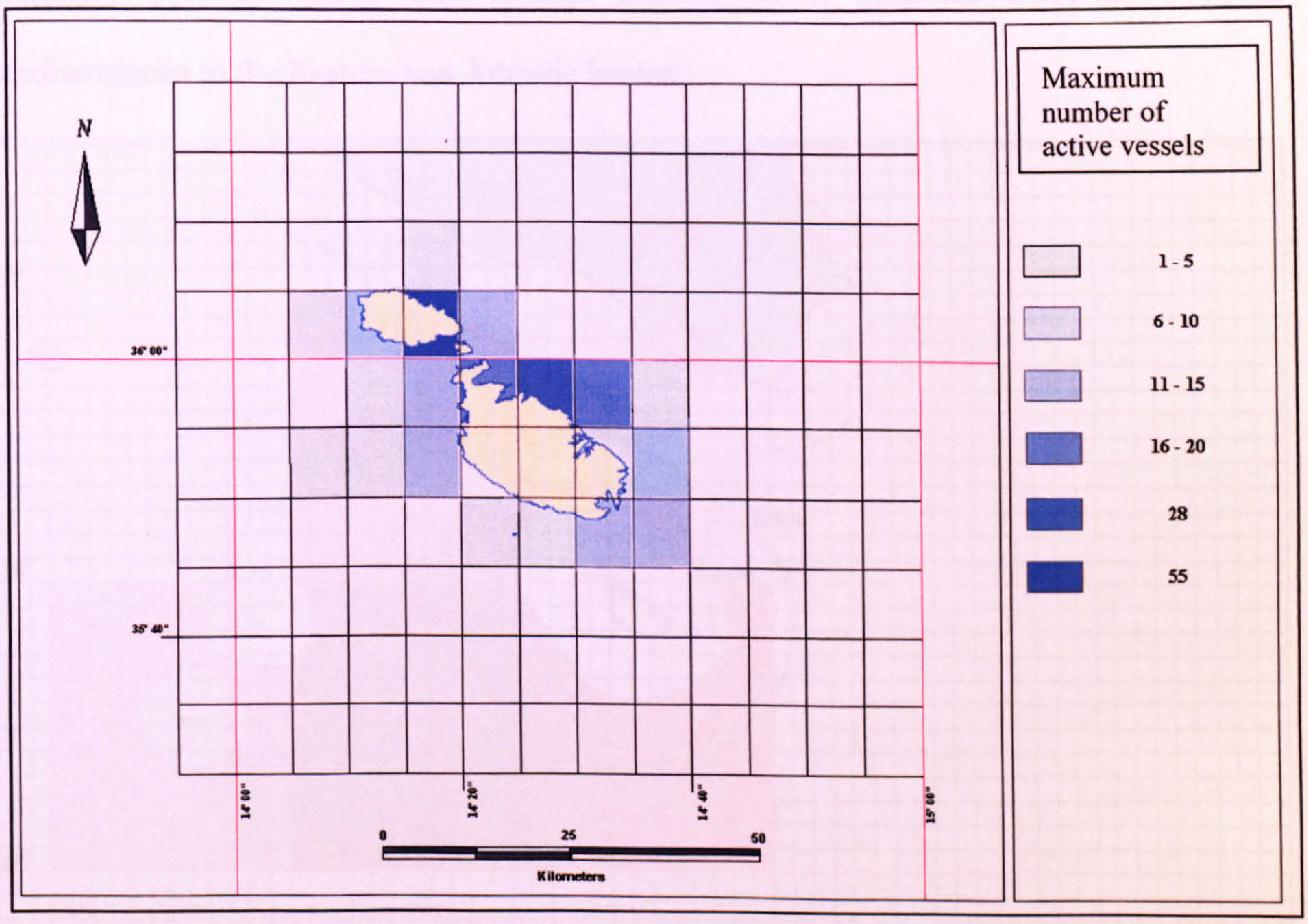


Figure 3.8 Spatial distribution and relative intensity of fishing effort of bogue trap fishing in terms of number of vessels – all size classes of vessels

3.3.5 Blue-fin tuna longlining

The analysis carried out on the fishing zone data contained in the fleet register database, has revealed that the fishing intensity for bluefin tuna mostly takes place beyond the 25nm Zone especially to the south west of the Islands (figure 3.9). This correlates well with the migratory pathway which this species follows as it migrates from the western Mediterranean to the Eastern and Adriatic basins.

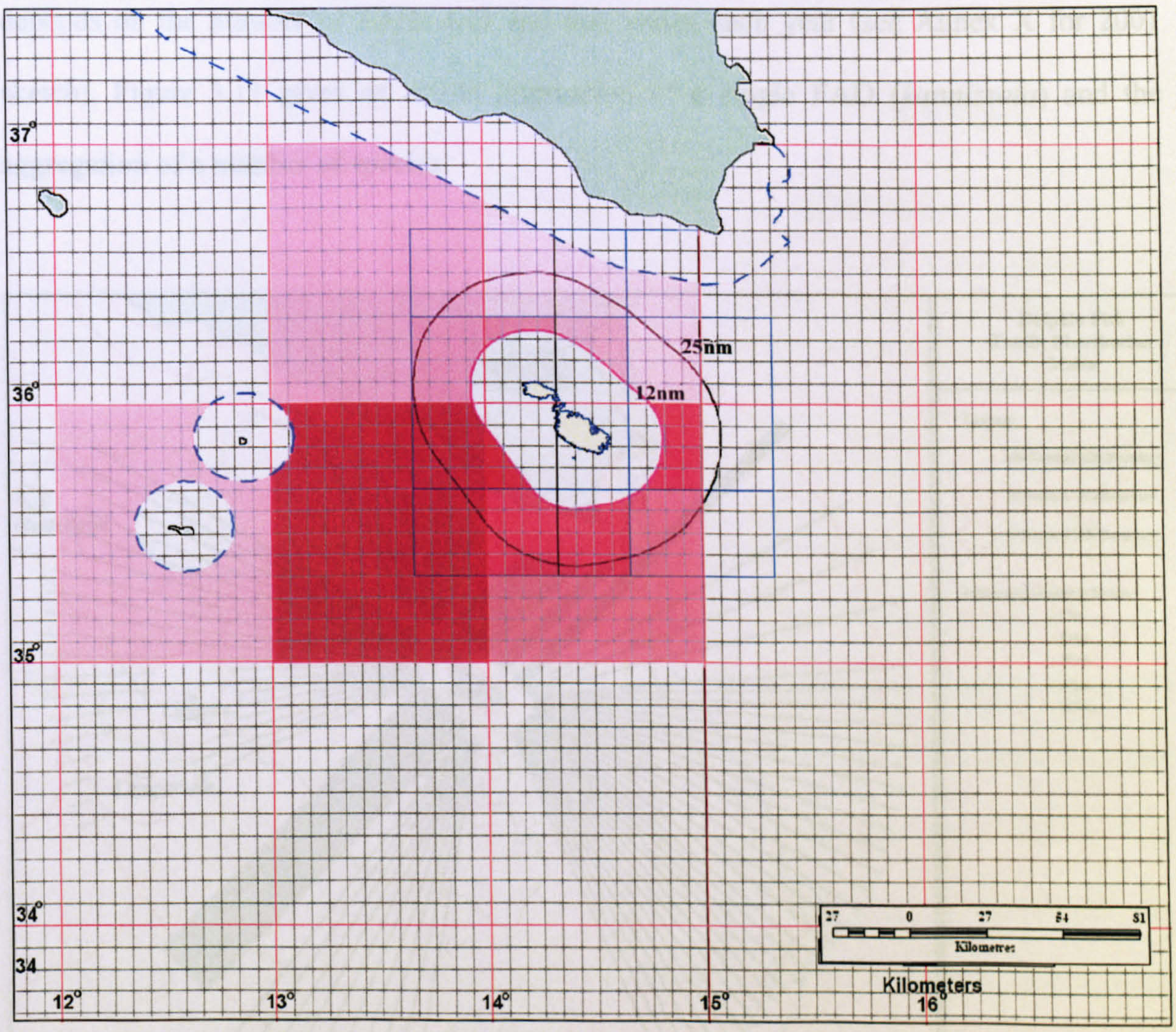


Figure 3.9 Spatial distribution and relative intensity of fishing effort (in number of vessels) of blue-fin tuna longlining for the period May – July (tuna season)

3.3.6 Dolphin fish *kannizzati* fishery

A brief description of the traditional dolphin fish fishery together with results of catch and effort survey carried out during the 2001 season is attached in Annex X. Figure 3.10 illustrates the plan for the deployment of FADs (*kanizzati*) along pre-set directions or *rimjiet*; the coordinates of the first FAD of each *rimja* as well as the bearing of each *rimja* remain the same each year, however, the outward extension of FADs along each *rimja* depends on the number of FADs laid and this varies each year (see Annex X for 2001 sketch). Figure 3.11 gives an artists impression of a single FAD (*kannizzata*) and the aggregation of a number of species.

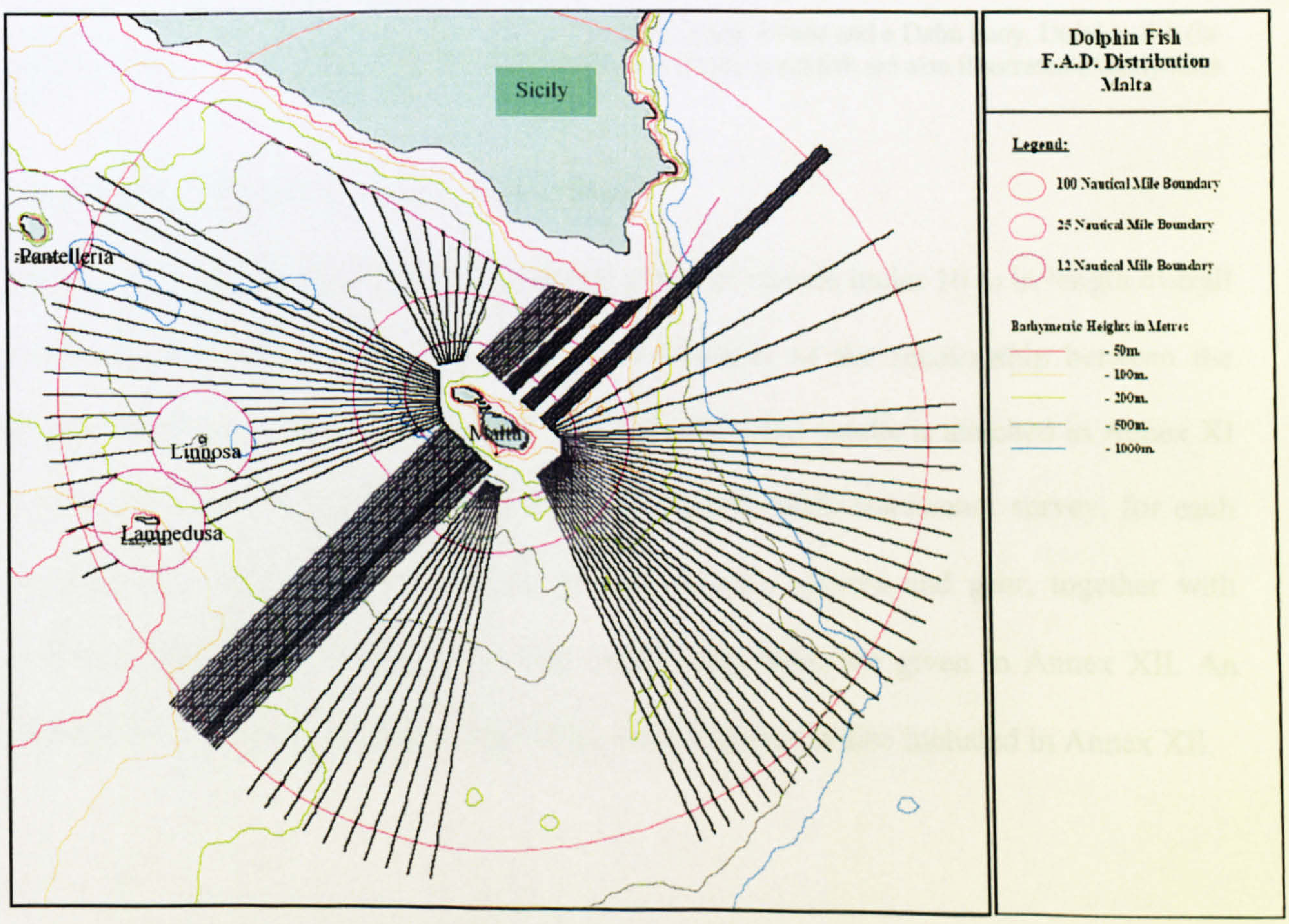


Figure 3.10 Dolphin fish FAD *rimjiet*. FADs (*kannizzati*) are laid along each line every quarter or half a mile. Each *rimja* is allocated to one vessel by drawing lots. The total number of *rimjiet* is 130.

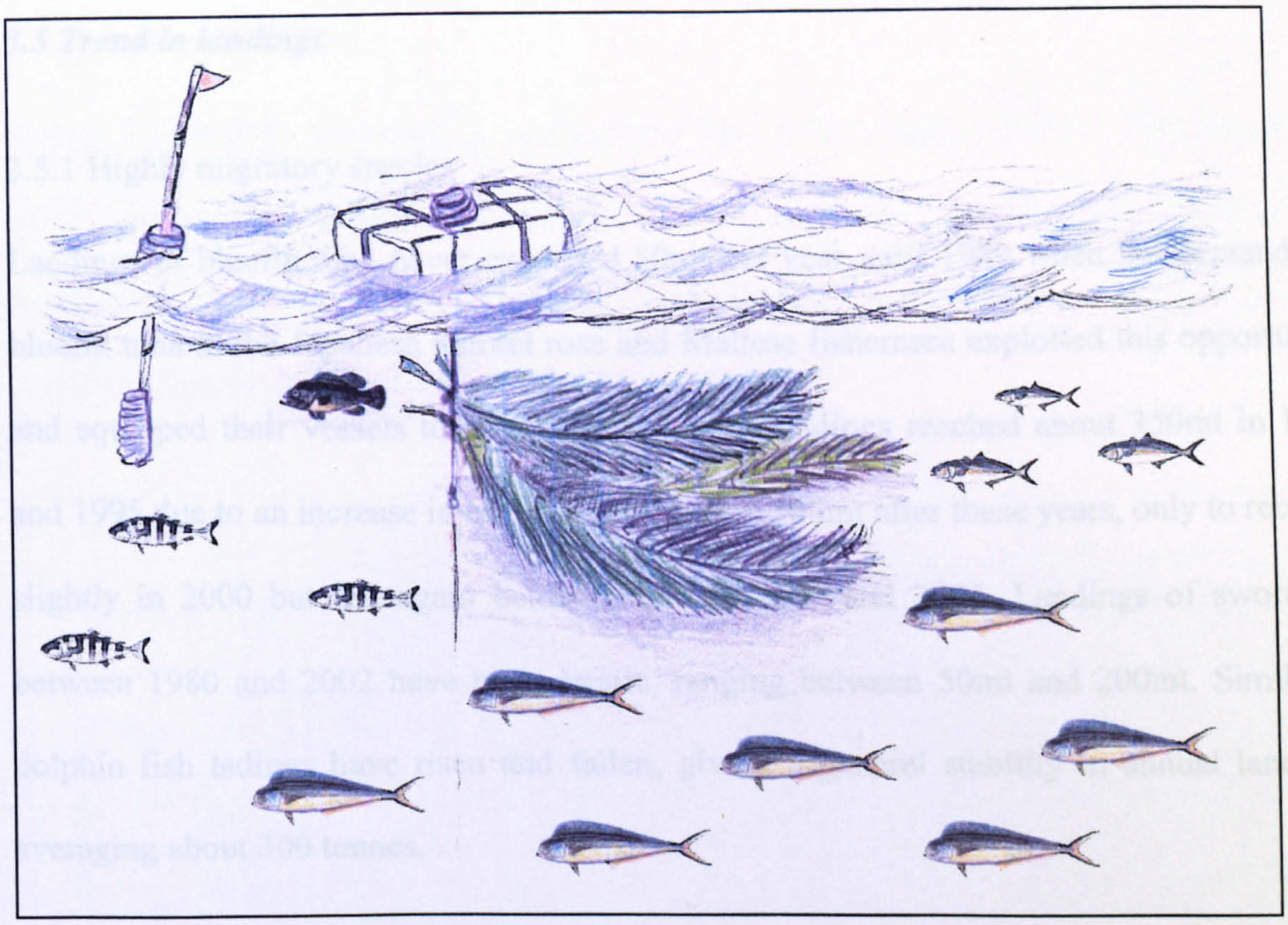


Figure 3.11 A *kannizzata* rigged up with a polystyrene block, palm fronds and a Dahn buoy. Dolphin fish (in majority) together with pilot fish (striped), amberjack and a single wreckfish are also illustrated (Anonymous artist).

3.4 Activities of small scale fleet (under 10 m)

Results of the preliminary study on catch and effort of vessels under 10 m in length overall are included in Annex VII. A preliminary assessment of the relationship between the structural characteristics of vessels and catches using these results is attached in Annex XI Catch and effort estimates, obtained from the second catch assessment survey, for each sampling port and the entire country, by day, month, species and gear, together with summary statistics on the activity of the small scale fleet, are given in Annex XII. An evaluation of slope (over 200m depth) small scale fisheries is also included in Annex XII.

3.5 Trend in landings

3.5.1 Highly migratory species

Landings of bluefin tuna never exceeded 50mt per year until 1989 when the demand for bluefin tuna in the Japanese market rose and Maltese fishermen exploited this opportunity and equipped their vessels to target this species. Landings reached about 350mt in 1994 and 1995 due to an increase in effort but fell below 300mt after these years, only to recover slightly in 2000 but fell again below 200mt in 2001 and 2002. Landings of swordfish between 1980 and 2002 have been erratic, ranging between 50mt and 200mt. Similarly, dolphin fish ladings have risen and fallen, giving a general stability in annual landings averaging about 300 tonnes.

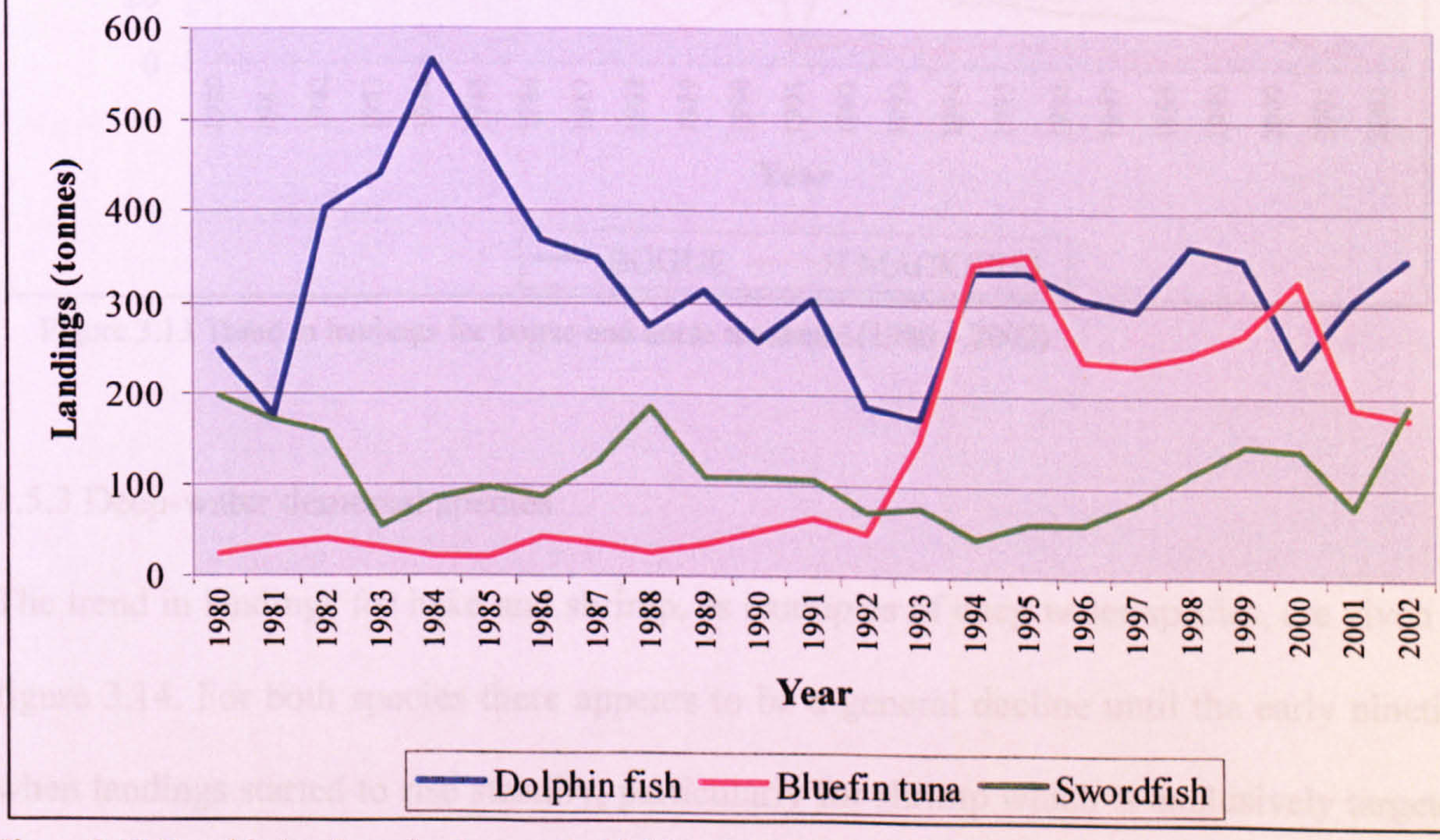


Figure 3.12 Trend in landings for three main highly migratory species (1980 – 2002)

3.5.2 Semi-pelagic species

Figure 3.13 shows the trend in landings for two semi-pelagic species. The remarkable decline in landings between 1980 and 1991 for both species may be attributable to low prices and negligible market interest. The landings since 1991 have not risen by any significant amount.

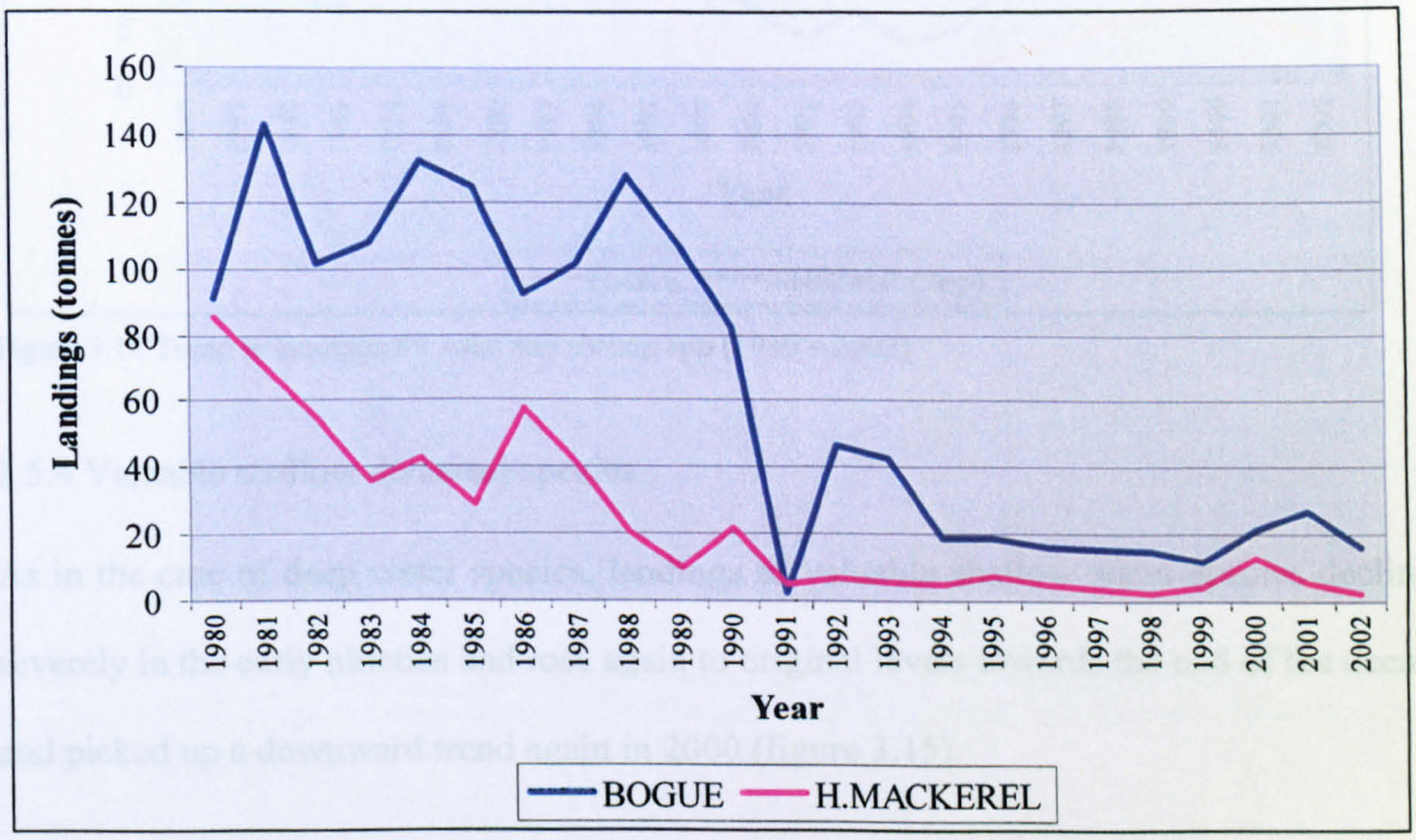


Figure 3.13 Trend in landings for bogue and horse mackerel (1980 – 2002)

3.5.3 Deep-water demersal species

The trend in landings for hake and shrimp, as examples of deep water species, are given in figure 3.14. For both species there appears to be a general decline until the early nineties when landings started to rise steadily, particularly for shrimp which is exclusively targeted by trawling. This increase may be attributed to an increase in effort for these deep water species of high market value.

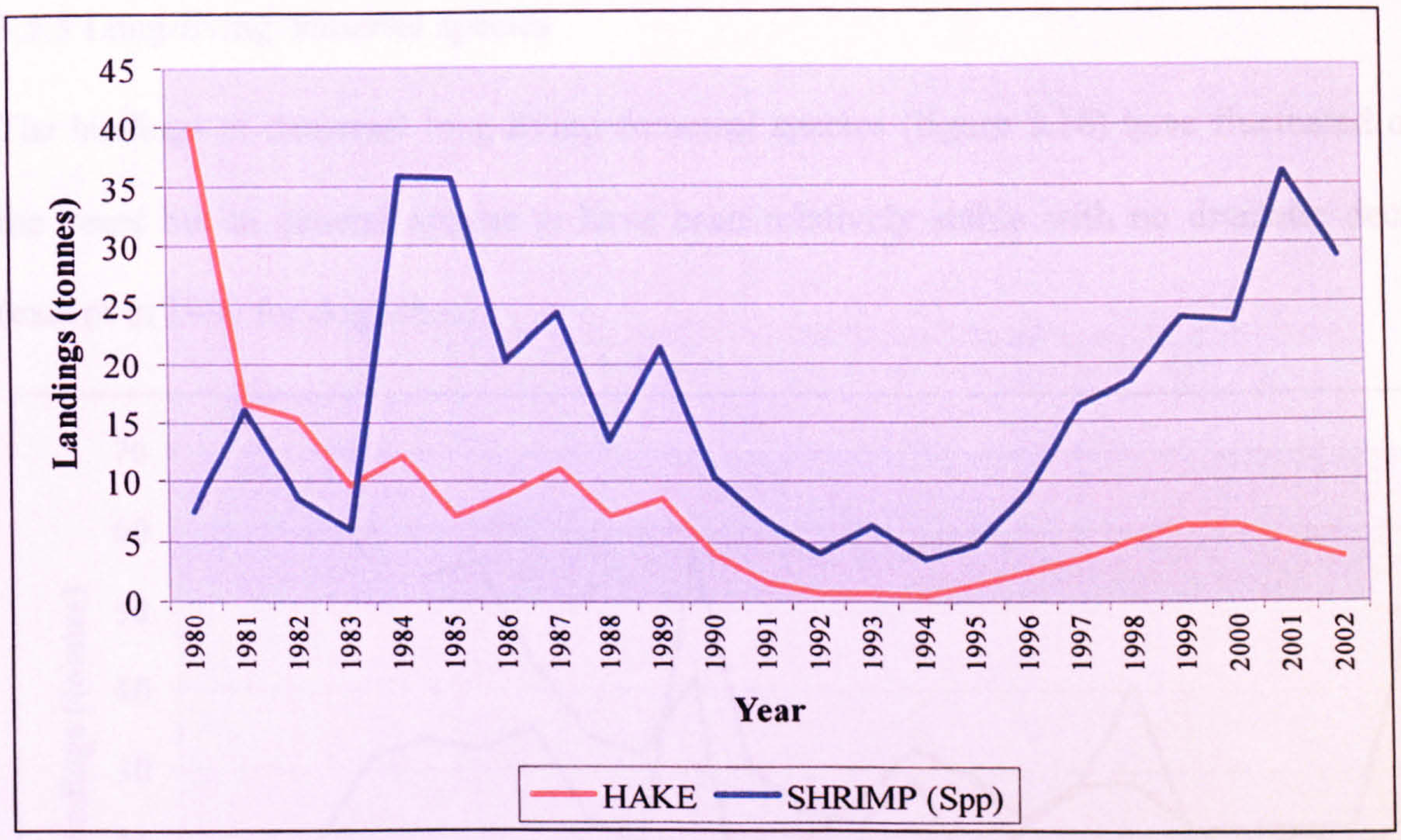


Figure 3.14 Trend in landings for hake and shrimp spp (1980 – 2002)

3.5.4 Valuable shallow demersal species

As in the case of deep water species, landings of valuable shallow water species declined severely in the early nineties and rose again to original levels towards the end of the decade and picked up a downward trend again in 2000 (figure 3.15).

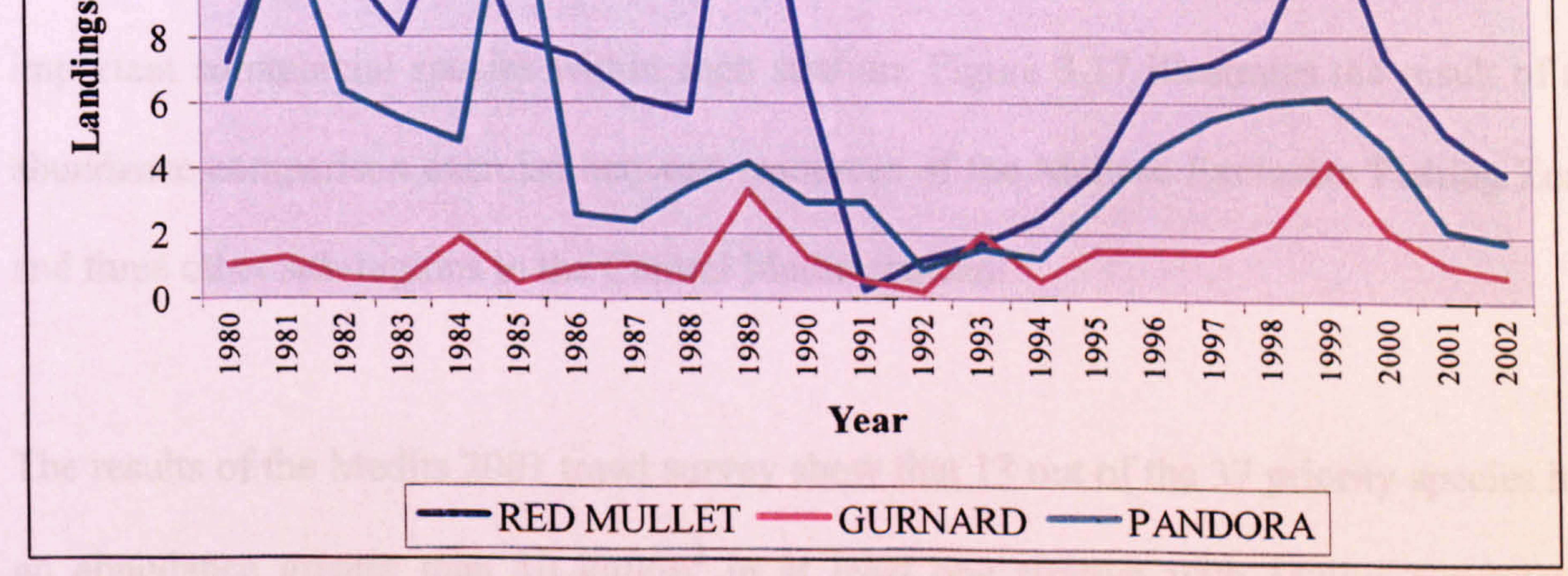


Figure 3.15 Trend in landings for red mullet, gurnard and pandora (1980 – 2002)

3.5.5 Long-living demersal species

The landings of demersal long-living demersal species (figure 3.16) have fluctuated over the years but in general appear to have been relatively stable with no dramatic decline (except in 1990 for dogfishes).

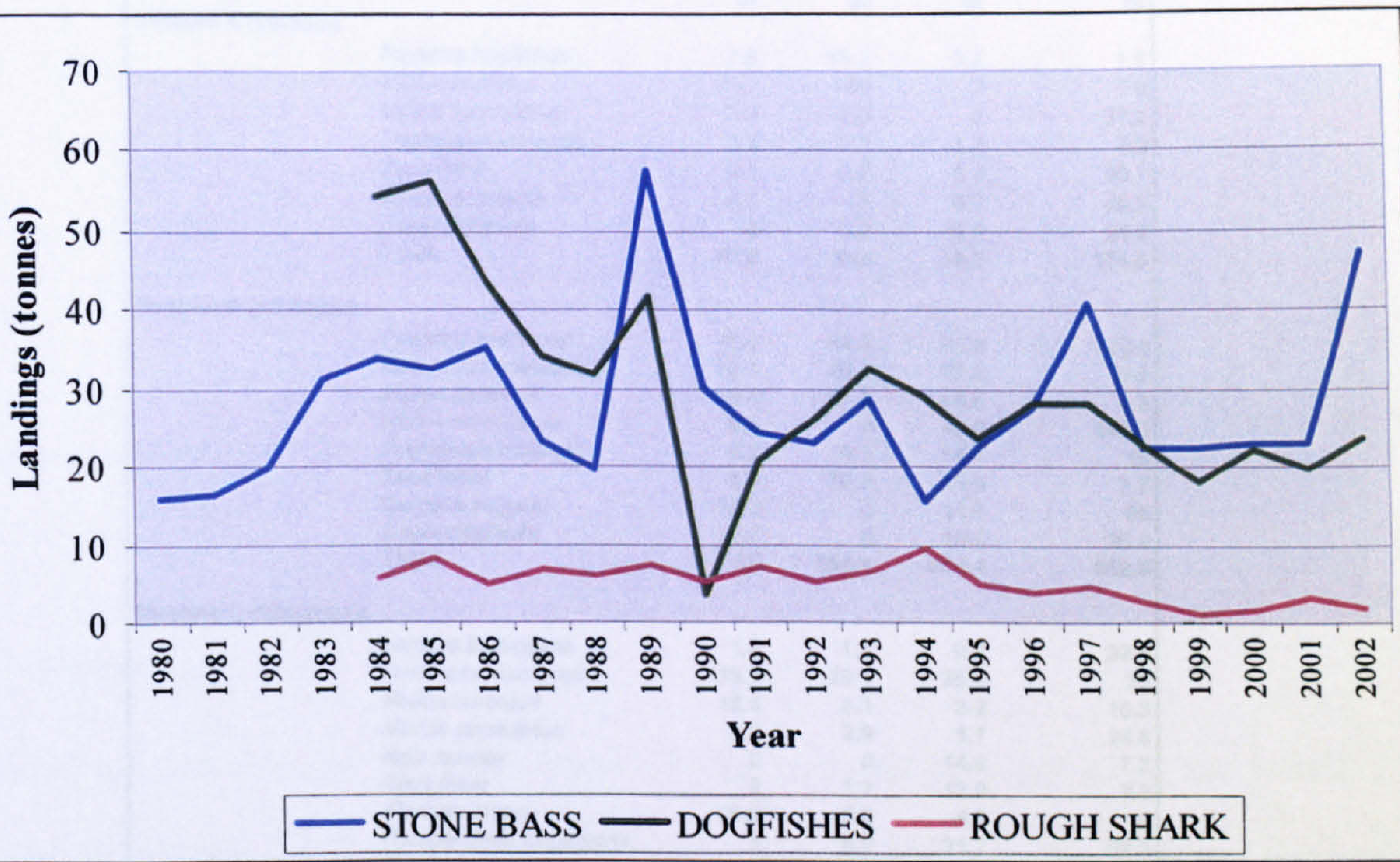


Figure 3.16 Trend in landings for stone bass, dogfish and rough shark

3.6 Abundance of demersal resources

Reports describing the results in terms of biomass and density indices by species and stratum derived from trawl surveys conducted in 2000 and 2001 are included in Annex XIV and XV. Table 3.6 presents abundance data by stratum and sub-region for the most important commercial species within each stratum. Figure 3.17 illustrates the result of an abundance comparison exercise between resources of the Maltese Exclusive Fishing Zone and three other sub-regions in the Central Mediterranean.

The results of the Medits 2001 trawl survey show that 13 out of the 37 priority species had an abundance greater than 10 kg/km^2 in at least one stratum with *Mullus surmuletus*, *Pagellus erythrinus* and *Octopus vulgaris* having impresive values in particular strata which exceeded 340 kg/km^2, 120 kg/km^2 and 80 kg/km^2 respectively. The comparison of abundances between the 4 sub-regions (table 3.6, figure 3.17) revealed that the overall average abundance of the first four strata (10-500m) taken together is very much higher within the Maltese EFZ.

	Species	M3a	M3b	M3c	M3d (Malta)
		BI	BI	BI	BI
Stratum A (10-50m)					
	Pagellus erythrinus	7.8	96.2	3.2	1.9
	Mullus barbatus	22.2	148	2	0
	Mullus surmuletus	0.2	0.3	0	31.2
	Trigloporus lastoviza	0.2	0.1	1.2	7.3
	Zeus faber	0.1	0.7	0.3	20.7
	Octopus vulgaris	2.1	18	6.7	86.2
	Sepia officinalis	9	0.7	2.9	24.5
	Total	**41.6**	**264**	**16.3**	**171.8**
Stratum B (50-100m)					
	Pagellus erythrinus	15.6	64.6	22.9	122.4
	Merluccius merluccius	12.7	30.8	22.8	6.8
	Mullus barbatus	18.4	67.9	56.6	4.3
	Mullus surmuletus	0.2	0	40.9	343.5
	Trigloporus lastoviza	0.2	0.3	14.4	15
	Zeus faber	6.9	70.8	16.5	7.7
	Octopus vulgaris	12.3	0	14.7	88
	Sepia officinalis	2.7	0	16.6	25.2
	Total	**69**	**234.4**	**205.4**	**612.9**
Stratum C (100-200m)					
	Lophius budegassa	1.7	1.7	0.2	32.8
	Merluccius merluccius	18.1	29.1	25.3	20
	Mullus barbatus	12.4	8.1	3.2	10.3
	Mullus surmuletus	0.2	2.9	1.7	24.6
	Raja clavata	0	0	14.6	7.2
	Zeus faber	2	1.7	12.9	7.2
	Eledone cirrosa	25.2	5.2	4.6	0
	Parapenaeus longirostris	5	6.3	21.2	52.3
	Total	**64.6**	**55**	**83.7**	**154.4**
Stratum D (200-500m)					
	Helicolenus dactylopterus	3.8	1.9	3.5	6.5
	Lophius budegassa	4.8	9.3	7.1	14.5
	Merluccius merluccius	16.2	18.5	22.2	23
	Phycis blennoides	8.2	9.2	6.3	5.8
	Raja clavata	2.9	0	8	36.1
	Scyliorhinus canicula	1	0.8	3.5	32.5
	Parapenaeus longirostris	9.4	11.4	36.5	23.3
	Nephrops norvegicus	4.2	1.1	6.6	10.7
	Total	**50.5**	**52.2**	**93.7**	**152.4**
Stratum E (500-800m)					
	Helicolenus dactylopterus	0.8	0.3	1.9	0
	Lophius budegassa	0.5	1.5	4.9	2.6
	Merluccius merluccius	0.4	3	3.4	0
	Phycis blennoides	6.8	5.9	10	1
	Galeus melastoma	32.8	19.1	33.1	1.2
	Aristeomorpha foliacea	17.7	11.6	30.3	33.8
	Aristeus antennatus	5.4	7.4	3.3	3.3
	Total	**64.4**	**48.8**	**86.9**	**41.9**

Table 3.6 Abundance (Biomass Index (BI): kg/km2) of the most important species by stratum in MEDITS M3 sub-regions (2001 survey)

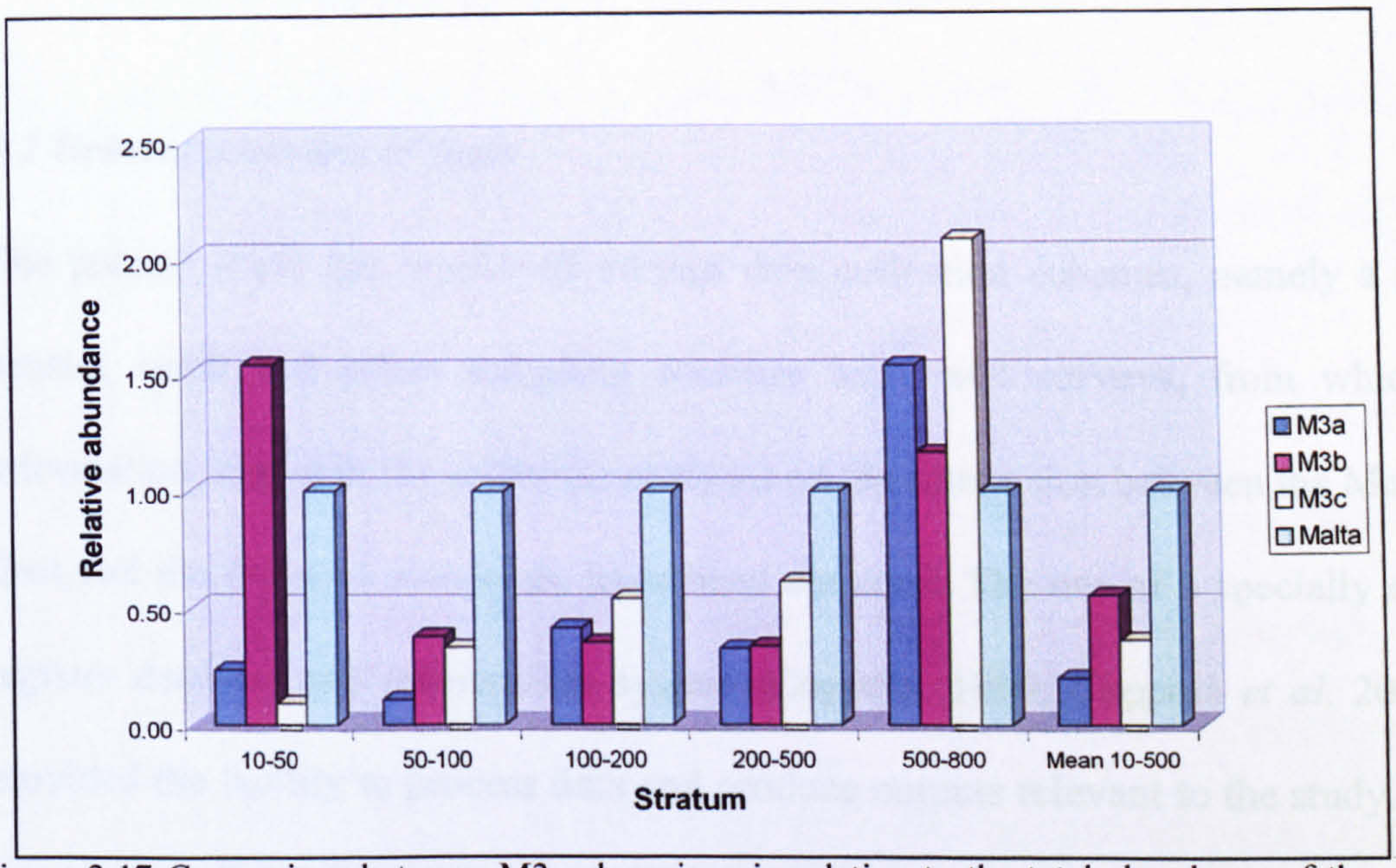


Figure 3.17 Comparison between M3 sub-regions in relation to the total abundance of the most important species by stratum (2001 survey)

3.7 Conclusion

The results described in this chapter provide the basis for discussions on the activities of the Maltese fishing fleet and the status of fisheries resources they target. There are several implications which emerge from the fleet profile, maps of the spatial distribution of fishing effort, results of the relative importance of different fisheries, dynamics of the small scale fleet, trends in landings as well as from the indices of abundance of demersal resources obtained from two pioneer trawl surveys. These implications are considered in Chapter 4 in which an evaluation of the fishing fleet activities and their interactions with resources, an interpretation of the trends in landings and a review of the information generated from the trawl surveys are carried.

Chapter 4. Discussion

4.1 General overview of study

The present study has employed various data collection schemes, namely a fishing fleet census, catch and effort sampling schemes and trawl surveys, from which data and information, useful in the scientific analyses on the interaction between the Maltese fishing fleet and the fisheries resources, have been obtained. The use of a specially adapted fleet register database and information system (Coppola, 1999; Coppola *et al.* 2003) has also provided the facility to process data and produce outputs relevant to the study. However, it must be noted that the study has had to rigidly make use of national and international data collection schemes, initiated and conducted during the study period, which have provided the only research opportunities for the author (see sections 1.4 and 1.8); options for the improvement of these schemes and suggestions for future data collection and research programmes are addressed later on in this document in section 5.3.

In the sections to follow, the results obtained from this study will be analysed with particular focus on the sustainability of fisheries resources targeted by the Maltese fleet. Although, stock assessment *per se* was not included in the framework of this study, mainly due to a lack of time series data, a status measure of the fisheries resources was obtained from fish market landings data and abundance indices. The latter, estimated for demersal resources, are very important in evaluating the impact of the fishing fleet upon the 25 mile EFZ, especially if these are compared with adjacent areas for which a biological reference point has been defined. Correlating the characteristics and activity of the Maltese fishing fleets involved in various fisheries (emerging from aims i, ii and iii of this study) with the findings on the status of resources provides answers to aims iv and v of this study (see section 1.4), which in turn suggest options to draw up a sustainable management regime (aim vi of this study).

4.2 Evaluation of the activity of the Maltese fishing fleet

The profile of the Maltese fishing fleet and its activities described in the results obtained in this study (sections 3) clearly demonstrate the largely traditional, artisanal and small scale nature of the fishing industry. On the whole, the preferred target species are inshore and offshore demersals together with dolphin fish, with the former being generally caught with trammel nets and bottom longlines from within the Maltese EFZ (see table 3.1 and 3.2). The preferred gear of vessels over 12 metres are surface longlines targeting large pelagic species, however, other artisanal gears used by the smaller classes are also used (see figure 3.2). Nevertheless, vessels of all sizes generally belong to more than one Operational Unit (see figure 3.3) and would thus be subject to the different respective effort management regimes should the Operational Unit management concept be adopted at regional level.

The catch and effort assessment surveys carried out within the framework of this study have demonstrated that the fishing effort exerted by vessels under 10 metres in length, which make up more than 92 percent of the fleet, is relatively small and is a function of the operational status and daily activity of the fleet, the effective fishing time, as well as of the dimensions and other physical parameters of the fishing gear used (see Annex XII). From the results, it is also evident that the amount of activity, the gear used, the production and species composition are seasonal and the catch quantities could be proportionate to the structural parameters of the vessels (see Annex XI).

Despite the main interest in demersal fish as target species, the catches of tuna and swordfish account for high percentages of annual landings (29.8 percent and 9.8 percent respectively; see table 3.3). These highly priced species are targeted and caught by a small percentage of the fleet which share almost 50 percent of the total annual value of Maltese landings associated with the catch of these species (see table 3.3). The five-month FAD dolphin fish fishery is responsible for almost a quarter of the total annual value of landings (see table 3.3), but similarly to the large pelagic fisheries, the earnings are shared by about 100 vessels. The small trawling fleet also lands a fair amount (7.8 percent in weight) of demersal species annually (see table 3.3). It is thus evident, from all these results, that less than 20 percent of the total annual value of landings is shared by the majority of the Maltese fishing fleet, albeit that most of the species landed are quality highly priced demersal fish which make operations of the smaller vessels involved profitable (i.e. value of catch well exceeds fishing trip costs). These landings mostly originate from the resources available within the EFZ making it vitally important for the economic livelihood of this fleet. The activities of industrial fishing methods should, in this respect, not be allowed to start in this relatively small EFZ, since they would unfairly compete for resources therein. In addition, gear conflicts would arise in an area where different metiers have enjoyed a serene working environment for several decades. The option of replacing the large artisanal fleet with a small industrial fleet should also be avoided due to the socio-economic importance of artisanal Maltese fisheries which has been spelt out in the very first paragraph of the introduction in this document.

The ICES / SCOR symposium on the "ecosystem effects of fishing" (1999) suggested that trawling should be regarded as an activity that should be restricted to selected smooth sand-mud areas where it is less likely to cause damage to the ecosystem. In accordance with this policy, trawling within the Maltese EFZ has been restricted[22] to these types of grounds of limited area (see figure 3.5), which receive fish immigrating from the untrawled bottom. In this respect, a frequency of trawling within these zones of more than once a year over these small areas of the zone should not be damaging to the demersal fish stocks and other macrofauna (Duplisea, 2002). Furthermore, the results of the spatial distribution and relative intensity of fishing effort related to other demersal gears (see sections 3.3.2, 3.3.3,

[22] On Malta's accession to the European Union in May 2004, an agreement was reached between Malta and the EU to maintain this policy and coordinates of these trawling zones have been inscribed into EC legislation (EC 813/2004). Satellite vessel monitoring systems are expected to help enforce this regulation.

3.3.4), which are also deployed on untrawlable grounds, have demonstrated that the current practices allow escapement of demersal species into slightly or non-exploited areas. The catch and effort survey further highlighted this phenomenon (see Annex XII) revealing that the areas where the small scale fleet operates are not determined by the spatial distribution and abundance of the resources but by the geographical location of the base ports. Thus, in the light of all of the above, it is reasonable to consider the Maltese scenario as favourable for creating 'refugia' or areas where species are protected from depletion; this concept has been considered in detail by the GFCM (Caddy, 1998) and has been recognised by the Maltese government and the European Union as an important scenario contributing to sustainable fisheries (see footnote 19).

In contrast to the case of demersal fishing methods, the spatial distribution of fishing effort in the tuna longline fishery (see figure 3.9), is very much congruent to the migratory pathway of the stock occurring to the south west of the Maltese Islands, generally beyond the Maltese EFZ. As described previously, this type of fishing operation is mostly practiced by larger boats which are able to venture further away from their ports and spend a few days at sea. On the other hand, the effort distribution in the FAD dolphin fish fishery is largely determined by the management scheme in place (see figure 3.10) with the limiting factors for the number of FADs laid being related to the median line boundary (in the north) with Sicily, engine power and size of the vessel.

4.3 Status of fisheries resources around the Maltese Islands

Generally, landings of major commercial fish species by Maltese fishing vessels have fallen slightly over the past couple of decades (figure 4.1). During this period, the number of registered professional fishing vessels has remained relatively constant but there has been a significant change in the type of fishing operations due to technological developments and changes in value and demand for different fish species. It follows, therefore, that the slight decline in landings is a first sign of overfishing which could be attributed to "technical creep" which has effectively increased the fishing effort.

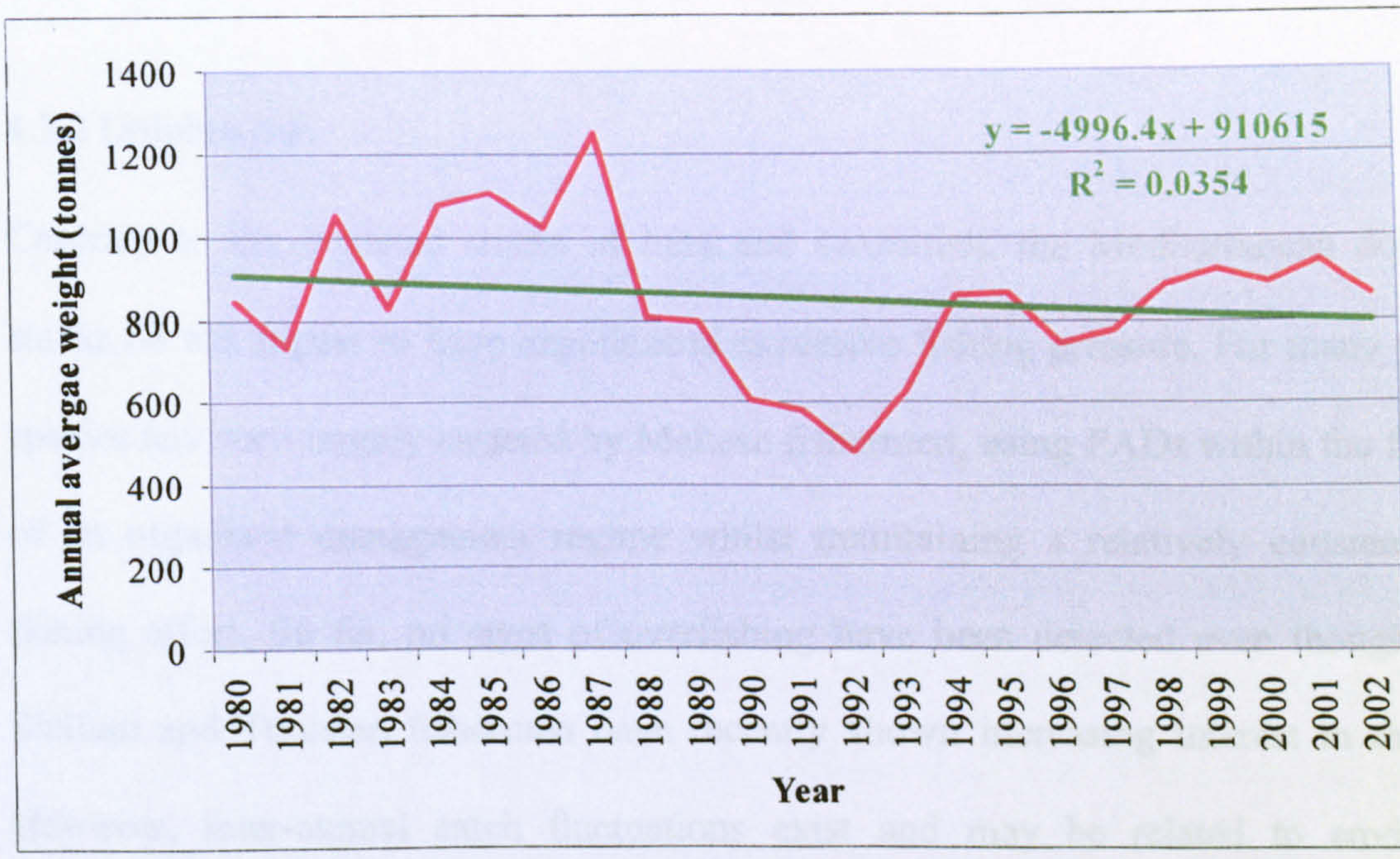


Figure 4.1 Annual average weight of the most important commercial species (combined) – from fish market landings data. Green line is the linear regression trend line illustrating a slight decrease in landings over a twenty two-year period.

4.3.1 Large pelagic species

It is certain that the sudden increase in bluefin tuna landings in Malta 1989 came about as a result of the tapping of the Japanese market (see figure 3.12), however, landings in recent years have started to fall since the single bluefin tuna stock (Rodriguez-Mar *et al.* 2003; Ravier and Fromentin 2001), which migrates from the Atlantic Ocean into the Mediterranean Sea to spawn (Medina *et al.,* 2002; Block *et al.,*. 2001) is being targeted by ever increasing numbers of fleets hailing from different countries as well as flag of convenience fleets (Lleonart, 2004). This is leading to overfishing of the stock despite the management measures drawn up by international fisheries bodies; however, the influence of large-scale environmental changes (Ravier-Mailly and Fromentin, 2003) together with tuna predator and prey abundance fluctuations on the Mediterranean bluefin tuna stock should not be discounted. Landings of swordfish by Maltese fleets have been erratic over the years and the stock of this migratory large pelagic species is also affected by a similar situation of increasing fishing pressure at regional level (Raymakers and Lynham 1999; Rosel and Block 1996).

4.3.2 Dolphin fish

Contrary to the depleted stocks of tuna and swordfish, the Mediterranean dolphin fish stocks do not appear to have experienced excessive fishing pressure. For many years, this species has been largely targeted by Maltese fishermen, using FADs within the framework of an organised management regime whilst maintaining a relatively constant level of fishing effort. So far, no signs of overfishing have been detected even though Spanish, Sicilian and Tunisian fishermen have recently shown increasing interest in the species. However, inter-annual catch fluctuations exist and may be related to environmental parameters, including global warming (Camilleri, 2002), and to the migratory behaviour pattern of the species which result in failures in annual spawning and/or recruitment to the fishery (Lleonart *et al.* 1999).

4.3.3 Demersal species

Unlike these three stocks of highly migratory species which are affected by regional anthropogenic and environmental processes, the fate of demersal stocks is more closely associated to sub-regional or localised parameters. In fact, sections 1.5.1 and 1.5.2 present some information which characterise Maltese demersal resources as being distinct or shared with neighbouring areas. Thus, the assessment of the status of these resources in relation to the local fishing activities is possible.

It is difficult to use the trends in market landings (see sections 3.5.2, 3.5.3, 3.5.4 and 3.5.5) as a measure of the status of the resources since, as pointed out in section 1.4, effort measurements are not available; however, these trends expose the situations of various fisheries over the years. The highest rate of decline in landings was for bogue and horse mackerel; however, these are generally pelagic and low value species, and it seems likely that they are not declining in abundance, but that the low prices and negligible market interest in these species has led Maltese vessels either to discard them or to avoid areas and gears that take them in large numbers. Apart from these two species, the general trends are fairly stable, with a significant rise in the last few years for trawl-caught fish due to an increase in exploitation rate.

As far as shallow shelf resources such as red mullet, gurnard, and pandora are concerned, there was a drop in landings in the early 1990s, when several fishers geared up for the tuna fishery, followed by a rise up to 1999 and redecline thereafter. This latter rise is attributed to an increase in effort for these more valuable species resulting from fishers preferring to catch species whose price has risen and the recent decline points out that overfishing has crept in. The deep water shrimp landings also show a decline and subsequent rise, and since shrimps are only taken by trawling, one could conclude that it is the Maltese trawl effort which is mainly responsible for the increase in landings of all trawlable species. It is therefore of great concern that Maltese trawl effort, even with a small fleet, is approaching the limit of production for a small trawlable shelf area. One must also consider that while the number of boats and full time fishers has remained stable, the number of part time fishermen, whose catches are more difficult to survey, has increased over the past few decades. This increase has also led shallow demersal fisheries to go beyond Maximum Sustainable Yield (MSY) conditions as indicated by the overall slight decline in catches in recent years.

The trends for deep water resources are more stable than for other resources, meaning that the long line fishery, which also exploits waters distant from Malta outside the EFZ, is not currently overexploited. This conclusion seems especially valid since the key species captured such as grouper are long-lived, and generally decline rapidly with even moderate levels of exploitation. Studies on the population dynamics of groupers in Maltese waters are yet to be carried out; results would confirm or otherwise that this species has not been affected by fishing pressure in deep waters.

In light of all of the above, one can make some conclusions on the current state of exploitation of Maltese resources. One can also analyse what would happen if, for example, a doubling of the current level of trawler effort were to occur. The result would certainly be a decline in catch rates by Maltese boats, leading to a decline in the economic viability of fishing operations.

4.4 Review of the MEDITS trawl survey

The results obtained from the trawl surveys (Annexes XIV, XV; section 3.6) give further scientific evidence as to the state of demersal resources in the Maltese EFZ. Focussing on abundance indices of important commercial fish species and of particular "indicator species", one can draw sound conclusions on the impact of exploitation by the Maltese fleet.

Some species in particular, namely *Octopus vulgaris* and *Sepia officinalis* in the shallower stratum, and in general, cartilaginous fish, the squid *Illex coindetti, Zeus faber*, and the skate, *Raja clavata*, were common and largely characteristic of Maltese waters and less common in the other M3 sub-regions. The presence of species which are especially vulnerable to intensive trawling, such as sharks and rays which have a low reproduction rate (Dulvy *et al.* 2000), and probably also *Zeus faber*, is an indicator that the faunal communities here have not been drastically altered by trawling. This observation is also supported by a catch of a spawning aggregation of *Sciaena umbra* during the first trawl survey (2000) in which a 17 year old male and 26 year old female were present (Ragonese *et al.*, 2002; Annex-XIII). In this respect, this is an indication that Maltese waters may serve as a 'refugium' for these vulnerable species in the central Mediterranean.

The survey results show that the maximum biomasses in the Maltese EFZ are on the 50 – 100 m grounds, which are the key target areas for trawling, which elsewhere in the Sicily channel area at the same depths have far lower abundance indices (table 3.6). In addition, within the 10-50m stratum, although the overall biomass of the most important commercial species in the EFZ is not the highest out of the trawl survey sub-regions, five out of the seven species enjoy far higher abundances in the former. It is interesting to note however that in this shallowest stratum the abundances of very important commercial species such as *Pagellus erythrinus* (Pandora) and *Mullus barbatus* (red mullet) are extremely low, proving that the increase in fishing pressure in coastal areas has affected certain shallow demersal species as already observed in section 4.3.3. Nevertheless, the comparison exercise of the abundance indices for the most important commercial species (figure 3.17) on the shelf and shallow slope areas (10-500m) revealed that on average the abundance in the Sicilian M3 sub-regions was about 40 percent of that in the Maltese EFZ. This situation could be attributed to the higher fishing intensity in these sub-regions sampled than in Maltese waters; hence stock sizes are scarcer for the same depths in Italian waters than around Malta. There seems to be enough reason to take this hypothesis seriously, and ask what is the relative level of fishing intensity in Maltese waters and the adjacent area M3c (Strait of Sicily – Sicilian waters). The situation in deeper strata evidently differs, but abundance is largely dominated by low value species such as the small sized shark *Galeus melastomus* in Sicilian deep waters and species at these depths are considered to be straddling stocks which are affected by both Maltese and Sicilian fleets.

The information obtained from the trawl survey data is not sufficient to be able to be able to perform a sound scientific assessment on the resources using any of the numerous models used in fish stock assessments (Cadima, 2003). However, the Gordon-Schaefer static conventional yield model commonly used in fisheries bioeconomics (Seijo et. al., 1998) (figure 4.2) may be applied to produce some broad reference points which are relevant to this present study using the limited information available. Under this model[23], sustainable biomass is a linear function of fishing effort and fishing intensity, and from the biomass index figures obtained in this study, one can conclude that the fishing rate in Italian waters has been over twice as high as in Maltese waters; this is not out of line with the actual fleet sizes.

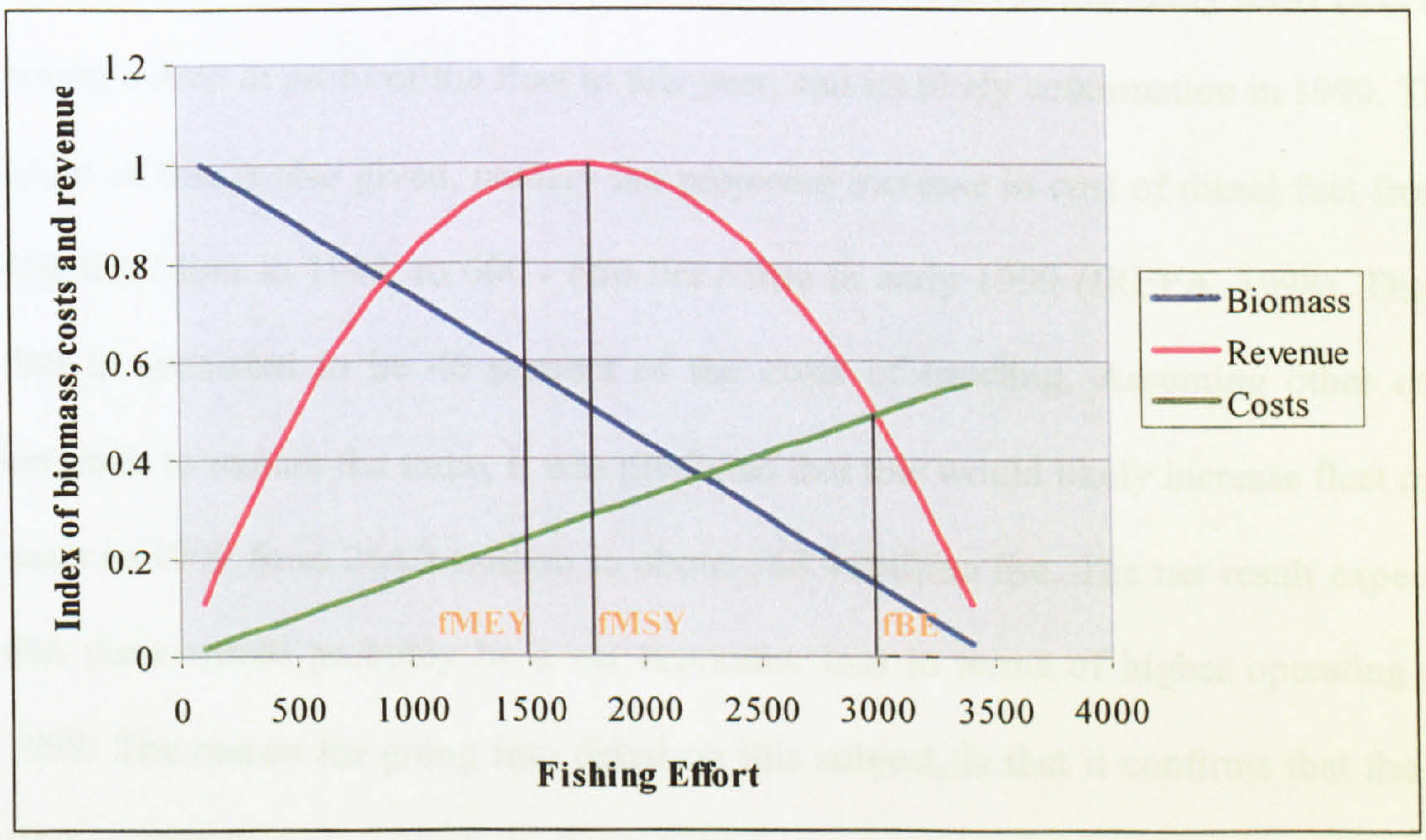


Figure 4.2 Gordon-Schaefer model of a fishery with MSY normalised to unity. fMEY= fishing effort at Maximum Economic Yield; fMSY = fishing effort at Maximum Sustainable Yield; fBE= fishing effort at Bioeconomic Equilibrium point (adapted from Seijo *et al.* 1998).

The Italian trawl fishery has been evaluated by IREPA (1998) and several excerpts from this report are relevant to the current study. Speaking of the fleet operating from Mazara del Vallo, which hosts the largest Italian fleet both in number and total tonnage (11% of the national total), the report implies that there is a fleet capacity operating out of this (and

[23] The curves and lines appearing in Figure 4.2 are arbitrary and are not generated from any data related to the Maltese demersal fishery. The figure simply demonstrates the relationships and functions in the model.

other) Sicilian port that is in excess of the productive capacity of Sicilian waters to support, hence the movement of the fleet offshore into deep waters such as those around and well beyond Malta. What emerges also is a qualitative indication that as far as Sicilian waters are concerned, the fishery is operating at beyond MSY levels of fishing effort. The report also indicates that potential conflicts have arisen in the past with countries of the southern Mediterranean due to the need for this fleet to find high catch rates not available in home waters, and that this has had political repercussions of a bilateral nature. It is hence a distinct possibility that incursions en masse would inevitably occur if Maltese waters were to be opened to more trawlers.

In this same report there is an analysis of the profit margin of the Sicily trawl fleet in 1998, noting a drop in profit of the fleet in this year, and its likely continuation in 1999. The main cause of this is also given, namely the projected increase in cost of diesel fuel from 350 - 400 lire / litre in 1998, to 600 - 650 lire / litre in early 1999 (IREPA, 1998). The cost of fuel is estimated to be 46 percent of the costs of trawling. Assuming other costs and revenues to remain the same, it was predicted that this would likely increase fleet operating costs in 1999 from 264.2 million to about 368.4 million lire. The net result expected was that there would probably be a net economic loss in terms of higher operating costs in 1999. The reason for going into detail on this subject, is that it confirms that the Sicilian fleet in 1999 was operating at or below the bioeconomic equilibrium point (Y_{BE}) representing a situation of no net profit (see figure 4.2). It is also important to note that the envisaged drastic reduction in subsides to fishers by the European Union will worsen this economic situation and the industry will drive itself to collapse.

Referring back to the Gordon-Schaefer model, Seijo *et al.* (1998) point out that the effort level exerted at fBE is twice that at fMEY i.e. the effort level for optimal economic performance occurs at half the level of fishing effort at which the profit margin is zero.

Whilst recognising that this model cannot be strictly fitted to the Maltese demersal fishery due to lack of sufficient data, the relationships in this model and the information that the Sicilian trawl fleet in 1999 was fishing at or beyond the Bioeconomic Equilibrium point, and knowing that in 2000 - 2001 the overall biomass index on the Sicily shelf / shallow slope was of less than half that in Maltese waters, one can tentatively conclude that the Maltese demersal fishery must be operating above MEY and quite close to MSY conditions. On the other hand, the trends in landings discussed in section 4.3.3 suggested that demersal fishing was operating at slightly beyond MSY conditions, and thus one can only be certain that the reference level of Maltese demersal fisheries resources stands above Bioeconomic Equilibrium and perhaps not far from MSY conditions. The relationships and reference points used in the Gordon-Schaefer model are illustrated in Figure 4.2, where the three vertical lines represent the effort level corresponding to (from left to right), f(MEY) - the point of Maximum Economic Yield, f(MSY) - the Maximum Sustainable Yield (but where economic returns are lower than for the last point), and f(BE) - the point of Bioeconomic Equilibrium, corresponding to zero profit.

In summary, the MEDITS survey with its higher biomass indices in shelf and shallow slope depth strata, has given evidence that the Maltese demersal fishery is operating at not far from a more or less optimal fishing effort level and should not be increased especially in coastal waters under 50m deep.

4.5 Conclusion

This chapter has brought out the essence of the scientific information from the research carried out within the framework of this study which is of relevance to the sustainable management of Maltese fisheries. Taking all of this into account, Chapter 5 gives a general overview of the current scenario with respect to Maltese fisheries, presents a proposal for a management regime for the sustainability of these fisheries and puts forward recommendations for further research and data collection schemes to address the gaps and uncertainties pending in this present study and to routinely monitor the fisheries and status of resources.

Chapter 5. Conclusion

5.1 General overview

The importance of data on landings, direct assessment methods and effort distribution described in section 1.3 has been reflected in this study. The data collection schemes carried out, namely those addressing the fleet and its activities, catch and effort, and abundance of demersal resources, together with market related data, have translated into a compilation of information describing the characteristics of the Maltese fleet and associated fisheries together with a very first analysis of their impact on the fisheries resources around the Maltese Islands. However, the availability of a long time series of abundance indices and catch per unit effort data in the future, through the continuation of these data collection schemes, would allow for more thorough monitoring and analysis of the sustainability of fisheries resources.

The sustainability of large pelagic species in the waters around Malta largely depends on international efforts to manage these fish stocks, and in view of the fact that they account for more than two thirds of the annual value of landings, it is in the country's interest to collaborate and contribute to the regional management process. On the other hand, enough evidence has been provided by this study that the fishing capacity and related effort associated with demersal fisheries in the Maltese EFZ should not be increased in order to ensure their sustainability. It is also important that the fishing effort distribution is not altered, especially in the case of trawling, in order to safeguard the fish "refugia" which exist in the EFZ.

The exclusive importance of the EFZ fisheries resources for the large artisanal small scale fleet has also been demonstrated by this study. In this respect, both the introduction of industrial fishing methods and any further increase in artisanal fishing would have negative impacts on the Maltese population involved in the fishing industry which is economically, geographically and culturally dependent on artisanal fisheries. In addition, the study has revealed that the daily activity and effective fishing time of the small-scale fleet is extremely limited and individually land very small quantities , implying that the capacity of this fleet category would be more appropriately measured by using parameters such as vessel size, gear size and effective fishing time, rather than the more commonly used parameters such as number of vessels, engine power and gross tonnage (see Annexes VII and XII). Nevertheless, the continual monitoring of activities of this fleet segment is vital for the sustainable management of shelf resources since any change in activity could result in an undesired increase in capacity.

5.2 A management regime for the sustainability of Maltese fisheries

5.2.1 The Maltese EFZ and demersal resources

The information contained in Section 1.6 demonstrated that there are criteria for defining the Maltese EFZ as a distinct Fisheries Conservation Zone – there is evidence that adult populations of shallow shelf resources within the zone are isolated from adjacent areas and that the Maltese shelf constitutes the main offshore area where spawning could take place for a significant proportion of the zone's demersal resources and other deep water species. Moreover as a consequence of the oceanographic features in the region, larval contribution from outside the Zone is an unlikely source of major recruitment of juvenile fish to demersal fisheries. In addition, satellite imagery also shows clear evidence that Malta is surrounded by water masses which are limited in productivity, making the ecosystem within the Zone more prone to negative effects caused by high exploitation rates. These are already enough reasons to consider that the Maltese EFZ should have its own specific management regime to conserve the sustainability of its resources.

The important refugia for spawners and juvenile fish, allowed to form by the current fishing practices, could only continue to exist if areas where trawling is currently absent would remain free from this type of fishing operation, both to maintain these vital sources of recruitment and also to protect fragile benthic ecosystems which are likely to be present in these particular areas. The indicative reference point produced by this study (i.e. somewhere slightly beyond MSY) in relation to demersal resources within the Maltese EFZ, calls for a limitation in fishing effort and capacity of trawlers and other vessels practicing demersal fishing operations. The size of trawlers could be limited, say, to 24m in length (non-industrial) with a global total allowable effort, in for example HP units, corresponding to the MEY / MSY reference points. It would also be good practice to limit the individual engine power of trawlers operating in shallow waters (less than 200m) so that fishing capacity targeting these resources is further controlled. As demonstrated by this study, the dimensions of small scale vessels have a direct effect on the limitation of fishing capacity and fishing effort, therefore limiting the size of vessels, other than trawlers, to, say, 12m in length, operating with demersal gears in the Zone would also have a direct control on fishing effort and the desirable effect of maintaining the sustainability of demersal resources.

5.2.2 Pelagic and highly migratory resources

This study falls short of addressing in detail the status of small pelagic fish resources targeted by Maltese fishing fleets. However, this is because local fisheries for these species are almost non existent and neither scientific nor fishing opportunity surveys have ever been directed towards these species. Available catch and effort data on these species are not sufficient to draw conclusions on specific management measures to be adopted, nevertheless, there is no evidence to restrict the limited *lampara* fishing operations carried out by Maltese fishermen. Likewise, the *lampuki* fishery appears to have been very well managed for decades, and in the absence of robust assessments on this species, a

Precautionary Approach should be adopted with limitations on numbers of licenses and fishing zone allocation schemes being maintained to ensure sustainability of this socially and economically important fishery.

The story of the large pelagic fisheries is somewhat more controversial, since the high unit value, overexploitation and the increase in competition between fishing fleets of different countries, may force Maltese fishermen to revert to using industrial longlining and purse seining methods to catch swordfish and bluefin tuna respectively. As mentioned previously, international efforts and measures are required to conserve these highly migratory stocks, nonetheless, the impact of these industrial fishing methods if they were to be introduced into the Maltese EFZ could be very negative, since they would completely disrupt the activities of the artisanal Maltese fishing fleet which, as demonstrated in Section 3.2.3, depends totally on the resources available within the Zone for its economic livelihood. The activities of these industrial fishing methods take up large areas and therefore would simply not allow space for a multitude of small-scale fishing vessels to carry out their own fishing operations. Numerous gear conflicts would arise in an area where different metiers have enjoyed a serene working environment for several decades.

A restriction on industrial scale fishing gear for large pelagic fish species would maintain the environmental equilibrium in the central Mediterranean. An increase in the fishing effort within the 25 mile Zone through the use of these methods would not only contribute to a reduction in the tuna stocks in this area (where the effort now is relatively low as a result of the limitation on gear) but could also affect other species, such as mammals or birds. In addition, this degradation of the environment could produce negative economic effects by tarnishing Malta's image on environmental issues. In view of all of the above, and in the context of responsible fisheries management, purse seining and industrial longline fishing should not be introduced into Maltese fisheries.

5.2.3 Compliance with EAF

The importance of incorporating ecosystem objectives into the management of sustainable fisheries (FAO, 2003a; Farrugio, 1996; Sainsbury and Sumaila, 2003), together with the four dimensions of sustainability – ecological, economic, social and institutional – (FAO, 2001) has been highlighted in the introduction to this present study. The use of reference points in management decisions (GFCM, 2004; Sainsbury and Sumaila, 2003) along with effective management tools such as marine protected areas, fishing effort control, zoning and protection of spawning and nursery areas in achieving these goals have also been addressed and considered in the study.

The meaning of the term "Ecosystem Approach to Fisheries"(FAO, 2003a) is still not universally defined and progressively evolving, however, it is certain that the future of an EAF and fisheries depends on the way in which the fundamental concepts of fisheries management, ecosystem management and their respective stakeholders will join efforts or collide (Garcia *et al.* 2003). In this context, the study has, brought together these concepts whereby abiotic, biotic, ecological, economic and social aspects have been considered throughout and are reflected in the concluding management proposals. With these management proposals in place, the Maltese EFZ could, in essence, constitute a large Marine Protected Area (MPA) with sustainable use objectives, which would be quite unique in the Mediterranean region. As already highlighted in section 1.7.3.2, MPAs are increasingly regarded as useful management measures, in that they contribute to ecosystem conservation and fisheries sustainability (Claudet and Pelletier, 2004). Likewise, the important role of MPAs in (i) the recovery of depleted stocks; (ii) the prevention of recruitment overfishing, and (iii) the spillover of fish to adjacent fished areas has also been highlighted by the sub-regional FAO Mediterranean project MedSudMed (FAO, 2003b). The proposed management regime in section 5.2 would also be in line with the GFCM approach to adopt a fishing effort control approach by vessel groups or Operational Units (see section 1.2).

5.3 Review of study and proposals for the future

5.3.1 General considerations

This study has, for the first time ever, extensively analysed and described Maltese fisheries, and evaluated their status in a multidisciplinary manner using almost only data generated during the study period; however, the need for robust stock assessments in Maltese waters is still lacking due to the lack of fishery and biological time series data. Furthermore, abundance estimates have only been derived from two preliminary trawl surveys which have not been compared to estimates derived from other methods such as the annual egg production method often used for estimating the spawning stock biomass for commercial demersal species (Armstrong *et al.* 1998; Armstrong *et al.* 2001). Acoustic methods for estimating abundance of small pelagic species supplemented by fisheries information and biological sampling (Pertierra and Lleonart, 1996) have also yet to be carried out in Maltese waters.

The continuation of annual trawl surveys, the introduction of other types of surveys mentioned above, the development of routine biological sampling schemes in ports and on-board vessels, the establishing of a by-catch and discard monitoring programme, the undertaking of *ad hoc* socio-economic studies, together with the extension of catch and effort survey programmes, are all essential in strengthening scientific knowledge which is in turn vital for the sustainable management of Maltese fisheries and the resources.

5.3.2 Meeting the aims of this study

The aims listed in section 1.4 have all been addressed in this study, albeit at different levels of achievement and precision. The use of the fleet census data and MaltaStat database and information system in categorising the Maltese fishing fleet and its activities has proved to be successful and the characteristics of the fleet have been clearly demonstrated in terms of vessel type, structural characteristics, operational units, gears used, target species and fishing zones. The integration of the MaltaStat fleet data with fish market landings data has also led to a clear demonstration of the relative importance of different fisheries, in terms of production and annual value. In addition, the importance of the 25 mile Exclusive Fishing Zone for artisanal small scale fisheries was also clearly determined using data from these two sources. Furthermore, the data on fishing areas collected during the fleet census in grid format was instrumental in being able to draw up general maps of the spatial distribution of fishing effort which gave insight into the behaviour of the different fleet segments operating in various fisheries; historic information on trawling areas and the specific study carried out on the dolphin fish fishery also gave indications on the spatial distribution of fishing effort for each of these two fisheries. The catch and effort assessment survey provided additional dynamic information on the spatial distribution of vessels under 10m in length, making up about 92 percent of the fleet, together with estimates of catch and effort by gear providing fine details on the activities of this socio-cultural important fleet segment.

The impact of the fishing operations, which as indicated above were well described in this study, on demersal and other fisheries resources was also addressed, though a scientific assessment was not strictly carried out as specified in aim (iv) listed in section 1.4 for reasons mentioned earlier (sections 4.1 and 4.4). Interpretation of the trends in fish market landings, comparison of trawl survey abundance indices with those of other areas and limited biological information gathered from these surveys were used as the basis for "assessing" the status of the resources. Similarly, the issue of an impact of an increase in fishing activities on the Maltese fishing population involved in the fishing industry was not evaluated quantitatively. However, combining the indicative results on the status of resources and the importance of various fisheries, some fair conclusions on the effect of an increase in fishing effort, of both industrial and small scale fisheries, on the artisanal fleet, in particular, were drawn up.

The final aim of this study was to propose a management regime to ensure the sustainability of Maltese fisheries on the basis of the results emerging from research carried out within the framework of this study. This has not been drawn up on the basis of a scientific model with forecasting features but is a rather theoretical management regime based on a precautionary approach reflecting the suggestions emerging from this study to restrict fishing effort to its current level, maintain the existing "refugia" and to safeguard artisanal fisheries.

It is thus evident from the above that further scientific work needs to be carried out to fully address aims iv, v and vi of this study and to continue the effective monitoring of the fisheries resources around the Maltese Islands. In this context, a number of recommendations for future, immediate and long-term, data collection schemes and studies have been put forward in section 5.3.3.

5.3.3 Recommendations for further data collection and studies

Clearly, the fleet census (see section 2.1) and catch and effort sampling scheme (see section 2.5) for small scale vessels have been a major source of information for this study and should continue to form the basis of scientific assessments of the local fisheries. It is worth noting, however, that whilst the fleet register is updated on an annual basis on renewal of vessel licenses (through the MALTASTAT system; Coppola *et al* 2003.) and data on the fleet becomes more accurate, the number and frequency of samples to obtain more precise estimates of catch and effort would need to increase. The improvement in statistical quality would of course depend on the financial resources available which should be directed more towards major fisheries rather than to the amelioration of statistics of minor fisheries which would have a negligible impact on the management of sustainable fisheries. In addition, the use of logbooks to collect data on the catch and effort of vessels over 10m in length on a census basis would be of utmost importance; the total catch and effort by gear and species of the Maltese fleet would be estimated by adding the logbook data to the sampling scheme data. With a logbook scheme not in place, no effort measurements were available for this study and unreliable market landings data had to be used as total fleet catches. A discards monitoring programme is also recommended in order to obtain a more accurate estimate of the fishing mortality for each species.

Trawl surveys are a practical and simple method of directly assessing demersal resources and should be maintained. In fact, one should seek to increase the frequency of surveys, say, at least twice a year (spring and autumn), as well as the number of hauls of future surveys within the EFZ; this would allow seasonal comparisons and produce more precise estimates of abundance. In addition, a biological sampling programme should be incorporated into the trawl surveys, whereby samples of selected species in the catch are measured, weighed, sexed, aged and assigned a maturity stage. This data could be used to produce outputs such as length frequency distributions, sex ratios and length-age relationships which provide the basis for the study of the population dynamics of various species (King, 1995; FAO, 2002a). The abundance of juveniles, recruits and spawners could be determined, the size at first maturity could be estimated and the growth parameters could be calculated using these outputs. With this information in hand, analyses could be performed on differences of these biological parameters for various species within the EFZ and outside it, giving further results on the relative impacts of the fleets on the resources. Similarly, biological data on large pelagic and other non demersal species could be obtained from samples taken from commercial catches.

In line with the Ecosystem Approach, research should also focus on the characterisation of the benthic habitats and the benthic assemblages that they support, since such habitats provide feeding and breeding grounds for commercially exploited fish species. An understanding of the correlation between habitat type and distribution of different life stages of the resources would help predict which commercial and other species are, or are not, likely to be affected adversely as a result of habitat modification, be this anthropogenic (eg. as a result of fishing activities[24]) or natural (eg. as a result of global environmental change). Thus, in this context, a long-term study involving benthic sampling for faunal and sediment analysis using a grab or box corer, as well as analysis of the benthic invertebrates collected during ongoing trawl surveys is recommended. The results of the benthic biotic analyses could be correlated with both the physical parameters of sediment and seabed as well as with the abundance and biological data obtained on the commercial fish species during the trawl surveys. Such studies could also be supplemented with gut content analyses of selected species in order to draw up predator-prey relationships within the studied habitats, the balance of which also influences the abundance of target commercial species. Predator-prey studies are also very relevant to large pelagic species since food availability is, in particular, a limiting factor for their abundance due to their high energy requirement.

Continuing on an ecosystem approach, the influence of atmospheric and oceanographic processes on the distribution and abundance of both demersal and pelagic species is also a subject of great importance which should be investigated. Drago (2002) stated that the

[24] A study on the impact of the numerous stone blocks used as anchors for each dolphin fish FAD year after year, would also constitute a very relevant study in itself.

persistent oceanic systems driving the transfer of heat and momentum, cause water masses to mix, carrying biotic material and shaping phytoplanktonic biomass distributions which have an important bearing on biological processes. He added that movements of fish are strongly connected to the physical characteristics and dynamics of the water body in which they reside, and are strongly correlated with temperature fronts, borders of flow, and zones of divergence and convergence. Daskalov 2002, also reported that temperature, atmospheric pressure, wind and run-off are climate-related parameters which have been found to be significantly correlated with most of the biological and fish stocks indices. Routine data collection carried out by various local and regional bodies through weather stations, sea stations and satellites (remote sensing) (FAO, 2002b) provide a wealth of information on the physical environmental factors associated with the sea, which could be used to quantify these relationships within the Maltese EFZ and its surrounding areas.

In connection with all of the above, one should seriously consider the use of Geographical Information System (GIS) technology, which is evolving as a very useful tool in fisheries science and management (FAO, 2003c). The formation of layers of geo-referenced data originating from various scientific disciplines and data collection schemes in GIS database would provide a practical setup for the analyses of a multitude of correlations between fishing, abiotic and biotic parameters, some of which have been discussed above. Such a database with mapping facilities could also help in selecting areas which should be appropriately identified as Marine Protected Areas according to some preset criteria such as the presence of vulnerable habitats, spawning areas and nursery areas (FAO, 2003b); figure 5.1 illustrates an example of this GIS data layering process. In summary, whilst the knowledge on the spatial distribution of species' populations is alone useful for stock identification and giving advice on short-term management problems, the integration of the analyses of the spatial distribution of fishing pressure and of the main environmental features affecting stock dynamics would translate into a more robust management framework (Pawson and Jennings, 1996).

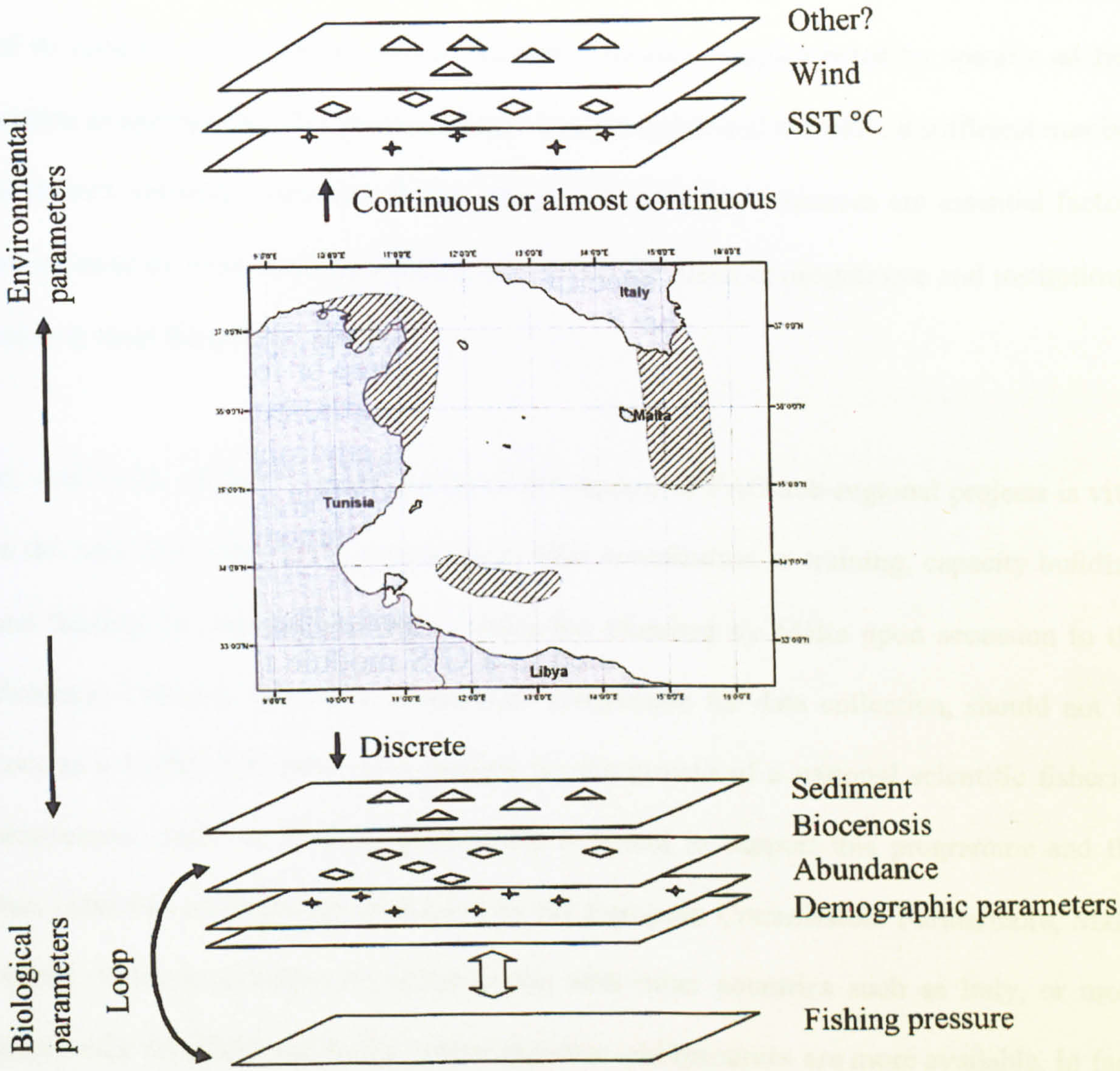


Figure 5.1 Layers of geo-referenced data in a GIS database. Only few general layers are shown in this diagram which is related to demersal species and habitats. (FAO, 2002b).

Finally, it is also highly recommended that economic surveys on the various Maltese Operational Units should be conducted in order to firmly establish bio-economic reference points of each fishery; a broad estimation of such a reference point was only obtained for the demersal fishery in this present study, without the availability of actual economic data (see section 4.4). The parameters to be collected are included in a list in Annex IX which have recommended by the GFCM in 2002.

With all of the data collection schemes recommended above in place, Malta would be in a stronger position both to manage its own resources in a sound scientific manner as well as to contribute to the regional management of shared fish stocks. The scientific assessments of its fisheries and resources should become a routine, supplemented by specific ad hoc studies as appropriate. This process should be sustainable and therefore a sufficient number of trained technical personnel, funds, equipment and other resources are essential factors which must be considered in building up a scientific national programme and institutional setup to meet these requirements.

In view of the above, the continuation of the support of FAO sub-regional projects is vital in the next five to ten years especially in their contribution to training, capacity building and funding. In addition, the recent obligation inherited by Malta upon accession to the European Union to undertake a minimum programme for data collection, should not be seen as a burden but rather as a catalyst for the growth of a national scientific fisheries programme, since the Maltese government is bound to support this programme and the data collection activities are co-funded by the European Commission. Furthermore, Malta should continue enriching its collaboration with other countries such as Italy, or more specifically neighbouring Sicily, where expertise and resources are more available. In fact, the existing collaboration with the Istituto di Ricerche sulle Risorse Marine e l'Ambiente (IAMC - Mazara del Vallo, Sicily) through the Medits trawl survey programme and FAO sub-regional projects should be taken further in such way that Malta, through the newly established Malta Centre for Fisheries Sciences (MCFS), could carry out joint surveys, assessments and studies with IAMC on shared stocks in the Sicily Channel. This is very important because it may take up to ten years for the MCFS to train a full compliment team of qualified personnel and it may never have the resources to run surveys at sea in its own capacity. In other words, the MCFS needs a strong partner during its present infancy phase to be able to grow and establish itself as a reputable international scientific institution. It is worth mentioning that thirty years ago, the IAMC itself was in the current situation of the MCFS and thus the former can, through its own experience, help in the growing phase of the latter. Such a partnership is greatly encouraged by the European Commission and would place both countries in a better position to obtain project and research funds through any one of the EC programmes.

5.3.4 Concluding remarks

The particular geographical, physical and biotic characteristics of the Maltese EFZ, the spectrum of fishing activities carried out by the Maltese fishing fleet, together with its history of an exploitation rate of fisheries resources far lower than the rest of the Sicily Channel, as well as the presence of fish refugia, make the zone an ideal Mediterranean fisheries science natural laboratory. In other words, the high variability of fishery characteristics, biological aspects and physical features existing within this small area provides opportunities to realistically carry out holistic studies contributing to responsible sustainable fisheries in the marine ecosystem of the Mediterranean.

ANNEX I: FLEET CENSUS INTERVIEW SHEETS

Recorder name: ____________________ **Code:** _____

Date: __ __/__ __/__ __ __ __(dd/MM/yyyy)

Recording Serial: _____

Recording place: ________________________

IMPORTANT NOTICES

- ► All underlined fields are required: this information must be inserted in the MedStat-Malta System.
- ► For Engine (box 4) and Fishing Operation (box 10), underlined fields are required for each eventual engine or operation.
- ► The column "Table" refers to the Codification System paper (*MaltaStat References Census*).

1. Fishing vessel characteristics

			TABLE
1.1	Matriculation	__ __ __ __ __ __ __ __	–
1.2	Registration Office		1.2
1.3	Flag	◻ Malta ◻ Other: ______________	1.3
1.4	Registration date	__ __/__ __/__ __ __ __(dd/MM/yyyy)	–
1.5	Vessel name		–
1.6	Vessel type		1.6
1.7	Operational status (one only)		1.7
1.7.1	Non activity reason		1.7.1
1.8	Base port permanent		1.8
1.9	Marine Registration No.		–
1.10	REMARKS		

2. Fishing authorisation

			TABLE
2.1.1	**Fishing authorisation type**		2.1.1
2.1.2	**Id document**		–
2.1.3	Date of issue	___/___/_____(dd/MM/yyyy)	–
2.1.4	Expiry date	___/___/_____(dd/MM/yyyy)	–
2.1.5	**Issuing Office**		1.2
2.2.1	**Main gear**		2.2.1
2.2.2	Fishing gear (2)		2.2.1
2.2.3	Fishing gear (3)		2.2.1
2.2.4	Fishing gear (4)		2.2.1
2.2.5	Other gear		–
2.3.1	Aux. units	□ Yes □ No	–
2.3.2	No. of Aux. units		–
2.3.3	With sources		–
2.3.4	Skin-diver	□ Yes □ No	–
2.4	REMARKS		

3. Structural characteristics

			TABLE
3.1	**Overall length (m.)**		–
3.2	Width (m.)		–
3.3	Height (m)		–
3.4	Shipyard		–
3.4.1	Construction place of the vessel		–
3.5	Construction country of the vessel	□ Malta □ Other: ____________	1.3
3.6	Construction year of the vessel		–
3.7	Hull material		–
3.8	Year of entry in fishery		–
3.9	GRT (Gross Registered Tonnage)		–
3.9.1	NRT (Net Registered)		–
3.10	**GT (Gross Tonnage)**		–
3.11	**Decked**	□ Yes □ No	–
3.12	REMARKS		

4. Engine

Engine (1)

			TABLE
4.1	Model or Manufacturer		—
4.1.1	Customer reference		—
4.2	Inboard/Outboard	□ Inboard □ Outboard	—
4.3	Power (kW)	— — — — —	—
4.4	Type of propulsion		4.4
4.5	Construction country of the engine	□ Malta □ Other: ______________	1.3
4.6	Construction year of the engine		—
4.7	REMARKS		

Engine (2)

			TABLE
4.1	Model or Manufacturer		—
4.1.1	Customer reference		—
4.2	Inboard/Outboard	□ Inboard □ Outboard	—
4.3	Power (kW)	— — — — —	—
4.4	Type of propulsion		4.4
4.5	Construction country of the engine	□ Malta □ Other: ______________	1.3
4.6	Construction year of the engine		—
4.7	REMARKS		

Engine (3)

			TABLE
4.1	Model or Manufacturer		—
4.1.1	Customer reference		—
4.2	Inboard/Outboard	□ Inboard □ Outboard	—
4.3	Power (kW)	— — — — —	—
4.4	Type of propulsion		4.4
4.5	Construction country of the engine	□ Malta □ Other: ______________	1.3
4.6	Construction year of the engine		—
4.7	REMARKS		

5. Electronic equipment

5.1 Navigation equipment

			TABLE
5.1.1.1	Navigation equipment (1)		5.1.1.1
5.1.1.2	Purchase year (1)		—
5.1.2.1	Navigation equipment (2)		5.1.1.1
5.1.2.2	Purchase year (2)		—
5.1.3.1	Navigation equipment (3)		5.1.1.1

5.1.3.2	Purchase year (3)		—
5.1.4.1	Navigation equipment (4)		5.1.1.1
5.1.4.2	Purchase year (4)		—
5.1.5.1	Other equipment		—
5.1.5.2	Purchase year		—

5.2 Communication apparatus

			TABLE
5.2.1.1	Communication apparatus (1)		5.2.1.1
5.2.1.2	Purchase year (1)		—
5.2.2.1	Communication apparatus (2)		5.2.1.1
5.2.2.2	Purchase year (2)		—
5.2.3.1	Communication apparatus (3)		5.2.1.1
5.2.3.2	Purchase year (3)		—
5.2.4.1	Other equipment		—
5.2.4.2	Purchase year		—
5.2.5	Radio call sign		—

5.3 Fish Finder

			TABLE
5.3.1.1	Fish finder apparatus (1)		5.3.1.1
5.3.1.2	Purchase year (1)		—
5.3.2.1	Fish finder apparatus (2)		5.3.1.1
5.3.2.2	Purchase year (2)		—
5.3.3.1	Fish finder apparatus (3)		5.3.1.1
5.3.3.2	Purchase year (3)		—
5.3.4.1	Other fish finder		—
5.3.4.2	Purchase year		—

5.4	REMARKS

6. Deck machinery

			TABLE
6.1	Method of activating the fishing gear		6.1
6.2.1	Number of line winches		—
6.2.2	Line winches operated by		6.2
6.3.1	Number of net winches		—
6.3.2	Net winches operated by		6.2
6.4.1	Number of trammel winches		—
6.4.2	Trammel winches operated by		6.2
6.5.1	Number of power block		—

6.5.2	Power block operated by		6.2
6.6.1	Other (1):		—
6.6.2	Number		—
6.6.3	Other (1): operated by		6.2
6.7.1	Other (2):		—
6.7.2	Number		—
6.7.3	Other (2): operated by		6.2
6.8	REMARKS		

7. Ownership

			TABLE
7.1.1	Company type		7.1.1
7.1.2	Company name		—
7.1.3	Company establishment year		—
7.1.4	Company address		—
7.1.5	Company postal code		—
7.1.6	Company town		—
7.1.7	Company country	☐ Malta ☐ Other: ________	1.3
7.2.1	Owner's name		—
7.2.1.1	No. of co-owners		—
7.2.2	Company operated by		7.2.2
7.2.2.1	Skipper's name		—
7.2.3	Owner's year of birth		—
7.2.4	Owner's address		—
7.2.5	Owner's address postal code		—
7.2.6	Owner's town of residence		—
7.2.7	Owner's telephone		—
7.2.8	Owner's mobile phone		—
7.12	REMARKS		

8. Crew

			TABLE
8.1	Maximum number		—
8.2	Minimum number		—
8.3	No. of registered full-time fishermen		—
8.4	REMARKS		

9. Operative port

			TABLE
9.1	Base port (at present)		1.8
9.1.1	Port (period 1)		1.8
9.1.2	Period 1	___/___ (mm/mm)	—
9.2.1	Port (period 2)		1.8
9.2.2	Period 2	___/___ (mm/mm)	—
9.3.1	Port (period 3)		1.8
9.3.2	Period 3	___/___ (mm/mm)	—
9.4.1	Port (period 4)		1.8
9.4.2	Period 4	___/___ (mm/mm)	—
9.5.1	Port (period 5)		1.8
9.5.2	Period 5	___/___ (mm/mm)	—
9.6	REMARKS		

10. Fishing operation

Fishing operation (1)

			TABLE
10.1.1	**Vessel gear category**		2.2.1
10.1.2	Units		10.1.2
10.1.3	Quantity of units		—
10.2.1	**Fishing starting month**	1 2 3 4 5 6 7 8 9 10 11 12	—
10.2.2	**Fishing ending month**	1 2 3 4 5 6 7 8 9 10 11 12	—
10.3	No. of outgoings		—
10.4.1	Fishing zone (1)		10.4
10.4.2	Fishing zone (2)		10.4
10.5.1	**Stock resource**		10.5
10.5.2	Stock resource		10.5
10.5.3	Stock resource		10.5
10.5.4	Stock resource		10.5
10.5.5	Discarded		10.5
10.6	REMARKS		

Fishing operation (2)

			TABLE
10.1.1	**Vessel gear category**		2.2.1
10.1.2	Units		10.1.2
10.1.3	Quantity of units		—
10.2.1	**Fishing starting month**	1 2 3 4 5 6 7 8 9 10 11 12	—
10.2.2	**Fishing ending month**	1 2 3 4 5 6 7 8 9 10 11 12	—
10.3	No. of outgoings		—

10.4.1	Fishing zone (1)		10.4
10.4.2	Fishing zone (2)		10.4
10.5.1	Stock resource		10.5
10.5.2	Stock resource		10.5
10.5.3	Stock resource		10.5
10.5.4	Stock resource		10.5
10.5.5	Discarded		10.5
10.6	REMARKS		

11. Equipment for preserving and processing of fish

11.1 Preservation

			TABLE
11.1.1.1	Hold for fresh fish	□ Yes □ No	–
11.1.1.2	Fresh fish hold capacity (m^3)		–
11.1.2.1	Cold storage	□ Yes □ No	–
11.1.2.2	Cold storage capacity (m^3)		–
11.1.2.3	Cold storage temperature (°C)		–
11.1.3.1	Refrigerated seawater production	□ Yes □ No	–
11.1.4.1	Hold for live fish	□ Yes □ No	–
11.1.4.2	Live fish hold capacity (m^3)		–
11.1.5.1	Ice plant	□ Yes □ No	–
11.1.5.2	Ice plant capacity (kg/h)		–
11.1.5.3	Ice format		11.1.5.3
11.1.6.1	Other equipment		–
11.1.6.2	Capacity other		–

11.2 Processing

			TABLE
11.2.1.1	Freeze	□ Yes □ No	–
11.2.1.2	Freezer capacity (m^3)		–
11.2.2.1	Fish meal	□ Yes □ No	–
11.2.2.2	Fish meal capacity (m^3)		–
11.2.3.1	Fish oil	□ Yes □ No	–
11.2.3.2	Fish oil capacity (m^3)		–
11.2.4.1	Filleter	□ Yes □ No	–
11.2.4.2	Number of machines		–
11.2.5	Other		–
11.3	REMARKS		

12. Other equipment

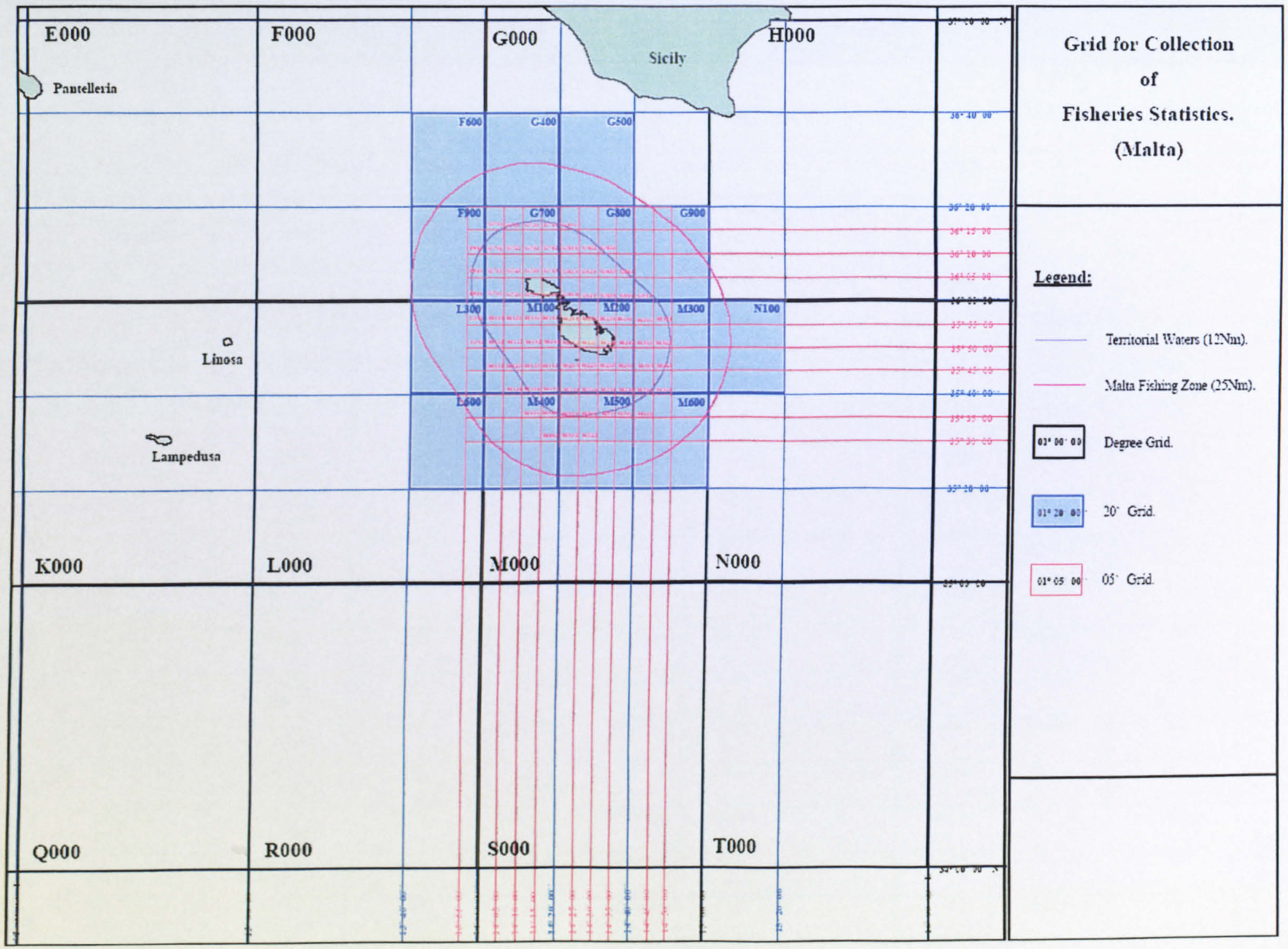
			TABLE
12.1	Lift equipment	□ Yes (Quantity: _____) □ No	–
12.2	Fish pumps	□ Yes (Quantity: _____) □ No	–
12.3	Mullus seeker	□ Yes □ No	–
12.4.1	Lights for fishing	□ Yes □ No	–
12.4.2	No. of lights		–
12.3.2	Power of each light (candle)		–
12.5	REMARKS		

13. Safety equipment

			TABLE
13.1	Number of belts		–
13.2	Number of lifeboats		–
13.3	Number of flares		–
13.4	Number of fire equipment		–
13.5	Other safety equipment		
13.6	REMARKS		

14. General remarks

ANNEX II: DATA COLLECTION GRID



ANNEX III: LIST OF MALTESE OPERATIONAL UNITS BASED ON GFCM IDENTIFICATION PARAMETERS

OPERATIONAL UNITS FORM - BASIC PARAMETERS

Management Unit	Resource Name	Main resource component	Scientific name	Associated species	Resouce distribution reference*	Base ports	Gear category	Vessel size class (length in metres)	Number of Units (fishing	Fishing period (months)	Operational Units name (in full)	Economic structure	Comments
15	Demersal inshore species	Shrimps	*Palaemon serratus*		N/A	M'Xlokk Ix-Xatt	Bottom shrimp trawl Gangmu	3-5.5	4	Jan - Dec	Artisanal	N/A	
15	Demersal inshore species	Saddled bream	*Oblada melanura*	Small tunids	N/A	Mgarr ix-Xini	Drift nets	4-5	2	Jan - Dec	Artisanal	N/A	
15	Demersal inshore species	Red Mullet Cuttle fish Bogue	*Mullus barbatus Sepia officinalis Boops boops*	Small gregarius pelagics	N/A	Mgarr	Gill-net/trammel net	7.5-9	3	Jan - Aug	Artisanal	N/A	
15	Demersal inshore species	Frigate mackerel Red Mullet Cuttle fish Bogue	*Auxis thazard Mullus barbatus Sepia officinalis Boops boops*		N/A	Marsalforn	Gillnets/ Trammel net	4.3-6.7	8	Mar-Aug	Artisanal	N/A	Period varies for individual vessels
15	Demersal inshore species	Comber	*Serranus cabrilla*		N/A	Msida Msida Creek	Hand-line	4.5-6	3	May-Aug	Artisanal	N/A	
15	Demersal inshore species	Comber	*Serranus cabrilla*		N/A	Mgarr	Hooks and lines	4-5	7	Jan - Dec	Artisanal	N/A	Period varies for individual vessels
15	Demersal inshore species	Pandora, Bream	*Pagellus erythrinus, Diplodus sargus*		N/A	Xlendi	Hooks and lines	4.25	2	Jan - Dec	Artisanal	N/A	Period varies for individual vessels
15	Demersal inshore species	Pandora, Bream	*Pagellus erythrinus, Diplodus sargus*	Sparidae Scorpaenidae	N/A	St.Paul's Bay Xemxija	Set bottom long-line	4-9	31	Jan - Dec	Artisanal	N/A	Period varies for individual vessels
15	Demersal inshore species	Red Mullet Cuttle fish Bogue	*Mullus barbatus Sepia officinalis Boops boops*	Sparidae Scorpaenidae	N/A	Anchor Bay	Trammel Net	4 - 4.5	4	Feb - Dec	Artisanal	N/A	Period varies for individual vessels
15	Demersal inshore species	Red Mullet Cuttle fish Bogue	*Mullus barbatus Sepia officinalis Boops boops*	Sparidae Scorpaenidae	N/A	Armier	Trammel Net	3.5 - 8	6	Mar - Dec	Artisanal	N/A	Period varies for individual vessels
15	Demersal inshore species	Red Mullet Cuttle fish Bogue	*Mullus barbatus Sepia officinalis Boops boops*	Sparidae Scorpaenidae	N/A	B'Bugia St. George's Bay	Trammel Net	4 - 10	21	Jan - Dec	Artisanal	N/A	Period varies for individual vessels
15	Demersal inshore species	Red Mullet Cuttle fish Bogue	*Mullus barbatus Sepia officinalis Boops boops*	Sparidae Scorpaenidae	N/A	B'Bugia Pretty Bay	Trammel Net	4 - 7	6	Jan - Dec	Artisanal	N/A	Period varies for individual vessels
15	Demersal inshore species	Red Mullet Cuttle fish Bogue	*Mullus barbatus Sepia officinalis Boops boops*	Sparidae Scorpaenidae	N/A	Bugibba	Trammel Net	4.9 - 6.5	15	Jan - Dec	Artisanal	N/A	Period varies for individual vessels
15	Demersal inshore species	Red Mullet Cuttle fish Bogue	*Mullus barbatus Sepia officinalis Boops boops*	Sparidae Scorpaenidae	N/A	Ghar Lapsi	Trammel Net	4 - 4.7	4	Jan - Dec	Artisanal	N/A	Period varies for individual vessels
15	Demersal inshore species	Red Mullet Cuttle fish Bogue	*Mullus barbatus Sepia officinalis Boops boops*	Sparidae Scorpaenidae	N/A	Gnejna	Trammel Net	4 - 8.5	25	Jan - Dec	Artisanal	N/A	Period varies for individual vessels
15	Demersal inshore species	Red Mullet Cuttle fish Bogue	*Mullus barbatus Sepia officinalis Boops boops*	Sparidae Scorpaenidae	N/A	Gzira Sliema Creek	Trammel Net	6.5	2	Mar - Nov	Artisanal	N/A	Period varies for individual vessels
15	Demersal inshore species	Red Mullet Cuttle fish Bogue	*Mullus barbatus Sepia officinalis Boops boops*	Sparidae Scorpaenidae	N/A	Gzira Lazzaretto Creek	Trammel Net	4.2 - 5.5	6	Jan - Dec	Artisanal	N/A	
15	Demersal inshore species	Red Mullet Cuttle fish Bogue	*Mullus barbatus Sepia officinalis Boops boops*	Sparidae Scorpaenidae	N/A	Kalkara Kalkara Creek	Trammel Net	5-12	5	Jan - Dec	Artisanal	N/A	Period varies for individual vessels
15	Demersal inshore species	Red Mullet Cuttle fish Bogue	*Mullus barbatus Sepia officinalis Boops boops*	Sparidae Scorpaenidae	N/A	Marsa	Trammel Net	11.5	1	Feb - Dec	Artisanal	N/A	

Management Unit	Resource Name	Main resource component	Scientific name	Associated species	Resouce distribution reference*	Base ports	Gear category	Vessel size class (length in metres)	Number of Units (fishing	Fishing period (months)	Operational Units name (in full)	Economic structure	Comments
15	Demersal inshore species	Red Mullet Cuttle fish Bogue	*Mullus barbatus Sepia officinalis Boops boops*	Sparidae Scorpaenidae	N/A	Marsalforn	Trammel Net	3.8-6.7	9	Jan - Sept	Artisanal	N/A	Period varies for individual vessels
15	Demersal inshore species	Red Mullet Cuttle fish Bogue	*Mullus barbatus Sepia officinalis Boops boops*	Sparidae Scorpaenidae	N/A	Marsaskala	Trammel Net	3.3-9.2	33	Jan - Dec	Artisanal	N/A	Period varies for individual vessels
15	Demersal inshore species	Red Mullet Cuttle fish Bogue	*Mullus barbatus Sepia officinalis Boops boops*		N/A	Mellieha	Trammel Net	3.8 - 10	16	Jan - Dec	Artisanal	N/A	Period varies for individual vessels
15	Demersal inshore species	Red Mullet Cuttle fish Bogue	*Mullus barbatus Sepia officinalis Boops boops*	Sparidae Scorpaenidae	N/A	Mgarr	Trammel Net	4-12	30	Jan - Dec	Artisanal	N/A	Period varies for individual vessels
15	Demersal inshore species	Red Mullet Cuttle fish Bogue	*Mullus barbatus Sepia officinalis Boops boops*	Sparidae Scorpaenidae	N/A	Mistra Bay	Trammel Net	3.6-8	5	Jan - Oct	Artisanal	N/A	Period varies for individual vessels
15	Demersal inshore species	Red Mullet Cuttle fish Bogue	*Mullus barbatus Sepia officinalis Boops boops*	Sparidae Scorpaenidae	N/A	Msida Msida Creek	Trammel Net	3.6-13.3	33	Aug-Dec	Artisanal	N/A	Period varies for individual vessels
15	Demersal inshore species	Red Mullet Cuttle fish Bogue	*Mullus barbatus Sepia officinalis Boops boops*	Sparidae Scorpaenidae	N/A	M'Xlokk Il-Maghluq	Trammel Net	4.5 - 13.2	55	Jan - Dec	Artisanal	N/A	Period varies for individual vessels
15	Demersal inshore species	Red Mullet Cuttle fish Bogue	*Mullus barbatus Sepia officinalis Boops boops*	Sparidae Scorpaenidae	N/A	M'Xlokk Ix-Xatt	Trammel Net	4-9.5	56	Jan - Dec	Artisanal	N/A	Period varies for individual vessels
15	Demersal inshore species	Red Mullet Cuttle fish Bogue	*Mullus barbatus Sepia officinalis Boops boops*		N/A	M'Xlokk Kavallerizza	Trammel Net	4.5 - 7.6	6	Jan - Dec	Artisanal	N/A	
15	Demersal inshore species	Red Mullet Cuttle fish Bogue	*Mullus barbatus Sepia officinalis Boops boops*	Sparidae Scorpaenidae	N/A	Qawra	Trammel Net	4-7	10	June-Oct	Artisanal	N/A	Period varies for individual vessels
15	Demersal inshore species	Red Mullet Cuttle fish Bogue	*Mullus barbatus Sepia officinalis Boops boops*	Sparidae Scorpaenidae	N/A	Ramla tal-Qortin	Trammel Net	4-7.3	10	Mar-Dec	Artisanal	N/A	Period varies for individual vessels
15	Demersal inshore species	Red Mullet Cuttle fish Bogue	*Mullus barbatus Sepia officinalis Boops boops*	Sparidae Scorpaenidae	N/A	Ramla tat-Torri	Trammel Net	4.2-5.2	3	Mar-Sept	Artisanal	N/A	Period varies for individual vessels
15	Demersal inshore species	Red Mullet Cuttle fish Bogue	*Mullus barbatus Sepia officinalis Boops boops*	Sparidae Scorpaenidae	N/A	Salina	Trammel Net	4.7-7	4	Jan -Sept	Artisanal	N/A	Period varies for individual vessels
15	Demersal inshore species	Red Mullet Cuttle fish Bogue	*Mullus barbatus Sepia officinalis Boops boops*	Sparidae Scorpaenidae	N/A	Senglea Dockyard Creek	Trammel Net	6.8	2	Jan - Dec	Artisanal	N/A	Period varies for individual vessels
15	Demersal inshore species	Red Mullet Cuttle fish Bogue	*Mullus barbatus Sepia officinalis Boops boops*	Sparidae Scorpaenidae	N/A	Senglea French Creek	Trammel Net	4-7.4	5	Mar- Dec	Artisanal	N/A	Period varies for individual vessels
15	Demersal inshore species	Red Mullet Cuttle fish Bogue	*Mullus barbatus Sepia officinalis Boops boops*	Sparidae Scorpaenidae	N/A	Sliema Creek	Trammel Net	4.57	1	Apr -Oct	Artisanal	N/A	
15	Demersal inshore species	Red Mullet Cuttle fish Bogue	*Mullus barbatus Sepia officinalis Boops boops*	Sparidae Scorpaenidae	N/A	St. Julians	Trammel Net	4-12	20	Jan - Dec	Artisanal	N/A	Period varies for individual vessels
15	Demersal inshore species	Red Mullet Cuttle fish Bogue	*Mullus barbatus Sepia officinalis Boops boops*	Sparidae Scorpaenidae	N/A	St. Paul's Bay il-Vecca	Trammel Net	3.4 - 7.6	5	Jan - Dec	Artisanal	N/A	Period varies for individual vessels
15	Demersal inshore species	Red Mullet Cuttle fish Bogue	*Mullus barbatus Sepia officinalis Boops boops*	Sparidae Scorpaenidae	N/A	St. Thomas Bay	Trammel Net	4-5	2	Jan - Dec	Artisanal	N/A	Period varies for individual vessels
15	Demersal inshore species	Red Mullet Cuttle fish Bogue	*Mullus barbatus Sepia officinalis Boops boops*	Sparidae Scorpaenidae	N/A	St.Paul's Bay il-Fekruna	Trammel Net	4.2-6.7	4	Jan - Dec	Artisanal	N/A	Period varies for individual vessels
15	Demersal inshore species	Red Mullet Cuttle fish Bogue	*Mullus barbatus Sepia officinalis Boops boops*	Sparidae Scorpaenidae	N/A	St.Paul's Bay il-Gillieru	Trammel Net	3.7-10	23	Jan - Dec	Artisanal	N/A	Period varies for individual vessels

Management Unit	Resource Name	Main resource component	Scientific name	Associated species	Resouce distribution reference*	Base ports	Gear category	Vessel size class (length in metres)	Number of Units (fishing	Fishing period (months)	Operational Units name (in full)	Economic structure	Comments
15	Demersal inshore species	Red Mullet Cuttle fish Bogue	*Mullus barbatus Sepia officinalis Boops boops*	Sparidae Scorpaenidae	N/A	St.Paul's Bay Xemxija	Trammel Net	4.3-9	23	Jan - Dec	Artisanal	N/A	Period varies for individual vessels
15	Demersal inshore species	Red Mullet Cuttle fish Bogue	*Mullus barbatus Sepia officinalis Boops boops*	Sparidae Scorpaenidae	N/A	Ta' Xbiex Msida Creek	Trammel Net	9.6	1	May - Aug	Artisanal	N/A	
15	Demersal inshore species	Red Mullet Cuttle fish Bogue	*Mullus barbatus Sepia officinalis Boops boops*	Sparidae Scorpaenidae	N/A	Valletta Grand Harbour	Trammel Net	12	1	Jan - May	Artisanal	N/A	
15	Demersal inshore species	Red Mullet Cuttle fish Bogue	*Mullus barbatus Sepia officinalis Boops boops*	Sparidae Scorpaenidae	N/A	Valletta Marsamxett	Trammel Net	14.8	1	Mar - Oct	Artisanal	N/A	
15	Demersal inshore species	Red Mullet Cuttle fish Bogue	*Mullus barbatus Sepia officinalis Boops boops*	Sparidae Scorpaenidae	N/A	Vittoriosa Kalkara Creek	Trammel Net	5.5	2	Mar - Dec	Artisanal	N/A	Period varies for individual vessels
15	Demersal inshore species	Red Mullet Cuttle fish Bogue	*Mullus barbatus Sepia officinalis Boops boops*	Sparidae Scorpaenidae	N/A	Xlendi	Trammel Net	5-7	5	Jan - Dec	Artisanal	N/A	Period varies for individual vessels
									520				
15	Demersal offshore species	Pandora, Bream	*Pagellus erythrinus, Diplodus sargus*	Gurnards	N/A	Armier	Set bottom long-line	4 - 8	7	Jan - Dec	Artisanal	N/A	Period varies for individual vessels
15	Demersal offshore species	Pandora, Bream	*Pagellus erythrinus, Diplodus sargus*	Gurnards	N/A	Balluta Bay	Set bottom long-line	4.27	1	Apr - Jun	Artisanal	N/A	*
15	Demersal offshore species	Pandora, Bream	*Pagellus erythrinus, Diplodus sargus*	Gurnards	N/A	B'Bugia St. George's Bay	Set bottom long-line	4 - 10	88	Jan - Dec	Artisanal	N/A	Period varies for individual vessels
15	Demersal offshore species	Pandora, Bream	*Pagellus erythrinus, Diplodus sargus*	Gurnards	N/A	B'Bugia Pretty Bay	Set bottom long-line	4 - 9.5	34	Jan - Dec	Artisanal	N/A	Period varies for individual vessels
15	Demersal offshore species	Pandora, Bream	*Pagellus erythrinus, Diplodus sargus*	Gurnards	N/A	Bugibba	Set bottom long-line	3.5 - 6.7	27	Jan - Dec	Artisanal	N/A	Period varies for individual vessels
15	Demersal offshore species	Pandora, Bream	*Pagellus erythrinus, Diplodus sargus*	Gurnards	N/A	Comino	Set bottom long-line	6.45	1	Jan - Jul	Artisanal	N/A	*
15	Demersal offshore species	Pandora, Bream	*Pagellus erythrinus, Diplodus sargus*	Gurnards	N/A	Dwejra	Set bottom long-line	4-4.5	3	May - Sep	Artisanal	N/A	*
15	Demersal offshore species	Pandora, Bream	*Pagellus erythrinus, Diplodus sargus*	Gurnards	N/A	Ghar Lapsi	Set bottom long-line	3.5 - 4.5	8	Jan - Dec	Artisanal	N/A	Period varies for individual vessels
15	Demersal offshore species	Pandora, Bream	*Pagellus erythrinus, Diplodus sargus*	Gurnards	N/A	Gnejna	Set bottom long-line	3.5 - 8.5	45	Jan - Dec	Artisanal	N/A	Period varies for individual vessels
15	Demersal offshore species	Pandora, Bream	*Pagellus erythrinus, Diplodus sargus*	Gurnards	N/A	Gzira Sliema Creek	Set bottom long-line	3.5 - 7.6	12	Jan - Dec	Artisanal	N/A	Period varies for individual vessels
15	Demersal offshore species	Pandora, Bream	*Pagellus erythrinus, Diplodus sargus*	Gurnards	N/A	Gzira Lazzaretto Creek	Set bottom long-line	3.8 - 7.6	9	Jan - Dec	Artisanal	N/A	Period varies for individual vessels
15	Demersal offshore species	Pandora, Bream	*Pagellus erythrinus, Diplodus sargus*	Gurnards	N/A	Hondoq ir-Rummien	Set bottom long-line	5.8	1	Jun - Oct	Artisanal	N/A	*
15	Demersal offshore species	Pandora, Bream	*Pagellus erythrinus, Diplodus sargus*	Gurnards	N/A	Kalkara Kalkara Creek	Set bottom long-line	4-12	32	Jan - Dec	Artisanal	N/A	Period varies for individual vessels
15	Demersal offshore species	Pandora, Bream	*Pagellus erythrinus, Diplodus sargus*	Gurnards	N/A	Marsa	Set bottom long-line	4 - 5.5	2	Jan - Oct	Artisanal	N/A	Period varies for individual vessels

Management Unit	Resource Name	Main resource component	Scientific name	Associated species	Resouce distribution reference*	Base ports	Gear category	Vessel size class (length in metres)	Number of Units (fishing	Fishing period (months)	Operational Units name (in full)	Economic structure	Comments
15	Demersal offshore species	Dentex Common bream	*Dentex dentex Pagrus pagrus*	Sparidae Scorpaenidae	N/A	Marsalforn	Set bottom long-line	4-10	11	Jan - Dec	Artisanal	N/A	Period varies for individual vessels
15	Demersal offshore species	Pandora, Bream	*Pagellus erythrinus, Diplodus sargus*		N/A	Marsaskala	Set bottom long-line	3.5-9	83	Jan - Dec	Artisanal	N/A	Period varies for individual vessels
15	Demersal offshore species	Common bream Dog-fish	*Pagurus pagurus Squalus acanthias*		N/A	Marsaskala	Set bottom long-line	10-20	9	Jan - April	Artisanal	N/A	
15	Demersal offshore species	Pandora, Bream	*Pagellus erythrinus, Diplodus sargus*		N/A	Mellieha	Set bottom long-line	4.1 - 14	21	Jan - Dec	Artisanal	N/A	Period varies for individual vessels
15	Demersal offshore species	Pandora, Bream	*Pagellus erythrinus, Diplodus sargus*	Gurnards	N/A	Mgarr	Set bottom long-line	4-10	50	Jan - Dec	Artisanal	N/A	Period varies for individual vessels
15	Demersal offshore species	Pandora, Bream	*Pagellus erythrinus, Diplodus sargus*	Gurnards	N/A	Mistra Bay	Set bottom long-line	5.5-8	2	May-Oct	Artisanal	N/A	Period varies for individual vessels
15	Demersal offshore species	Pandora, Bream	*Pagellus erythrinus, Diplodus sargus*	Sparidae Scorpaenidae	N/A	Msida Msida Creek	Set bottom long-line	4-10	55	Jan - Dec	Artisanal	N/A	Period varies for individual vessels
15	Demersal offshore species	Pandora, Bream	*Pagellus erythrinus, Diplodus sargus*		N/A	M'Xlokk Il-Maghluq	Set bottom long-line	3.8 - 9.2	84	Jan - Dec	Artisanal	N/A	Period varies for individual vessels
15	Demersal offshore species	Large scaled scorpion fish	*Scorpaena scrofa*	*Diplodus sargus*	N/A	M'Xlokk Ix-Xatt	Set bottom long-line	3.6-7.5	44	Jan - Dec	Artisanal	N/A	Period varies for individual vessels
15	Demersal offshore species	Common bream Dog-fish	*Pagurus pagurus Squalus acanthias*		N/A	M'Xlokk Ix-Xatt	Set bottom long-line	7.6-16.2	20	Jan - Dec	Artisanal	N/A	Period varies for individual vessels
15	Demersal offshore species	Pandora, Bream	*Pagellus erythrinus, Diplodus sargus*		N/A	M'Xlokk Kavallerizza	Set bottom long-line	6.7 - 10	4	Jan - Dec	Artisanal	N/A	Period varies for individual vessels
15	Demersal offshore species	Pandora, Bream	*Pagellus erythrinus, Diplodus sargus*	Sparidae Scorpaenidae	N/A	Qawra	Set bottom long-line	4-10	18	Jan - Dec	Artisanal	N/A	Period varies for individual vessels
15	Demersal offshore species	Pandora, Bream	*Pagellus erythrinus, Diplodus sargus*	Gurnards	N/A	Ramla tal-Qortin	Set bottom long-line	4.2-7.3	5	Mar - Dec	Artisanal	N/A	Period varies for individual vessels
15	Demersal offshore species	Pandora, Bream	*Pagellus erythrinus, Diplodus sargus*	Sparidae Scorpaenidae	N/A	Salina	Set bottom long-line	4.7-7	8	Mar-Dec	Artisanal	N/A	Period varies for individual vessels
15	Demersal offshore species	Pandora, Bream	*Pagellus erythrinus, Diplodus sargus*	Sparidae Scorpaenidae	N/A	Senglea Dockyard Creek	Set bottom long-line	5-7	12	Jan - Dec	Artisanal	N/A	Period varies for individual vessels
15	Demersal offshore species	Pandora, Bream	*Pagellus erythrinus, Diplodus sargus*	Gurnards	N/A	Senglea French Creek	Set bottom long-line	4-7.4	10	Jan - Dec	Artisanal	N/A	
15	Demersal offshore species	Pandora, Bream	*Pagellus erythrinus, Diplodus sargus*	Gurnards	N/A	Sliema Creek	Set bottom long-line	6 - 6.25	2	Apr- Oct	Artisanal	N/A	
15	Demersal offshore species	Pandora, Bream	*Pagellus erythrinus, Diplodus sargus*	Gurnards	N/A	St. Julians	Set bottom long-line	4-10	28	Jan - Dec	Artisanal	N/A	Period varies for individual vessels
15	Demersal offshore species	Pandora, Bream	*Pagellus erythrinus, Diplodus sargus*	Gurnards	N/A	St. Paul's Bay il-Vecca	Set bottom long-line	4.6 - 6.7	5	Jan - Dec	Artisanal	N/A	Period varies for individual vessels
15	Demersal offshore species	Pandora, Bream	*Pagellus erythrinus, Diplodus sargus*	Gurnards	N/A	St.Paul's Bay il-Fekruna	Set bottom long-line	3.7-13.5	11	Jan - Dec	Artisanal	N/A	Period varies for individual vessels
15	Demersal offshore species	Pandora, Bream	*Pagellus erythrinus, Diplodus sargus*	Sparidae Scorpaenidae	N/A	St.Paul's Bay il-Gillieru	Set bottom long-line	4.2-10	32	Jan - Dec	Artisanal	N/A	Period varies for individual vessels

Management Unit	Resource Name	Main resource component	Scientific name	Associated species	Resouce distribution reference*	Base ports	Gear category	Vessel size class (length in metres)	Number of Units (fishing	Fishing period (months)	Operational Units name (in full)	Economic structure	Comments
15	Dolphin fish	Dolphin fish	*Coryphaena hippurus*	*Auxis thazard*	N/A	St. Paul's Bay il-Vecca	Hand trolling lines	4-14.4	4	Mar-Nov	Artisanal	N/A	Period varies for individual vessels
15	Dolphin fish	Dolphin fish	*Coryphaena hippurus*	*Auxis thazard*	N/A	St.Paul's Bay il-Fekruna	Hand trolling lines	5.5-6.4	5	May-Nov	Artisanal	N/A	
15	Dolphin fish	Dolphin fish	*Coryphaena hippurus*	*Auxis thazard*	N/A	St.Paul's Bay il-Gillieru	Hand trolling lines	3.7-9.5	37	Jan - Dec	Artisanal	N/A	Period varies for individual vessels
15	Dolphin fish	Dolphin fish	*Coryphaena hippurus*	*Auxis thazard*	N/A	St.Paul's Bay Xemxija	Hand trolling lines	4.2-8.6	18	Jan - Dec	Artisanal	N/A	Period varies for individual vessels
15	Dolphin fish	Dolphin fish	*Coryphaena hippurus*	*Auxis thazard* *Seriola dumerili*	N/A	Ta' Xbiex Msida Creek	Hand trolling lines	4 - 6.5	2	Feb - Dec	Artisanal	N/A	
15	Dolphin fish	Dolphin fish	*Coryphaena hippurus*	*Auxis thazard* *Seriola dumerili*	N/A	Valletta Marsamxett	Hand trolling lines	4 - 15	4	May - Dec	Artisanal	N/A	
15	Dolphin fish	Dolphin fish	*Coryphaena hippurus*	*Auxis thazard*	N/A	Vittoriosa Dockyard Creek	Hand trolling lines	5-11	2	Jan - Nov	Artisanal	N/A	Period varies for individual vessels
15	Dolphin fish	Dolphin fish	*Coryphaena hippurus*	*Auxis thazard*	N/A	Xlendi	Hand trolling lines	4.3-6	5	Aug- Dec	Artisanal	N/A	
									378				
15	Large pelagics	Blue-fin tuna	*Thunnus thynnus*	Albacore	N/A	St. Julians	Drifting long-lines	6-12	4	May - Dec	Artisanal	N/A	Period varies for individual vessels
15	Large pelagics	Dolphin fish	*Coryphaena hippurus*	*Seriola dumerili*	N/A	Comino	Hand trolling lines	6.45	1	Aug - Dec	Artisanal	N/A	
15	Large pelagics	Dolphin fish	*Coryphaena hippurus*	*Seriola dumerili*	N/A	Qbajjar	Hand trolling lines	4 - 4.5	3	May - Oct	Artisanal	N/A	
15	Large pelagics	Blue shark	*Prionace glauca*	sharks	N/A	Marsalforn	Set surface long-line	3.8-5.9	4	Jan - Dec	Artisanal	N/A	Period varies for individual vessels
Mediterranean	Large pelagics	Blue shark	*Prionace glauca*	sharks	N/A	Xlendi	Set surface long-line	6	2	Jan - Dec	Artisanal	N/A	Period varies for individual vessels
15	Large pelagics	Blue shark	*Prionace glauca*	sharks	N/A	Mgarr	Set surface long-lines	4-7	4	May - Dec	Artisanal	N/A	Period varies for individual vessels
									18				
15	Octopus	Octopus	*Octopus vulgaris*	*Muraena helena*	N/A	B'Bugia St. George's Bay	Octopus pots	4 - 5.2	3	Jan - Dec	Artisanal	N/A	
15	Octopus	Octopus	*Octopus vulgaris*	*Muraena helena*	N/A	B'Bugia St. George's Bay	Octopus pots	16.6	1	Jan - Aug	Artisanal	N/A	
15	Octopus	Octopus	*Octopus vulgaris*	*Muraena helena*	N/A	Dahlet Qorrot	Octopus pots	4.42	1	Feb - Sep	Artisanal	N/A	
15	Octopus	Octopus	*Octopus vulgaris*		N/A	Kalkara Kalkara Creek	Octopus pots	3.7-8.8	3	Mar - Dec	Artisanal	N/A	Period varies for individual vessels
15	Octopus	Octopus	*Octopus vulgaris*		N/A	Marsalforn	Octopus pots	4.2-5.2	5	Mar-Aug	Artisanal	N/A	
15	Octopus	Octopus	*Octopus vulgaris*		N/A	Marsaskala	Octopus pots	4.8-5.9	3	Jan - Dec	Artisanal	N/A	
15	Octopus	Octopus	*Octopus vulgaris*		N/A	Mgarr	Octopus pots	4-8	16	Jan - Dec	Artisanal	N/A	Period varies for individual vessels
15	Octopus	Octopus	*Octopus vulgaris*		N/A	M'Xlokk Il-Maghluq	Octopus pots	3.8 - 6.1	6	Jan - Dec	Artisanal	N/A	
15	Octopus	Octopus	*Octopus vulgaris*		N/A	M'Xlokk Ix-Xatt	Octopus pots	3.5-6.5	11	Jan - Dec	Artisanal	N/A	
15	Octopus	Octopus	*Octopus vulgaris*		N/A	M'Xlokk Kavallerizza	Octopus pots	6.2 - 7.3	2	Jan - Dec	Artisanal	N/A	Period varies for individual vessels
15	Octopus	Octopus	*Octopus vulgaris*		N/A	Ramla tal-Qortin	Octopus pots	4.3-5.1	2	Mar-Oct	Artisanal	N/A	
15	Octopus	Octopus	*Octopus vulgaris*	*Muraena helena*	N/A	St. Julians	Octopus pots	4-10	5	Jan - Dec	Artisanal	N/A	Period varies for individual vessels
15	Octopus	Octopus	*Octopus vulgaris*		N/A	St. Paul's Bay il-Vecca	Octopus pots	3.5 - 7.6	5	Jan - Dec	Artisanal	N/A	Period varies for individual vessels
15	Octopus	Octopus	*Octopus vulgaris*		N/A	St.Paul's Bay Xemxija	Octopus pots	5-6.5	2	Jan - Dec	Artisanal	N/A	Period varies for individual vessels
15	Octopus	Octopus	*Octopus vulgaris*		N/A	Xlendi	Octopus pots	4-6	2	Jan - Dec	Artisanal	N/A	Period varies for individual vessels
									67				
15	Small gregarious pelagic	Pellucid sole	*Brachyochirus pellucidus*		N/A	Msida Msida Creek	Boat seine Tartarun	6.4	1	July-Aug	Artisanal	N/A	
15	Small gregarious pelagic	Pellucid sole	*Brachyochirus pellucidus*		N/A	M'Xlokk Ix-Xatt	Boat seine *Tartarun*	5.3-5.6	2	June - Dec	Artisanal	N/A	

Management Unit	Resource Name	Main resource component	Scientific name	Associated species	Resouce distribution reference*	Base ports	Gear category	Vessel size class (length in metres)	Number of Units (fishing	Fishing period (months)	Operational Units name (in full)	Economic structure	Comments
15	Demersal offshore species	Pandora, Bream	*Pagellus erythrinus, Diplodus sargus*	Gurnards	N/A	St.Thomas Bay	Set bottom long-line	6-12	3	Jan - Dec	Artisanal	N/A	Period varies for individual vessels
15	Demersal offshore species	Pandora, Bream	*Pagellus erythrinus, Diplodus sargus*	Gurnards	N/A	Ta' Xbiex Msida Creek	Set bottom long-line	4 - 10	3	Jan - Dec	Artisanal	N/A	* Period varies for individual vessels
15	Demersal offshore species	Pandora, Bream	*Pagellus erythrinus, Diplodus sargus*	Gurnards	N/A	Valletta Marsamxett	Set bottom long-line	4 - 5.5	2	Jan - Dec	Artisanal	N/A	* Period varies for individual vessels
15	Demersal offshore species	Pandora, Bream	*Pagellus erythrinus, Diplodus sargus*	Gurnards	N/A	Vittoriosa Kalkara Creek	Set bottom long-line	5.5	3	Jan - Dec	Artisanal	N/A	Period varies for individual vessels
15	Demersal offshore species	Pandora, Bream	*Pagellus erythrinus, Diplodus sargus*	Gurnards	N/A	Wied iz-Zurrieq	Set bottom long-line	3.8	1	June-Sept	Artisanal	N/A	
15	Demersal offshore species	Pandora, Bream	*Pagellus erythrinus, Diplodus sargus*	Gurnards	N/A	Xlendi	Set bottom long-line	4.4-8	12	Jan - Dec	Artisanal	N/A	Period varies for individual vessels
									808				
15	Dolphin fish	Dolphin fish	*Coryphaena hippurus*	*Auxis thazard Seriola dumerili*	N/A	Anchor Bay	Hand trolling lines	5	1	Jun - Nov	Artisanal	N/A	
15	Dolphin fish	Dolphin fish	*Coryphaena hippurus*	*Auxis thazard Seriola dumerili*	N/A	Armier	Hand trolling lines	5 - 5.5	2	Mar - Dec	Artisanal	N/A	Period varies for individual vessels
15	Dolphin fish	Dolphin fish	*Coryphaena hippurus*	*Auxis thazard Seriola dumerili*	N/A	B'Bugia St. George's Bay	Hand trolling lines	4 - 10	28	Jan - Dec	Artisanal	N/A	Period varies for individual vessels
15	Dolphin fish	Dolphin fish	*Coryphaena hippurus*	*Auxis thazard Seriola dumerili*	N/A	B'Bugia Pretty Bay	Hand trolling lines	4 - 12	29	Jan - Dec	Artisanal	N/A	Period varies for individual vessels
15	Dolphin fish	Dolphin fish	*Coryphaena hippurus*	*Auxis thazard*	N/A	Bugibba	Hand trolling lines	4 - 5.8	10	Jan - Dec	Artisanal	N/A	Period varies for individual vessels
15	Dolphin fish	Dolphin fish	*Coryphaena hippurus*	*Auxis thazard*	N/A	Ghar Lapsi	Hand trolling lines	3.5 - 4.7	8	Jan - Dec	Artisanal	N/A	Period varies for individual vessels
15	Dolphin fish	Dolphin fish	*Coryphaena hippurus*	*Auxis thazard*	N/A	Gnejna	Hand trolling lines	3.7 - 9.5	46	Jan - Dec	Artisanal	N/A	Period varies for individual vessels
15	Dolphin fish	Dolphin fish	*Coryphaena hippurus*	*Auxis thazard*	N/A	Gzira Lazzaretto Creek	Hand trolling lines	4.2 - 7.4	6	May - Dec	Artisanal	N/A	Period varies for individual vessels
15	Dolphin fish	Dolphin fish	*Coryphaena hippurus*	*Auxis thazard*	N/A	Kalkara Kalkara Creek	Hand trolling lines	4-7.2	9	Jan - Dec	Artisanal	N/A	Period varies for individual vessels
15	Dolphin fish	Dolphin fish	*Coryphaena hippurus*	*Auxis thazard*	N/A	Marsalforn	Hand trolling lines	3.7-4.9	6	May - Dec	Artisanal	N/A	Period varies for individual vessels
15	Dolphin fish	Dolphin fish	*Coryphaena hippurus*	*Naucrates ductor*	N/A	Marsaskala	Hand trolling lines	3.2 - 7.3	35	Jan - Dec	Artisanal	N/A	Period varies for individual vessels
15	Dolphin fish	Dolphin fish	*Coryphaena hippurus*	*Auxis thazard Seriola dumerili*	N/A	Mellieha	Hand trolling lines	4 - 10	12	Jun - Oct	Artisanal	N/A	Period varies for individual vessels
15	Dolphin fish	Dolphin fish	*Coryphaena hippurus*	*Seriola dumerili*	N/A	Mgarr	Hand trolling lines	3.6-9.2	30	Aug-Nov	Artisanal	N/A	
15	Dolphin fish	Dolphin fish	*Coryphaena hippurus*	*Auxis thazard*	N/A	Mistra Bay	Hand trolling lines	4.5-8.5	3	May-Oct	Artisanal	N/A	Period varies for individual vessels
15	Dolphin fish	Dolphin fish	*Coryphaena hippurus*	*Auxis thazard*	N/A	Msida Msida Creek	Hand trolling lines	4-7.2	39	Jan - Dec	Artisanal	N/A	Period varies for individual vessels
15	Dolphin fish	Dolphin fish	*Coryphaena hippurus*	*Auxis thazard*	N/A	Qawra	Hand trolling lines	4-10	6	June-Nov	Artisanal	N/A	
15	Dolphin fish	Dolphin fish	*Coryphaena hippurus*	*Auxis thazard*	N/A	Ramla tal-Qortin	Hand trolling lines	3.8-5.5	8	Feb - Dec	Artisanal	N/A	Period varies for individual vessels
15	Dolphin fish	Dolphin fish	*Coryphaena hippurus*	*Auxis thazard*	N/A	Salina	Hand trolling lines	5-5.5	3	May-Dec	Artisanal	N/A	Period varies for individual vessels
15	Dolphin fish	Dolphin fish	*Coryphaena hippurus*	*Auxis thazard*	N/A	Senglea Dockyard Creek	Hand trolling lines	5-7	8	Jan - Dec	Artisanal	N/A	Period varies for individual vessels
15	Dolphin fish	Dolphin fish	*Coryphaena hippurus*	*Auxis thazard*	N/A	Senglea French Creek	Hand trolling lines	4-6	3	Mar- Dec	Artisanal	N/A	
15	Dolphin fish	Dolphin fish	*Coryphaena hippurus*	*Auxis thazard Seriola dumerili*	N/A	Sliema Creek	Hand trolling lines	4.5-6.5	2	May - Nov	Artisanal	N/A	
15	Dolphin fish	Dolphin fish	*Coryphaena hippurus*	*Seriola dumerili*	N/A	St. Julians	Hand trolling lines	4-8	7	Jul - Dec	Artisanal	N/A	

Management Unit	Resource Name	Main resource component	Scientific name	Associated species	Resouce distribution reference*	Base ports	Gear category	Vessel size class (length in metres)	Number of Units (fishing	Fishing period (months)	Operational Units name (in full)	Economic structure	Comments
15	Small gregarious pelagic	Saddled bream	*Oblada melanura*	Scombridae spp.	N/A	Mgarr	Driftnets	4.5-9	6	April-Sept	Artisanal	N/A	
15	Small gregarious pelagic	Saddled bream	*Oblada melanura*	Demersal inshore	N/A	St. Julians	Gillnets / Entangling nets	4-10	8	Jan - Dec	Artisanal	N/A	Period varies for individual vessels
15	Small gregarious pelagic	Frigate mackerel	*Auxis thazard*	*Seriola dumerili*	N/A	Gzira Sliema Creek	Hand trolling lines	4.2 - 6.4	12	Mar - Dec	Artisanal	N/A	Period varies for individual vessels
15	Small gregarious pelagic	Dolphin fish	*Coryphaena hippurus*	*Auxis thazard*	N/A	M'Xlokk Il-Maghluq	Hand trolling lines	4.1 - 8	14	Jan - Dec	Artisanal	N/A	Period varies for individual vessels
15	Small gregarious pelagic	Frigate mackerel	*Auxis thazard*	*Seriola dumerili*	N/A	M'Xlokk Ix-Xatt	Hand trolling lines	3.6-6.8	23	Jan - Dec	Artisanal	N/A	Period varies for individual vessels
15	Small gregarious pelagic	Frigate mackerel	*Auxis thazard*		N/A	St. Julians	Hand trolling lines	4-7	10	Jun - Dec	Artisanal	N/A	
15	Small gregarious pelagic	Bogue	*Boops boops*		N/A	B'Bugia St. George's Bay	Traps	5 - 7.5	11	Jan - Dec	Artisanal	N/A	Period varies for individual vessels
15	Small gregarious pelagic	Bogue	*Boops boops*		N/A	B'Bugia Pretty Bay	Traps	4 - 5.5	2	Jun - Oct	Artisanal	N/A	
15	Small gregarious pelagic	Bogue	*Boops boops*		N/A	Bugibba	Traps	3.5 - 6.7	5	Jan - Dec	Artisanal	N/A	Period varies for individual vessels
15	Small gregarious pelagic	Bogue	*Boops boops*		N/A	Dwejra	Traps	4-4.5	4	May - Dec	Artisanal	N/A	
15	Small gregarious pelagic	Bogue	*Boops boops*		N/A	Ghar Lapsi	Traps	4 - 4.5	2	Jun - Dec	Artisanal	N/A	
15	Small gregarious pelagic	Bogue	*Boops boops*		N/A	Gnejna	Traps	4 - 8.5	34	Jan - Dec	Artisanal	N/A	Period varies for individual vessels
15	Small gregarious pelagic	Bogue	*Boops boops*		N/A	Gzira Sliema Creek	Traps	3.5 - 6.5	2	Jul - Dec	Artisanal	N/A	Period varies for individual vessels
15	Small gregarious pelagic	Bogue	*Boops boops*		N/A	Marfa	Traps	4.5-5	4	Mar-Oct	Artisanal	N/A	Period varies for individual vessels
15	Small gregarious pelagic	Bogue	*Boops boops*	picarel	N/A	Marsalforn	Traps	4-10	7	April-Nov	Artisanal	N/A	Period varies for individual vessels
15	Small gregarious pelagic	Bogue	*Boops boops*		N/A	Marsaskala	Traps	4-6.4	9	Jan - Dec	Artisanal	N/A	Period varies for individual vessels
15	Small gregarious pelagic	Bogue	*Boops boops*		N/A	Mellieha	Traps	3.6 - 5	13	May - Oct	Artisanal	N/A	Period varies for individual vessels
15	Small gregarious pelagic	Bogue	*Boops boops*		N/A	Mgarr	Traps	3.6-10	61	Jan - Dec	Artisanal	N/A	Period varies for individual vessels
15	Small gregarious pelagic	Picarel			N/A	Mgarr	Traps	7.5-7.8	4	Feb-July	Artisanal	N/A	Period varies for individual vessels
15	Small gregarious pelagic	Bogue	*Boops boops*		N/A	Msida Msida Creek	Traps	5-10	13	Jan - Dec	Artisanal	N/A	Period varies for individual vessels
15	Small gregarious pelagic	Bogue	*Boops boops*		N/A	M'Xlokk Il-Maghluq	Traps	4.2 - 6	4	Mar - Oct	Artisanal	N/A	

Management Unit	Resource Name	Main resource component	Scientific name	Associated species	Resouce distribution reference*	Base ports	Gear category	Vessel size class (length in metres)	Number of Units (fishing	Fishing period (months)	Operational Units name (in full)	Economic structure	Comments
15	Small gregarious pelagic	Bogue	*Boops boops*		N/A	Qawra	Traps	4-5	7	June-Sept	Artisanal	N/A	Period varies for individual vessels
15	Small gregarious pelagic	Bogue	*Boops boops*		N/A	Qbajjar	Traps	4-4.5	3	May - Sep	Artisanal	N/A	
15	Small gregarious pelagic	Bogue	*Boops boops*		N/A	Ramla tal-Qortin	Traps	3.8-7.3	10	Mar-Dec	Artisanal	N/A	
15	Small gregarious pelagic	Bogue	*Boops boops*		N/A	Ramla tat-Torri	Traps	4.3-4.6	2	June-Sept	Artisanal	N/A	
15	Small gregarious pelagic	Bogue	*Boops boops*		N/A	Salina	Traps	5-5.5	2	April-Nov	Artisanal	N/A	Period varies for individual vessels
15	Small gregarious pelagic	Bogue	*Boops boops*		N/A	Senglea Dockyard Creek	Traps	5.7	2	April-Nov	Artisanal	N/A	Period varies for individual vessels
15	Small gregarious pelagic	Bogue	*Boops boops*		N/A	St. Julians	Traps	4-5	2	Jun - Dec	Artisanal	N/A	
15	Small gregarious pelagic	Bogue	*Boops boops*		N/A	St. Paul's Bay il-Vecca	Traps	4 - 4.5	2	Jan - Aug	Artisanal	N/A	Period varies for individual vessels
15	Small gregarious pelagic	Bogue	*Boops boops*		N/A	St.Paul's Bay il-Gillieru	Traps	4.3-9.5	10	Feb - Dec	Artisanal	N/A	Period varies for individual vessels
15	Small gregarious pelagic	Bogue	*Boops boops*		N/A	St.Paul's Bay Xemxija	Traps	4.2-8.6	8	April-Dec	Artisanal	N/A	Period varies for individual vessels
15	Small gregarious pelagic	Bogue	*Boops boops*		N/A	Ta' Xbiex Msida Creek	Traps	4.5	1	Jul - Dec	Artisanal	N/A	
15	Small gregarious pelagic	Bogue	*Boops boops*		N/A	Wied iz-Zurrieq	Traps	3.8	1	June-Sept	Artisanal	N/A	
15	Small gregarious pelagic	Bogue	*Boops boops*		N/A	Xlendi	Traps	4-6	7	May-Sept	Artisanal	N/A	
									308				
15	Squid	Squid	*Loligo vulgaris*	*Scomber japonicus*	N/A	Ghar Lapsi	Hand Line	3.8 - 4	2	Jan - Dec	Artisanal	N/A	
15	Squid	Squid	*Loligo vulgaris*	Mackerel	N/A	Marsalforn	Hand Line	4.2-4.9	3	Jan - Dec	Artisanal	N/A	Period varies for individual vessels
15	Squid	Squid	*Loligo vulgaris*		N/A	M'Xlokk Il-Maghluq	Hand Line	5.6 - 8	3	Jan - Dec	Artisanal	N/A	Period varies for individual vessels
15	Squid	Squid	*Loligo vulgaris*		N/A	M'Xlokk Ix-Xatt	Hand Line	3.8-6.8	5	Jan - Dec	Artisanal	N/A	
15	Squid	Squid	*Loligo vulgaris*		N/A	Valletta Marsamxett	Hand Line	5.5	2	Jan - Apr	Artisanal	N/A	
15	Squid	Squid	*Lolligo vulgaris*		N/A	Xlendi	Hand trolling lines	3.8-4.4	3	Jan - April	Artisanal	N/A	
15	Squid	Squid	*Loligo vulgaris*		N/A	Mgarr	Hand-line	4-8	43	Jan - Dec	Artisanal	N/A	Period varies for individual vessels
									61				
15	Small gregarious pelagic	Chub Mackerel	*Scomber japonicus*	*Trachurus mediterraneus*	N/A	Mgarr	Purse seine	16.6-23	4	Jan - Aug	Lampara	N/A	
15	Small gregarious pelagic	Chub Mackerel	*Scomber japonicus*	*Trachurus mediterraneus*	N/A	M'Xlokk Ix-Xatt	Purse seine	14	1	Jan - April	Lampara	N/A	
									5				
Mediterranean	Dolphin fish	Dolphin fish	*Coryphaena hippurus*	*Naucrates ductor*	N/A	Xlendi	Surroundig net	4-6.5	2	Aug-Dec	Lampuki Fishery	N/A	

Management Unit	Resource Name	Main resource component	Scientific name	Associated species	Resouce distribution reference*	Base ports	Gear category	Vessel size class (length in metres)	Number of Units (fishing	Fishing period (months)	Operational Units name (in full)	Economic structure	Comments
Mediterranean	Dolphin fish	Dolphin fish	*Coryphaena hippurus*	*Naucrates ductor*	N/A	B'Bugia St. George's Bay	Surrounding Nets	5.5 - 10	8	Aug - Dec	Lampuki Fishery	N/A	
Mediterranean	Dolphin fish	Dolphin fish	*Coryphaena hippurus*	*Naucrates ductor*	N/A	Marsalforn	Surrounding Nets	4.5-14.6	4	Aug - Dec	Lampuki Fishery	N/A	
Mediterranean	Dolphin fish	Dolphin fish	*Coryphaena hippurus*	*Naucrates ductor*	N/A	Marsaskala	Surrounding Nets	6.4-20	10	Aug - Dec	Lampuki Fishery	N/A	
Mediterranean	Dolphin fish	Dolphin fish	*Coryphaena hippurus*	*Naucrates ductor*	N/A	Mgarr	Surrounding Nets	6.8-23	24	Aug - Dec	Lampuki Fishery	N/A	
Mediterranean	Dolphin fish	Dolphin fish	*Coryphaena hippurus*	*Naucrates ductor*	N/A	Msida Msida Creek	Surrounding Nets	8.5-13.3	2	Aug - Dec	Lampuki Fishery	N/A	
Mediterranean	Dolphin fish	Dolphin fish	*Coryphaena hippurus*	*Naucrates ductor*	N/A	M'Xlokk Il-Maghluq	Surrounding Nets	6 - 25	32	Aug - Dec	Lampuki Fishery	N/A	
Mediterranean	Dolphin fish	Dolphin fish	*Coryphaena hippurus*	*Naucrates ductor*	N/A	M'Xlokk Ix-Xatt	Surrounding Nets	8-14	7	Aug - Dec	Lampuki Fishery	N/A	
Mediterranean	Dolphin fish	Dolphin fish	*Coryphaena hippurus*	*Naucrates ductor*	N/A	St. Paul's Bay il-Vecca	Surrounding Nets	4.5 - 12	3	Aug - Dec	Lampuki Fishery	N/A	
									92				
15	Demersal offshore species	Groupers	*Epinephelus caninus Polyprion americanus*	*Squalus acanthias Pagrus pagrus*	N/A	B'Bugia St. George's Bay	Set bottom long-line	10 - 16.6	4	Jan - Dec	Long Liners	N/A	Period varies for individual vessels
15	Demersal offshore species	Groupers	*Epinephelus caninus Polyprion americanus*	*Squalus acanthias Pagrus pagrus*	N/A	Marsa	Set bottom long-line	11.5	1	Jun - Nov	Long Liners	N/A	
15	Demersal offshore species	Groupers	*Epinephelus caninus Polyprion americanus*	*Squalus acanthias Pagrus pagrus*	N/A	Mgarr	Set bottom long-line	10-20	10	Jan - Dec	Long Liners	N/A	Period varies for individual vessels
15	Demersal offshore species	Groupers	*Epinephelus caninus Polyprion americanus*	*Squalus acanthias Pagrus pagrus*	N/A	Msida Msida Creek	Set bottom long-line	10-13	3	May-Nov	Long Liners	N/A	
15	Demersal offshore species	Groupers	*Epinephelus caninus Polyprion americanus*	*Squalus acanthias Pagrus pagrus*	N/A	M'Xlokk Il-Maghluq	Set bottom long-line	9.3 - 25	33	Jan - Apr	Long Liners	N/A	
15	Demersal offshore species	Groupers	*Epinephelus caninus Polyprion americanus*	*Squalus acanthias Pagrus pagrus*	N/A	M'Xlokk Kavallerizza	Set bottom long-line	11 - 25	4	Jan - Apr	Long Liners	N/A	
15	Demersal offshore species	Groupers	*Epinephelus caninus Polyprion americanus*	*Squalus acanthias Pagrus pagrus*	N/A	St. Paul's Bay il-Vecca	Set bottom long-line	12-14.5	2	Jan - Nov	Long Liners	N/A	
15	Demersal offshore species	Groupers	*Epinephelus caninus Polyprion americanus*	*Squalus acanthias Pagrus pagrus*	N/A	Valletta Grand Harbour	Set bottom long-line	12 - 21	3	Jun - Dec	Long Liners	N/A	
									60				
Mediterranean	Large pelagics	Swordfish	*Xiphias gladius*	*Thunnus thynnus*	N/A	B'Bugia St. George's Bay	Drifting long-lines	5.5 - 14	8	Jan - Dec	Swordfish Fleet	N/A	Period varies for individual vessels
15	Large pelagics	Swordfish	*Xiphias gladius*	*Prionace glauca*	N/A	Gnejna	Drifting long-lines	5.7 - 8.5	3	Mar - Dec	Swordfish Fleet	N/A	Period varies for individual vessels
Mediterranean	Large pelagics	Swordfish	*Xiphias gladius*	*Thunnus thynnus Prionace glauca*	N/A	M'Xlokk Il-Maghluq	Drifting long-lines	7 - 22	34	Jan - Dec	Swordfish Fleet	N/A	Period varies for individual vessels
Mediterranean	Large pelagics	Swordfish	*Xiphias gladius*	*Thunnus thynnus*	N/A	M'Xlokk Ix-Xatt	Drifting long-lines	6.4-16.2	13	May - Dec	Swordfish Fleet	N/A	Period varies for individual vessels
Mediterranean	Large pelagics	Blue-fin Tuna, Swordfish	*Thunnus thynnus, Xiphias gladius*		N/A	M'Xlokk Kavallerizza	Drifting long-lines	8.8 - 25	6	May - Dec	Swordfish Fleet	N/A	Period varies for individual vessels
Mediterranean	Large pelagics	Swordfish	*Xiphias gladius*		N/A	Qawra	Drifting long-lines	5-6	2	Mar-Dec	Swordfish Fleet	N/A	
Mediterranean	Large pelagics	Swordfish	*Xiphias gladius*		N/A	Senglea Dockyard Creek	Drifting long-lines	7.6	1	Jan - Dec	Swordfish Fleet	N/A	
Mediterranean	Large pelagics	Swordfish	*Xiphias gladius*		N/A	St. Paul's Bay il-Vecca	Drifting long-lines	4-8	4	Jan - Dec	Swordfish Fleet	N/A	
Mediterranean	Large pelagics	Swordfish	*Xiphias gladius*	*Thunnus thynnus*	N/A	St.Paul's Bay il-Fekruna	Drifting long-lines	7.5	1	Jan - Dec	Swordfish Fleet	N/A	
Mediterranean	Large pelagics	Swordfish	*Xiphias gladius*	*Thunnus thynnus*	N/A	St.Paul's Bay il-Gillieru	Drifting long-lines	4.2-10	4	Jan - Dec	Swordfish Fleet	N/A	Period varies for individual vessels

Management Unit	Resource Name	Main resource component	Scientific name	Associated species	Resouce distribution reference*	Base ports	Gear category	Vessel size class (length in metres)	Number of Units (fishing	Fishing period (months)	Operational Units name (in full)	Economic structure	Comments
Mediterranean	Large pelagics	Swordfish	*Xiphias gladius*	*Thunnus thynnus*	N/A	St.Paul's Bay Xemxija	Drifting long-lines	8.5	2	Jan - Dec	Swordfish Fleet	N/A	Period varies for individual vessels
Mediterranean	Large pelagics	Swordfish	*Xiphias gladius*	*Thunnus thynnus*	N/A	Vittoriosa Dockyard Creek	Drifting long-lines	10-11	2	June-Dec	Swordfish Fleet	N/A	Period varies for individual vessels
Mediterranean	Large pelagics	Swordfish	*Xiphias gladius*	*Thunnus thynnus*	N/A	Xlendi	Drifting long-lines	4.8-8.3	3	May - Dec	Swordfish Fleet	N/A	Period varies for individual vessels
									83				
15	Demersal offshore species	Shrimps	*Parapenaeus longirostris Aristaemorpha foliacca Aristeus artennatus*	*Mullus* spp., Picarels *Octopus vulgaris Pagellus erythrinus Merluccius merluccius*	N/A	Mgarr	otter trawl	20-24	4	Jan - Dec	Trawl fleet	N/A	
15	Demersal offshore species	Shrimps	*Parapenaeus longirostris Aristaemorpha foliacca Aristeus artennatus*	*Mullus* spp., Picarels *Octopus vulgaris Pagellus erythrinus Merluccius merluccius*	Ministry of Agriculture and Fisheries	Valletta Grand Harbour	Otter Trawl	19 - 27	5	Jan - Dec	Trawl Fleet	N/A	
									9				
Mediterranean	Large pelagics	Blue-fin tuna	*Thunnus thynnus*	*Xiphias gladius*	N/A	Armier	Drifting long-lines	6.2	1	May - Jul	Tuna Fleet	N/A	
15	Large pelagics	Blue-fin tuna	*Thunnus thynnus*	*Xiphias gladius*	N/A	B'Bugia Pretty Bay	Drifting long-lines	7 - 12	2	May - Oct	Tuna Fleet	N/A	
Mediterranean	Large pelagics	Blue-fin tuna	*Thunnus thynnus*	*Xiphias gladius*	N/A	Gzira Sliema Creek	Drifting long-lines	5.5 - 8.3	4	May - Sep	Tuna Fleet	N/A	
Mediterranean	Large pelagics	Blue-fin tuna	*Thunnus thynnus*	*Xiphias gladius*	N/A	Gzira Lazzaretto Creek	Drifting long-lines	8.22	1	May - Oct	Tuna Fleet	N/A	
Mediterranean	Large pelagics	Blue-fin tuna	*Thunnus thynnus*	*Xiphias gladius*	N/A	Marsa	Drifting long-lines	5.5	1	May - Jul	Tuna Fleet	N/A	
Mediterranean	Large pelagics	Blue-fin Tuna	*Thunnus thynnus*	*Xiphias gladius*	N/A	Marsalforn	Drifting long-lines	6.4-14.2	3	April-Nov	Tuna Fleet	N/A	Period varies for individual vessels
Mediterranean	Large pelagics	Blue-fin tuna	*Thunnus thynnus*	*Xiphias gladius*	N/A	Marsaskala	Drifting long-lines	7 - 20	10	May - Jul	Tuna Fleet	N/A	
Mediterranean	Large pelagics	Blue-fin Tuna	*Thunnus thynnus*	*Xiphias gladius*	N/A	Mellieha	Drifting long-lines	7.9	1	May - Aug	Tuna Fleet	N/A	
Mediterranean	Large pelagics	Blue-fin tuna	*Thunnus thynnus*	*Xiphias gladius*	N/A	Mgarr	Drifting long-lines	5-20	20	April-July	Tuna Fleet	N/A	
Mediterranean	Large pelagics	Blue-fin tuna	*Thunnus thynnus*	*Xiphias gladius*	N/A	Msida Msida Creek	Drifting long-lines	7-13.3	5	May-Dec	Tuna Fleet	N/A	Period varies for individual vessels
Mediterranean	Large pelagics	Blue-fin tuna	*Thunnus thynnus*	Xiphias gladius	N/A	M'Xlokk Il-Maghluq	Drifting long-lines	7 - 25	21	May - Jul	Tuna Fleet	N/A	
Mediterranean	Large pelagics	Blue-fin tuna	*Thunnus thynnus*	*Xiphias gladius*	N/A	St. Paul's Bay il-Vecca	Drifting long-lines	3.5-6.3	4	May-July	Tuna Fleet	N/A	
Mediterranean	Large pelagics	Blue-fin tuna	*Thunnus thynnus*	*Xiphias gladius*	N/A	St. Paul's Bay il-Vecca	Drifting long-lines	12-14.5	2	May-Aug	Tuna Fleet	N/A	
Mediterranean	Large pelagics	Blue-fin tuna	*Thunnus thynnus*	*Xiphias gladius*	N/A	St.Paul's Bay il-Fekruna	Drifting long-lines	13.5	1	May-June	Tuna Fleet	N/A	
Mediterranean	Large pelagics	Blue-fin tuna	*Thunnus thynnus*	*Xiphias gladius*	N/A	St.Paul's Bay Xemxija	Drifting long-lines	6.5-8	2	May-July	Tuna Fleet	N/A	
Mediterranean	Large pelagics	Swordfish	*Xiphias gladius*	*Thunnus thynnus*	N/A	Valletta Grand Harbour	Drifting long-lines	13 - 21	2	Jan - Aug	Tuna Fleet	N/A	
Mediterranean	Large pelagics	Blue-fin tuna	*Thunnus thynnus*	*Xiphias gladius*	N/A	Xlendi	Drifting long-lines	6.4	1	May-July	Tuna Fleet	N/A	
									81				

ANNEX IV: CATCH AND EFFORT SURVEY INTERVIEW SHEET

CATCH AND EFFORT SAMPLE SURVEY OF SMALL SCALE FISHERY

Vessels < 10 m

Daily Landings of Sampled Fishing Units

Form: MaltaCas 2.3

(a)Interviewer's Name: ____________ Code:______ (b)Stratum: ____ (c)Site Name: ____________ Code: ______ (d)Date: ___/___/_____ Time:______

(e)Sampled Unit: Type : ____________ Code:______ (f)Registry Number:________ (g) Auxiliary Boats:_____ (h)Prof. Fishermen:_____ (i)Part Time:______

(l)Number of Trips in the Day: _____(m)Fishing Area: ____________ Code: ________ (n)Time Spent in Fishing: ____________ (Hrs)

Reference Number	(o)Gear Name	(p) Gear Code	(q) Number of Units	(r)Size, length or Number	(s)Gear Reference	(t)Species Name	Species Code	(u)Number of Boxes or Number of Animals	(v)Box Weight or Average Weight of the Animal
1	Trammel Nets								
2	Long Lines								
3	Traps								
4	Small Beam Trawls								
5	Gill Nets								
6	Trolling lines								
7	Surrounding Nets								
8	Others: Specify:								
9									
10									

Comment:

ANNEX IV

ANNEX V: Catches by species (1994 – 2001)

FISH CATCHES BY SPECIES: 1994-2001

SPECIES MALTESE NAME	SPECIES ENGLISH NAME	1994 Weight (kg)	1994 Value (Lm)	1995 Weight (kg)	1995 Value (Lm)	1996 Weight (kg)	1996 Value (Lm)	1997 Weight (kg)	1997 Value (Lm)	1998 Weight (kg)	1998 Value (Lm)	1999 Weight (kg)	1999 Value (Lm)	2000 Weight (kg)	2000 Value (Lm)	2001 Weight (kg)	2001 Value (Lm)
ACCOLA	AMBERJACK	329	865	4323	6441	8632	13167	5970	10962	6395	11494	5745	10539	2922	7331	2354	5542
AWWISTA	CRAYFISH	10	95	17	157	47	349	36	321	39	262	104	761	75	523	37	297
ALJOTTA	MIXED FISH	1716	2007	2063	2327	5935	6417	5035	5281	4427	4663	5379	5362	5645	5299	3608	3520
ALONGA	ALBACORE	0	0	0	0	0	0	673	958	665	776	6077	5157	3596	3677	3940	5037
ARZNELL/MUNQARA	PICAREL	3369	1726	3117	1762	0	0	0	0	0	0	0	0	0	0	586	344
ARZNELL	PICAREL	0	0	0	0	2377	1189	1194	774	998	677	1992	1004	1601	732	0	0
AWRAT	GILTHEAD BREAM	316	585	0	0	424	842	218	484	270	553	261	430	298	562	192	284
BAZUK	BLUE SPOTTED BREAM	3725	15064	7373	31485	5158	22841	4494	18123	2586	12520	2666	14095	1874	9233	2266	11026
BOLL	COMMON STING RAY	360	399	603	712	960	1075	912	918	887	1038	642	714	465	496	468	504
BRIEQEX	PAINTED COMBER	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CAWL	DAMSEL FISH	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CERNA	GROUPER	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1348	4210
CINTORINI	SCARBARD FISH	417	368	356	263	229	148	334	143	0	0	0	0	0	0	232	126
CIPPULLAZZ	LARGE SCALE SCORPION FISH	2993	10473	4256	17394	6075	23196	7110	28415	6860	28877	9241	42632	8191	39187	7060	34883
DENCI	DENTEX	658	2471	266	1282	478	2048	620	2604	473	2219	712	3374	890	4511	967	4978
DOTT/HNIEZER	STONE BASS	15696	37960	22527	66741	27758	79619	40828	103296	22554	64630	22442	67311	22997	70408	23039	65249
FANFRI	PILOT FISH	28658	24848	12702	9556	6694	10129	4460	7437	13171	17190	23246	26021	28296	33663	7637	10367
GALLINI	GURNARD	549	1471	1489	4146	1511	4194	1453	4429	2062	5521	4240	8693	2065	5459	1126	3096
GAMBLI	SHRIMPS\PRAWNS	3585	14046	4833	28454	9112	46339	16454	81359	18492	116701	23857	134046	23420	130482	36073	190735
GATTARELLI	SMALL SPOTTED DOG FISH	706	711	173	203	555	512	561	499	470	415	1510	1266	2195	1773	1778	1454
GRIEBEL	BROWN MEAGRE	0	0	10	49	0	0	79	64	0	0	0	0	0	0	0	0
GRINGUIET	GONGER	0	0	0	0	2450	2310	3788	3377	2747	2560	1772	1807	2483	2431	3242	3303
GRINGU/IMREJJEN	GONGER/MORAY EELS	4445	4399	1989	2014	0	0	0	0	0	0	0	0	0	0	0	0
GURDIEN	RAT TAIL	0	0	0	0	69	154	56	134	690	1325	162	419	1438	2664	387	708
HAMIEMA	WHITE SKATE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HUTA KAHLA	BLUE SHARK	581	675	1376	1963	1389	2049	2220	3093	2151	2606	1571	1820	1151	1541	833	1278
IMREJJEN	MORAY EELS	0	0	0	0	768	732	458	407	193	154	169	125	11	9	165	147
KAHLI	SADDLED BREAM	129	262	934	2086	898	2379	1916	4595	1491	3609	2012	5262	1559	4196	1209	3604
KAVALLI	MACKEREL	9785	17011	12845	16263	23442	20131	26932	26088	39606	29107	19294	14595	34427	26042	31762	17634
KLAMARI	SQUID	218	672	296	960	1595	4374	2041	6074	2388	7337	2045	6708	2709	6437	1846	6424
KUBRIT	LITTLE TUNNY	0	0	409	310	210	214	338	389	446	392	428	392	179	151	363	261
KURAZZA	HAMMER-HEAD SHARK	0	0	55	83	0	0	0	0	0	0	0	0	0	0	0	0
LACCI	ALLICE SHAD	0	0	0	0	0	0	0	0	0	0	209	262	1849	1069	17626	4237
LAMPUKI	DOLPHIN FISH	333595	264384	333725	179588	306564	386343	295225	356741	363113	418380	349129	363387	234282	369933	302896	336109
LIPP	LING	800	1541	999	2004	1654	2994	2266	3611	2788	4843	4174	7151	4655	7657	3422	5834
LIZZ	BARRACUDA	0	0	0	0	0	0	0	0	479	614	869	1204	1093	1641	877	1527
MAKKU	PELLUCID SOLE	108	229	19	43	1511	1844	572	945	1702	2132	1011	1133	1400	1666	1978	2333
MAZZOLA	DOG FISH	29102	36664	23563	26369	26352	32492	28320	34897	22839	26538	18241	21379	19431	22088	17428	21998
MERLUZZ	HAKE	551	1017	1377	3471	2475	4822	3533	6885	5037	9366	6368	11561	6282	11111	5028	10087
MIRLI	BROWN WRASSE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MSELL	GAR-FISH	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MULETT	GREY MULLET	0	0	20	15	264	289	425	362	118	74	49	37	124	94	11	9
MUNQARA	PICAREL	0	0	0	0	4793	2742	5357	3037	5832	3148	6410	3432	6971	3681	5102	2686
MURUNA	SIX-GILLED SHARK	7886	7560	3039	3609	2720	2997	4464	5401	4862	6018	3629	4291	4867	5612	3419	4549
PAGELL	PANDORA	1240	2992	2799	7209	4504	9997	5528	12739	5978	14321	6166	16308	4634	14294	2199	7204
PAGRI	COMMON SEA BREAM	4618	19643	6373	29960	8399	40697	8963	39939	7757	39062	5550	29355	5629	29903	4427	24771
PASTARDELLA	SPEAR-FISH	410	610	894	1341	1104	1669	1197	1800	2426	3211	2390	2744	1362	1609	1844	2586
PETRICI	ANGLER FISH	94	121	0	0	365	378	378	385	0	0	1736	1932	1215	1170	1504	1333
PIXXIPLAMTU	PORBEAGLE SHARK	110	239	229	577	960	1984	223	459	907	1844	319	528	502	979	1072	1953
PIXXISPAD	SWORDFISH	42155	109978	58191	145947	57659	153082	82979	200813	115647	294700	146896	297803	140155	319358	78478	215800
PLAMTI	ATLANTIC BONITO	0	0	239	253	2074	2487	6651	6860	1567	1887	1828	2067	1053	1356	426	573
QARNIT	OCTOPUS	4462	9218	6346	13480	11210	22704	11396	24766	9362	19558	10457	22145	8868	18056	5482	10919
QTATES	SPOTTED DOGFISH	535	529	603	567	925	864	592	579	1960	3329	515	529	550	520	551	562
RAJ	SKATE	4736	3895	4657	3526	6440	4747	6960	4528	4143	2975	4607	3227	5123	3620	4491	3550
RASPA	SCOURER	233	324	63	88	703	914	443	635	682	656	475	561	564	686	1154	1247
REBEKKINI	LONG NOSE SKATE	248	235	246	303	212	185	295	211	79	55	705	582	1169	1001	1532	1143
SAN PIETRU	JOHN DORY	110	372	73	277	517	1786	671	2279	835	2776	1459	4995	578	2168	274	1144
SARGI	WHITE BREAM	0	0	317	1124	1510	5444	2743	9967	3554	13589	3936	15691	2043	8113	1916	8455
SAWRELL	HORSE MACKEREL	5060	5144	7511	8634	4796	4307	3591	2823	2277	1922	4242	3576	13002	9255	5558	5338
SERRAN	COMBER	148	153	1331	1562	1242	1365	860	961	577	641	1606	1659	1557	1435	2007	1941
SICC	CUTTLE FISH	1202	2254	1445	2595	4578	7917	3482	6183	3335	5927	4838	8314	3635	5979	1747	3176
SKORFON	SCORPION FISH	1075	2600	2345	5697	2278	4932	2581	5831	1624	3776	2993	6656	2537	6055	2603	6736
SPNOTT	SEA BASS	101	319	460	981	117	210	20	39	84	217	1751	2614	1148	2977	115	321
TONN	BLUE-FIN TUNA	343671	642147	353014	566622	239667	428414	236272	462915	246314	391796	268990	374800	324393	604806	188693	486107
TOTLI	SQUID	269	352	0	0	621	660	928	1056	2109	2418	2041	2395	1665	1948	1458	1763
TRACNI	SPOTTED WEEVER	506	930	1243	2526	2006	3701	1982	3833	2621	4916	3034	5474	2586	4462	1441	2957
TRILL	RED MULLET	2495	4603	3909	7553	6849	12829	7227	13813	8047	15480	12048	22504	7365	12966	5105	9130
TUMBRELLI	FRIGATE MACKEREL	1358	971	2299	935	2541	1171	5582	2205	842	325	3373	1041	1201	400	1402	497
TUNNAGGI	SMALL BLUE-FIN TUNNY	8032	8138	2421	1897	2992	3348	3103	3439	1645	2114	1912	2218	2168	2317	4997	3673
VOPI	BOGUE	19054	14017	18921	12975	16600	10389	15875	12215	14818	10556	11948	8528	21210	14156	26893	17184
XILEP	SALEMA	145	153	56	38	624	400	1315	903	547	359	348	226	154	115	169	125
XKATLU	ANGEL FISH	134	170	112	161	244	309	0	0	234	255	261	400	171	256	138	177
ZAGHRUN	ROUGH SHARK	9671	6258	4907	3032	3657	2460	4794	3194	2630	1481	1103	763	1516	1040	3346	2097
TOTALS		902159	1284068	925760	1231652	840935	1408481	867013	1549693	979432	1626107	1033585	1606205	967294	1854421	841347	1587044

ANNEX VI: LANDINGS GEAR INDEX BY SPECIES

SPECIES MALTESE NAME	SPECIES ENGLISH NAME	Landings gear index Trawling	Trammel	BLL	Other demersal gears	Tuna SLL	Swordfish SLL	SLL and other pelagic gears	FADs	Total
ACCOLA	AMBERJACK	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	1.00
AWWISTA	CRAYFISH	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	1.00
ALJOTTA	MIXED FISH	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00
ALONGA	ALBACORE	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	1.00
ARZNELL/MUNQARA	PICAREL	0.75	0.00	0.00	0.25	0.00	0.00	0.00	0.00	1.00
AWRAT	GILTHEAD BREAM	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00
BAZUK	BLUE SPOTTED BREAM	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	1.00
BOLL	COMMON STING RAY	0.50	0.00	0.50	0.00	0.00	0.00	0.00	0.00	1.00
CERNA	GROUPER	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	1.00
CINTORINI	SCARBARD FISH	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	1.00
CIPPULLAZZ	LARGE SCALE SCORPION FISH	0.05	0.00	0.95	0.00	0.00	0.00	0.00	0.00	1.00
DENCI	DENTEX	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	1.00
DOTT/HNIEZER	STONE BASS	0.05	0.00	0.95	0.00	0.00	0.00	0.00	0.00	1.00
FANFRI	PILOT FISH	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	1.00
GALLINI	GURNARD	0.25	0.00	0.75	0.00	0.00	0.00	0.00	0.00	1.00
GAMBLI	SHRIMPS\PRAWNS	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00
GATTARELLI	SMALL SPOTTED DOG FISH	0.60	0.00	0.40	0.00	0.00	0.00	0.00	0.00	1.00
GRIEBEL	BROWN MEAGRE	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00
GRINGIJIET	GONGER	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	1.00
GURDIEN	RAT TAIL	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	1.00
HUTA KAHLA	BLUE SHARK	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	1.00
IMREJJEN	MORAY EELS	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	1.00
KAHLI	SADDLED BREAM	0.00	0.10	0.00	0.90	0.00	0.00	0.00	0.00	1.00
KAVALLI	MACKEREL	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	1.00
KLAMARI	SQUID	0.50	0.00	0.00	0.50	0.00	0.00	0.00	0.00	1.00
KUBRIT	LITTLE TUNNY	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	1.00
KURAZZA	HAMMER-HEAD SHARK	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	1.00
LACCI	ALLICE SHAD	0.75	0.00	0.00	0.25	0.00	0.00	0.00	0.00	1.00
LAMPUKI	DOLPHIN FISH	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	1.00
LIPP	LING	0.50	0.00	0.50	0.00	0.00	0.00	0.00	0.00	1.00
LIZZ	BARRACUDA	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00
MAKKU	PELLUCID SOLE	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	1.00
MAZZOLA	DOG FISH	0.05	0.00	0.95	0.00	0.00	0.00	0.00	0.00	1.00
MERLUZZ	HAKE	0.50	0.00	0.50	0.00	0.00	0.00	0.00	0.00	1.00
MULETT	GREY MULLET	0.50	0.00	0.00	0.50	0.00	0.00	0.00	0.00	1.00
MUNQARA	PICAREL	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00
MURUNA	SIX-GILLED SHARK	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	1.00
PAGELL	PANDORA	0.80	0.05	0.15	0.00	0.00	0.00	0.00	0.00	1.00
PAGRI	COMMON SEA BREAM	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	1.00
PASTARDELLA	SPEAR-FISH	0.80	0.00	0.00	0.20	0.00	0.00	0.00	0.00	1.00
PETRICI	ANGLER FISH	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00
PIXXIPLAMTU	PORBEAGLE SHARK	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	1.00
PIXXISPAD	SWORDFISH	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	1.00
PLAMTI	ATLANTIC BONITO	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	1.00
QARNIT	OCTOPUS	0.60	0.00	0.00	0.40	0.00	0.00	0.00	0.00	1.00
QTATES	SPOTTED DOGFISH	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	1.00
RAJ	SKATE	0.30	0.00	0.70	0.00	0.00	0.00	0.00	0.00	1.00
RASPA	SCOURER	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	1.00
REBEKKINI	LONG NOSE SKATE	0.70	0.00	0.30	0.00	0.00	0.00	0.00	0.00	1.00
SAN PIETRU	JOHN DORY	0.65	0.05	0.30	0.00	0.00	0.00	0.00	0.00	1.00
SARGI	WHITE BREAM	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	1.00
SAWRELL	HORSE MACKEREL	0.30	0.05	0.00	0.65	0.00	0.00	0.00	0.00	1.00
SERRAN	COMBER	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00
SICC	CUTTLE FISH	0.60	0.40	0.00	0.00	0.00	0.00	0.00	0.00	1.00
SKORFON	SCORPION FISH	0.20	0.10	0.70	0.00	0.00	0.00	0.00	0.00	1.00
SPNOTT	SEA BASS	0.00	0.50	0.00	0.00	0.00	0.00	0.50	0.00	1.00
TONN	BLUE-FIN TUNA	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	1.00
TOTLI	SQUID	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00
TRACNI	SPOTTED WEEVER	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00
TRILL	RED MULLET	0.90	0.10	0.00	0.00	0.00	0.00	0.00	0.00	1.00
TUMBRELLI	FRIGATE MACKEREL	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	1.00
TUNNAGGI	SMALL BLUE-FIN TUNNY	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	1.00
VOPI	BOGUE	0.25	0.25	0.00	0.50	0.00	0.00	0.00	0.00	1.00
XILEP	SALEMA	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00
XKATLU	ANGEL FISH	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	1.00
ZAGHRUN	ROUGH SHARK	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	1.00

ANNEX VII: Catch and Effort data of the small scale vessels (January – October 2002)

Catch and effort survey data, set from January to October 2002. Number of boats sampled (by gear class) and number of boats landed. Catch per Unit of Effort, average Length, Gross Tonnage and Engine Power of boats sampled.

CPUE: Catch per Unit of Effor; GT: Gross Tonage; L: Boat overall length; HP: Engine Power

Data relative to the available sampled months only (sampled months showed under the port name)

Boat Type	Gear Class	Number of Gear per boat Sampled	TOTAL Boats Landed	TOTAL Boats Sampled	Catch per boat (kg)		CPUE on L (kg)		CPUE on GT (kg)		CPUE on HP (kg)		Length (m)		Gross Tonnage		Engine Power	
					Average	CV	Average	CV	Average	CV	Average	CV	Average	CV	Average	CV	Average	CV
Marsalforn																		
February, May, August																		
Kajjik	Long Lines	4			7.500	120.5%	1.589	118.2%	6.377	120.0%	0.429	112.2%	4.640	4.8%	1.175	7.6%	24.245	88.4%
	Trammel Nets	1			5.000		1.232		5.435		0.372		4.060		0.920		13.430	
	Traps	4			6.250	60.4%	1.395	61.7%	5.591	61.7%	0.519	74.6%	4.520	3.1%	1.127	3.1%	15.107	51.9%
	Trolling Lines	2			1.500	47.1%	0.325	42.8%	1.128	71.0%	0.171	79.9%	4.575	4.8%	1.480	28.7%	15.295	106.9%
Luzzu	Gill Nets	4			33.250	39.9%	5.337	39.9%	14.910	39.9%	1.486	39.9%	6.230	0.0%	2.230	0.0%	22.380	0.0%
	Long Lines	2			29.500	40.7%	4.735	40.7%	13.229	40.7%	1.318	40.7%	6.230	0.0%	2.230	0.0%	22.380	0.0%
	Surrounding Nets	1			50.000		5.291		9.398		1.031		9.450		5.320		48.490	
	Trammel Nets	10			14.300	91.4%	2.400	91.1%	7.952	104.1%	0.345	120.3%	5.930	1.9%	1.942	11.4%	69.378	44.9%
	Traps	11			27.636	104.0%	4.456	103.3%	12.527	102.2%	1.159	115.5%	6.175	3.9%	2.152	5.3%	41.030	81.9%
	Trolling Lines	1											5.360		1.960		28.350	
MPV	Long Lines	1			0.000		0.000		0.000		0.000		5.480		1.310		11.190	
	Trammel Nets	5			12.600	42.2%	2.027	49.4%	7.071	64.4%	0.478	143.1%	6.376	7.9%	1.950	18.3%	52.966	44.1%
	Traps	1			20.000		3.650		15.267		1.787		5.480		1.310		11.190	
	TOTAL	47	59	46														
Mgar																		
January, March, June, September																		
Kajjik	Long Lines	26			2.365	103.3%	0.537	103.7%	2.375	99.9%	0.187	90.3%	4.527	14.9%	1.093	31.7%	16.355	58.7%
	Trammel Nets	5			5.800	56.4%	1.242	53.3%	5.195	48.7%	0.352	43.2%	4.616	5.1%	1.088	12.4%	16.114	22.1%
	Traps	17			2.794	59.7%	0.623	59.8%	2.771	60.2%	0.176	74.7%	4.421	7.6%	0.994	26.6%	18.957	63.8%
	Trolling Lines	22			3.933	107.5%	0.826	106.7%	4.256	112.4%	0.217	102.2%	4.599	8.5%	1.242	62.5%	17.362	66.8%
Luzzu	Long Lines	18			4.583	100.1%	0.773	104.2%	2.911	101.0%	0.158	121.5%	6.428	17.7%	1.724	23.3%	36.718	42.0%
	Surrounding Nets	2			200.000	0.0%	25.575	0.0%	61.350	0.0%	3.724	0.0%	7.820	0.0%	3.260	0.0%	53.710	0.0%
	Trammel Nets	24			9.396	33.0%	1.435	35.3%	4.799	46.4%	0.354	75.5%	6.668	12.3%	2.236	39.4%	44.697	68.6%
	Traps	23			22.152	130.7%	3.030	121.2%	7.471	84.0%	0.465	95.1%	6.628	15.4%	2.363	57.8%	41.840	60.0%
	Trolling Lines	18			5.844	68.6%	0.831	65.5%	3.744	75.7%	0.182	81.7%	6.864	24.7%	1.704	40.3%	35.807	58.7%
MPV	Long Lines	12			14.333	96.8%	2.010	101.0%	4.665	131.7%	0.182	115.4%	7.036	11.9%	3.291	47.2%	89.955	50.1%
	Trammel Nets	23			7.522	78.2%	1.130	79.7%	3.293	81.0%	0.133	78.1%	6.857	11.8%	2.352	19.0%	57.993	16.9%
	Traps	14			33.929	92.4%	4.542	89.9%	8.668	76.7%	0.264	86.3%	7.271	7.0%	3.995	45.2%	118.294	25.3%
	Trolling Lines	15			4.125	87.4%	0.624	83.8%	2.463	109.3%	0.043	70.0%	6.209	16.7%	2.053	28.3%	78.578	50.5%
Others	Traps	1			5.000		1.337		5.556		0.394		3.740		0.900		12.680	
	TOTAL	220	1420	214														

Boat Type	Gear Class	Number of Gear per boat Sampled	TOTAL Boats Landed	TOTAL Boats Sampled	Catch per boat (kg)		CPUE on L (kg)		CPUE on GT (kg)		CPUE on HP (kg)		Length (m)		Gross Tonnage		Engine Power	
					Average	CV	Average	CV	Average	CV	Average	CV	Average	CV	Average	CV	Average	CV
Xlendi																		
April, July, October																		
Kajjik	Long Lines	7			4.400	74.7%	0.927	73.1%	3.667	60.1%	0.902	117.7%	4.719	4.3%	1.160	23.2%	13.749	51.8%
	Trammel Nets	9			10.889	44.1%	2.307	42.8%	8.174	42.2%	2.037	114.7%	4.696	3.5%	1.372	22.1%	9.616	68.9%
	Trolling Lines	1											4.000		0.860		8.210	
Luzzu	Traps	6			33.167	131.4%	5.661	131.0%	15.981	129.9%	0.562	124.0%	5.603	11.7%	1.887	26.4%	52.218	42.0%
	Trolling Lines	1			0.500		0.086		0.362		0.012		5.790		1.380		41.030	
MPV	Long Lines	4			30.750	36.0%	4.805	36.0%	13.546	36.0%	0.229	36.0%	6.400	0.0%	2.270	0.0%	134.280	0.0%
	Trammel Nets	2			18.500	26.8%	2.891	26.8%	7.584	18.2%	0.190	58.2%	6.400	0.0%	2.420	8.8%	108.170	34.1%
	TOTAL	30	75	30														
B'Bugia																		
May, August																		
Kajjik	Long Lines	4			0.667	43.3%	0.139	43.3%	0.565	43.3%	0.036	43.3%	4.780	0.0%	1.180	0.0%	18.650	0.0%
	Other	2											5.000	0.0%	1.635	55.8%	26.110	0.0%
	Trammel Nets	8			12.813	28.2%	2.332	35.9%	9.315	61.8%	0.519	48.3%	5.828	31.9%	2.057	75.9%	29.095	49.9%
	Traps	5			0.667	114.6%	0.139	114.6%	0.565	114.6%	0.036	114.6%	4.780	0.0%	1.180	0.0%	18.650	0.0%
	Trolling Lines	11			9.111	149.2%	1.931	146.6%	8.305	136.0%	0.525	135.8%	4.595	6.1%	1.076	30.0%	15.802	25.8%
Luzzu	Trammel Nets	8			9.313	83.0%	1.449	88.2%	6.196	110.1%	0.497	93.6%	6.622	20.5%	1.994	54.4%	27.043	74.8%
Other	Other	1			2.000		0.415		2.000		0.077		4.820		1.000		26.110	
	Trolling Lines	3			2.000	70.7%	0.404	68.7%	1.382	39.1%	0.041	10.9%	5.573	20.7%	1.570	33.0%	52.967	43.9%
	TOTAL	42	304	36														
Gnejna Bay																		
August																		
Kajjik	Long Lines	3			0.500	0.0%	0.111	7.6%	0.569	38.7%	0.028	45.4%	4.623	6.2%	1.400	58.7%	27.107	52.4%
	Trammel Nets	3			7.800	33.5%	1.600	32.5%	5.983	28.0%	0.304	13.8%	4.860	1.4%	1.287	7.2%	25.117	22.3%
	Traps	4			2.000	100.0%	0.414	91.4%	1.224	87.6%	0.069	47.7%	4.620	8.7%	1.625	32.3%	29.283	63.2%
	Trolling Lines	5			0.633	53.7%	0.133	53.9%	0.410	45.4%	0.073	118.4%	4.854	3.0%	1.494	18.3%	24.618	64.2%
Luzzu	Traps	2			5.500	38.6%	0.825	40.4%	2.530	30.2%	0.360	88.8%	6.695	2.0%	2.145	8.9%	20.890	60.6%
Others	Traps	2			2.000		0.448		1.942		0.054		4.980	14.8%	1.175	17.5%	24.245	76.1%
	Trolling Lines	7			0.592	82.2%	0.121	83.5%	0.517	95.4%	0.021	92.6%	4.974	6.9%	1.249	28.3%	41.030	70.2%
Unknown	Traps	1			2.000		0.469		1.980		0.103		4.260		1.010		19.400	
	TOTAL	27	169	24														
Il-Vecca																		
September																		
Kajjik	Trolling Lines	3			7.575	82.6%	1.585	82.6%	9.712	82.6%	0.338	82.6%	4.780	0.0%	0.780	0.0%	22.380	0.0%
Luzzu	Long Lines	1			5.750		0.920		2.725		0.514		6.250		2.110		11.190	
	Surrounding Nets	1			84.000		13.440		23.333		3.217		6.250		3.600		26.110	
	Trolling Lines	1			7.000		1.434		6.140		0.670		4.880		1.140		10.440	
	TOTAL	6	35	6														

Boat Type	Gear Class	Number of Gear per boat Sampled	TOTAL Boats Landed	TOTAL Boats Sampled	Catch per boat (kg)		CPUE on L (kg)		CPUE on GT (kg)		CPUE on HP (kg)		Length (m)		Gross Tonnage		Engine Power	
					Average	CV	Average	CV	Average	CV	Average	CV	Average	CV	Average	CV	Average	CV
Marsaskala																		
February, April, July, October																		
Firilla	Trammel Nets	1			10.000		2.188		20.408		1.786		4.570		0.490		5.600	
	Trolling Lines	1			4.000		0.875		8.163		0.714		4.570		0.490		5.600	
Kajjik	Gill Nets	2			2.500	28.3%	0.517	26.2%	2.706	40.9%	0.179	45.3%	4.825	2.2%	0.950	13.4%	14.545	18.1%
	Long Lines	21			2.275	42.6%	0.466	44.4%	2.056	50.2%	0.140	52.8%	4.934	8.4%	1.158	27.7%	20.977	72.1%
	Trammel Nets	29			12.138	112.5%	2.336	79.6%	11.347	63.8%	0.908	64.8%	4.847	13.0%	1.014	33.8%	16.490	107.7%
	Traps	9			2.500	81.2%	0.542	79.4%	2.804	76.7%	0.299	102.9%	4.842	16.6%	1.140	48.5%	18.899	115.2%
	Trolling Lines	17			3.727	98.8%	0.772	97.4%	3.519	82.2%	0.392	141.4%	4.816	5.2%	1.065	18.9%	15.535	57.0%
Luzzu	Gill Nets	1			2.000		0.274		0.329		0.134		7.290		6.070		14.920	
	Long Lines	1			1.500		0.266		1.456		0.134		5.640		1.030		11.190	
	Trawls	1			17.000		3.014		16.505		1.519		5.640		1.030		11.190	
	Trammel Nets	11			16.682	35.9%	2.462	44.4%	10.965	74.6%	0.899	65.1%	7.120	23.2%	2.157	68.4%	22.720	44.0%
	Traps	5			3.800	37.9%	0.573	54.2%	2.679	74.5%	0.231	84.7%	7.210	23.5%	1.802	40.5%	23.276	47.6%
	Trolling Lines	2			3.000	47.1%	0.513	20.9%	2.488	28.3%	0.141	7.4%	5.680	27.6%	1.340	70.7%	21.635	53.6%
MPV	Gill Nets	1			6.000		1.022		3.333		0.192		5.870		1.800		31.330	
	Long Lines	2			2.250	47.1%	0.333	33.0%	0.947	16.9%	0.055	18.0%	6.585	15.4%	2.315	31.5%	39.910	30.4%
	Trammel Nets	3			17.333	39.3%	4.055	61.2%	29.797	86.8%	6.119	97.2%	4.873	43.1%	1.237	111.6%	17.530	153.0%
	Trolling Lines	3			8.333	102.1%	2.019	124.4%	15.580	141.2%	3.271	146.6%	5.257	52.6%	1.590	125.3%	31.207	161.8%
Others	Long Lines	1			1.000		0.193		0.775		0.074		5.180		1.290		13.430	
	Trammel Nets	3			7.333	43.8%	1.479	48.4%	6.526	64.9%	0.241	73.0%	5.047	7.8%	1.313	41.3%	41.030	63.0%
	Traps	1			2.000		0.386		1.550		0.149		5.180		1.290		13.430	
		115	393	103														
Marsaxlokk																		
January, March, June, September																		
Firilla	Trammel Nets	6			16.750	44.3%	2.974	44.7%	13.481	44.6%	2.245	44.3%	5.620	4.1%	1.240	3.5%	7.460	0.0%
	Traps	2			8.000	88.4%	1.372	88.4%	6.250	88.4%	1.072	88.4%	5.830	0.0%	1.280	0.0%	7.460	0.0%
	Trolling Lines	8			5.643	55.7%	0.976	54.9%	4.438	55.0%	0.756	55.7%	5.725	3.4%	1.260	2.9%	7.460	0.0%
Kajjik	Gill Nets	1			2.500		0.619		2.976		0.558		4.040		0.840		4.480	
	Long Lines	7			8.429	78.0%	1.681	84.8%	8.104	125.0%	0.667	167.3%	5.053	16.1%	1.394	60.8%	22.167	52.0%
	Trammel Nets	45			15.807	56.6%	3.372	56.2%	16.579	61.0%	1.825	129.5%	4.695	12.3%	1.033	46.3%	20.787	128.3%
	Traps	23			3.141	97.6%	0.668	103.1%	3.585	145.0%	0.292	163.7%	4.861	12.0%	1.224	46.3%	18.731	59.3%
	Trolling Lines	29			4.678	56.3%	0.980	54.5%	4.418	64.6%	0.318	102.8%	4.771	5.0%	1.173	25.0%	20.605	58.6%
Luzzu	Gill Nets	15			6.536	49.7%	1.009	45.4%	4.034	49.2%	0.287	44.2%	6.411	12.3%	1.686	27.2%	22.879	46.3%
	Long Lines	23			11.483	52.8%	1.771	56.2%	7.077	71.7%	0.602	78.2%	6.573	17.2%	1.912	46.9%	34.673	96.9%
	Other	1			5.000		0.769		3.704		0.191		6.500		1.350		26.110	
	Trammel Nets	179			17.746	56.3%	2.749	59.1%	10.441	81.4%	1.027	94.3%	6.556	18.5%	1.954	51.7%	26.282	89.4%
	Traps	43			3.768	78.7%	0.606	78.4%	2.524	90.1%	0.271	111.4%	6.434	19.8%	1.876	80.6%	26.510	102.6%
MPV	Trolling Lines	51			5.554	77.5%	0.926	73.6%	3.985	77.0%	0.428	95.4%	5.957	20.7%	1.579	48.0%	19.572	90.1%
	Traps	1			2.000		0.273		1.527		0.037		7.320		1.310		54.460	
	Trolling Lines	7			3.250	25.5%	0.535	30.3%	2.483	46.2%	0.114	51.3%	6.031	12.0%	1.409	24.1%	36.023	58.9%
		441	1485	385														

Boat Type	Gear Class	Number of Gear per boat Sampled	TOTAL Boats Landed	TOTAL Boats Sampled	Catch per boat (kg)		CPUE on L (kg)		CPUE on GT (kg)		CPUE on HP (kg)		Length (m)		Gross Tonnage		Engine Power	
					Average	CV	Average	CV	Average	CV	Average	CV	Average	CV	Average	CV	Average	CV
Msida																		
February, April, July																		
Kajjik	Long Lines	12			3.000	123.5%	0.540	123.4%	2.103	154.7%	0.118	121.5%	5.469	17.1%	1.528	50.6%	32.824	87.9%
	Other	2			11.000	115.7%	2.343	112.7%	7.481	78.4%	0.456	135.9%	4.475	8.7%	1.160	68.3%	67.140	94.3%
	Trammel Nets	5			9.000	66.7%	1.921	63.9%	7.443	72.6%	0.531	54.9%	4.620	5.1%	1.426	42.2%	16.264	20.3%
	Traps	4			4.250	55.6%	0.773	53.1%	3.876	77.0%	0.093	99.1%	5.512	27.0%	1.710	108.3%	72.175	82.6%
	Trolling Lines	17			1.963	101.5%	0.386	109.5%	1.576	124.2%	0.093	144.1%	5.138	24.4%	1.549	70.1%	31.508	91.0%
Luzzu	Trammel Nets	1			7.500		1.055		3.000		0.402		7.110		2.500		18.650	
	Traps	1			9.000		1.800		5.202		0.603		5.000		1.730		14.920	
	Trolling Lines	1			0.000		0.000		0.000		0.000		4.500		0.980		11.940	
MPV	Trolling Lines	1			1.250		0.223		0.584		0.017		5.600		2.140		74.600	
Others	Long Lines	1											6.700		2.000		26.860	
	Trammel Nets	2			10.000		2.075		10.000		0.383		4.820	0.0%	1.000	0.0%	26.110	0.0%
	Trolling Lines	3			4.500	141.4%	0.672	141.4%	2.250	141.4%	0.168	141.4%	5.467	19.5%	1.363	40.6%	25.367	7.8%
		50	188	48														
St. Paul's Bay																		
March, September																		
Kajjik	Long Lines	4			4.500	90.3%	0.818	90.3%	4.639	90.3%	0.093	90.3%	5.500	0.0%	0.970	0.0%	48.490	0.0%
	Surrounding Nets	2			34.500	88.1%	6.273	88.1%	35.567	88.1%	0.711	88.1%	5.500	0.0%	0.970	0.0%	48.490	0.0%
	Trammel Nets	4			7.750	41.3%	1.648	39.6%	5.859	59.0%	0.554	64.3%	4.675	11.8%	1.443	21.8%	19.953	95.4%
	Traps	2			6.000	94.3%	1.090	94.6%	5.660	116.2%	0.148	55.9%	5.520	0.5%	1.475	48.4%	35.435	52.1%
	Trolling Lines	4			15.000		2.727		15.464		0.309		5.275	8.5%	0.915	12.0%	45.133	14.9%
Luzzu	Trammel Nets	7			9.357	53.7%	1.863	47.5%	6.962	73.8%	0.630	46.0%	5.063	19.0%	1.847	68.5%	16.943	55.5%
	Traps	3			5.167	14.8%	0.986	21.9%	5.019	6.6%	0.257	107.2%	5.293	6.8%	1.027	9.6%	35.807	61.4%
	Trolling Lines	2			0.500		0.091		0.515		0.010		5.110	10.8%	0.845	20.9%	29.840	88.4%
MPV	Long Lines	2			29.500	26.4%	4.538	26.4%	22.692	26.4%	0.608	26.4%	6.500	0.0%	1.300	0.0%	48.490	0.0%
	Surrounding Nets	2			107.500	75.6%	12.440	54.0%	26.820	61.4%	1.437	40.0%	8.050	27.2%	6.085	111.2%	69.005	42.0%
	Trammel Nets	1			18.000		2.769		13.846		0.371		6.500		1.300		48.490	
	Traps	1			2.000		0.308		1.538		0.041		6.500		1.300		48.490	
	Trolling Lines	2			3.175	125.8%	0.343	119.2%	0.635	81.4%	0.024	98.4%	8.000	26.5%	3.650	91.1%	98.845	72.0%
Others	Trammel Nets	1			4.000		0.500		0.672		0.034		8.000		5.950		119.360	
		37	64	32														

Gear contribution to each of the 27 most important species (spec base 100)

ANNEX VII

ANNEX VIII: List of most common commercial species

SCIENTIFIC NAME	COMMON NAME (ENGLISH)	COMMON NAME (MALTESE)	MEDITS
Alopias vulpinus	Thresher shark	Pixxivolpi/Gurdien	
Alosa alosa	Allis shad	Lacca	
Anguilla anguilla	European eel	Sallura	
Aphanopus carbo	Black scabbardfish	Cinturin iswed	
Aphia minuta	Transparent goby	Makku	
Aristaeomorpha folicea	Giant red shrimp		*
Aristeus antennatus	Blue and red shrimp		*
Aspitrigla cuculus	Red gurnard	Zumbrell	
Atherina boyeri	Bigscale sand smelt	Kurunella	
Atherina hepsetus	Mediterranean sand smelt	Kurunella	
Auxis rochei	Bullet tuna	Tumbrell	
Balistes carolinensis	Grey triggerfish	Hallouf	
Belone belone	Garfish	Imsell	
Boops boops	Bogue	Vopa	
Brama brama	Atlantic pomfret	Pixxiluna	
Buccinum undatum	Common whelk	Bronja kumuni	
Cancer pagurus	Edible crab	Granc	
Caranx (Caranx) crysos	Blue runner	Sawrella mperjali	
Caranx (Caranx) rhonchus	False scad	Sawrella mperjali mibruma	
Carcharhinus brevipinna	Spinner shark		
Carcharhinus falciformis	Silky shark		
Carcharhinus obscurus	Dusky shark		
Carcharhinus plumbeus	Sandbar shark	Kelb gris	
Centrophorus granulosus	Gulper shark	Zaghrun	
Chimaera monstrosa	Rabbit fish	Fenek tal-bahar	
Chromis chromis	Damsel fish	Cawla	
Citharus macrolepidotus	Spotted Flounder	Ingwata tal- iskwami	*
Clupea harengus	Atlantic herring	Arringa ta' l-Atlantiku	
Conger conger	European conger	Gringu	
Coryphæna hippurus	Common dolphinfish	Lampuka	
Crangon crangon	Crangonid shrimps	Gambli Krangonidi	
Dasyatis pastinaca	Common stingray	Boll	
Dentex dentex	Common dentex	Dentici	
Dentex gibbosus	Pink dentex	Hajwat	
Dicentrarchus labrax	European seabass	Spnotta	
Dicentrarchus punctatus	Spotted seabass	Spnotta tat-tbajja	
Diplodus annularis	Annular seabream	Sparlu	
Diplodus sargus sargus	White seabream	Sargi	
Diplodus vulgaris	Common two-banded seabream	Xirgien	
Eledone cirrohosa	Horned octopus		*
Eledone moschata	Musky octopus		*
Engraulis encrasicolus	European anchovy	Incova	
Epinephelus æneus	White grouper	Fellusa tac-Cerna	
Epinephelus caninus	Dogtooth grouper		
Epinephelus costæ	Goldblotch grouper		
Epinephelus marginatus	Dusky grouper	Cerna	
Epinephelus haifensis	Haifa grouper		
Euthynnus alletteratus	Little tunny	Kubrita	
Eutrigla gurnardus	Grey gurnard	Gallina	*
Gadus morhua	Cod	Bakkaljaw/Merluzz	
Gadus potassou/Micromesistius poutassou	Blue weighting	Stokkafixx	
Gaidropsarus mediterraneus	Shore rockling		
Gaidropsarus vulgaris	Three-bearded rockling	Ballotra	
Galeus melastomus	Blackmouth catshark		*
Gymnammodytes cicerellus	Mediterranean sand eel	Fjammeta	
Helicolenus dactylopterus	Blackbelly rockfish	Skorfna imperjali	*
Heptranchias perlo	Sharpnose sevengill shark	Murruna	
Hexanchus griseus	Bluntnose sixgill shark	Murruna	
Homorus gammalus	Lobster	Ljunfant	
Illex coindeti	Broadtail squid		*
Isurus oxyrinchus	Shortfin mako	Pixxitondu	
Labrus merula	Brown wrasse	Mirli	
Lamna nasus	Porbeagle	Pixxiplamtu	
Lepidopus caudatus	Silver scabbardfish/frostfish	Fjamma/xabla	
Lepidorhombus boscii	Fourspotted megrim	Ingwata ta l-erba' tikkek	*
Lichia amia	Leerfish	Serra	
Limanda Limanda	Dab	Barbun	
Lithognathus mormyrus	Sand steenbras	Mingus	

Annex VIII

ANNEX IX: LISTS OF SOCIO-ECONOMIC DATA

Socio-economic data recommended by the GFCM Sub-Committee on economic and social sciences and accepted by the GFCM-Scientific Advisory Committee, 2002:

Macro-level (Vessel) Data:
Import/export weight and value
Annual interest rate
Population
Working population
Gross National Product
Aquaculture production weight and value

Micro-level (Vessel) Data:
Number of vessels
Gross tonnage
Horse power
Employment
Salary Share %
Landings weight
Landings value
Vessel value
Number of days fishing /year
Number of fishing hours/day
Cost of fishing/day
Yearly fixed costs

SCIENTIFIC NAME	COMMON NAME (ENGLISH)	COMMON NAME (MALTESE)	MEDITS
Liza aurata	Golden grey mullet	Mullett tal-misluta	
Liza ramada	Thinlip mullet	Mullett tal-imcarat	
Loligo vulgaris	Common Squid	Klamari	*
Lophius budegassa	Black-bellied angler	Petricia tat-tbajja	*
Lophius piscatorius	Angler	Petrici	*
Maja squinado	Spinous spider crab	Aguza	
Melangogrammus aeglefinus	Haddock	Haddock	
Merlangius merlangus	Whiting	Imsell	
Merluccius merluccius	European hake	Marloz	*
Micromesistius poutassou	Blue whiting	Stokkafixx	*
Microstomus kitt	Lemon sole	Lingwata	
Mobula mabular	Manta ray	Manta	
Molva Molva	Ling	Lipp/Linarda	
Mugil cephalus	Flathead grey mullet	Kaplat/Mulett	
Mullus barbatus	Striped mullet	Trilja tal-qawwi	*
Mullus surmuletus	Red mullet	Trilja tal-hama	*
Muræna helena	Mediterranean moray	Morina	
Mustelus asterias	Starry smooth-hound	Mazzola tat-tbajja	
Mustelus mustelus	Smooth-hound	Mazzola bla xewka	
Mustelus punctulatus	Blackspotted smooth-hound		
Mycteroperca rubra	Mottled grouper		
Naucrates ductor	Pilotfish	Fanfru	
Nephrops norvegiicus	Norway lobster	Langostina	*
Oblada melanura	Saddled seabream	Kahlija	
Octopus vulgaris	Common Octopus	Qarnita	*
Oxynotus centrina	Angular rough shark	Gurdien, Pixxiporku	
Pagellus acarne	Axillary seabream	Bazuga	*
Pagellus bellottii bellottii	Red pandora		
Pagellus bogaraveo	Blackspot seabream	Bazuga	*
Pagellus erythrinus	Common pandora	Pagella hamra	*
Pagrus pagrus pagrus	Common seabream	Pagru	
Palinurus elephas	Spiny Lobster	Awwista	
Pandalus borealis	Pandalid shrimps	Gambli Pandaladi	
Paracentrotus lividus	Sea Urchin	Rizza	
Parapenaeus longirostris	Deep water pink shrimp		*
Pecten maximus	Common Scallop	Moxt tal-bahar komuni	
Phycis blennoides	Greater forkbeard	Lipp abjad	*
Phycis phycis	Forkbeard	Lipp tal-qawwi	
Platichthys flesus	European flounder	Barbun	
Pleuronectes platessa	European plaice	Barbun tat-tbajja	
Pollachius pollachius	Pollack	Pollack	
Pollachius virnes	Saithe	Bakkaljaw	
Polyprion americanus	Wreckfish	Dott or hanzir	
Pomatomus saltatrix	Bluefish	Serra tas-snien/Serra imperjali	
Prionace glauca	Blue shark	Huta kahla	
Psetta maxima maxima	Turbot	Barbun Imperiali	
Raja alba	White skate	Hamiema	
Raja asterias	Starry ray	Rajja tal-kwiekeb	
Raja batis	Skate	Rebekkin skur	
Raja brachyura	Blonde ray		
Raja clavata	Thornback ray	Rajja tal- fossos	*
Raja fullonica	Shagreen ray	Rajja Petruza	
Raja miraletus	Brown ray	Raja lixxa	
Raja montagui	Spotted ray		
Raja nævus	Cuckoo ray		
Raja oxyrinchus	Longnosed skate	Rebekkini/ Hamiema	
Raja polystigma	Speckled ray		
Raja radula	Rough ray	Rajja tar-ramel	
Raja undulata	Undulate ray		
Ruvettua priaetiousus	Oilfish	Raspa	
Sarda sarda	Atlantic bonito	Plamtu	
Sardina pilchardus	European pilchard	Sardin kahla	
Sardinella aurita	Round sardinella	Lacca tal-faxx	
Sarpa salpa	Salema	Xilpa	
Sciæna umbra	Brown meagre	Griebel	
Scomber japonicus	Chub mackerel	Kavall tal-ghajn	
Scomber scombrus	Atlantic mackerel	Pizzintun	
Scomberesox saurus	Atlantic saury/skipper	Kastardella	

SCIENTIFIC NAME	COMMON NAME (ENGLISH)	COMMON NAME (MALTESE)	MEDITS
Scomberomorus commerson	Narrow-barred Spanish mackerel		
Scophthalmus rhombus	Brill	Partun	
Scorpæna notata	Small red scorpionfish	Skorfnott	
Scorpæna porcus	Black scorpionfish	Skorfna sewda	
Scorpæna scrofa	Red scorpionfish	Cipullazza	
Scyliorhinus canicula	Small-spotted catshark	Gattarel	
Scyliorhinus stellaris	Nursehound	Gattarell tar-rukkal/ qtates	
Scyllarides latus	Squat Lobster	Ckala	
Sepia officinalis	Cuttlefish	Sicc	•
Seriola dumerili	Greater amberjack	Accola	
Serranus cabrilla	Comber	Sirrana	
Serranus hepatus	Brown comber	Serrana tar-ramel/ hanzir	
Serranus scriba	Painted comber	Brieqex	
Siganus luridus	Dusky spinefoot		
Solea ægyptiaca	Egyptian sole		
Solea senegalensis	Senegalese sole		
Solea vulgaris	Common sole	Ingwata	•
Sparisoma cretense	Parrotfish	Marzpan/Pakkagall	
Sparus aurata	Gilthead seabream	Awrata	
Sphyræna sphyræna	European barracuda	Lizz	
Sphyræna viridensis	Yellowmouth barracuda		
Sphyrna zygæna	Smooth hammerhead	Kurazza	
Spicara flexuosa	Picarel	Arznella	•
Spicara smaris/Maena sararis	Picarel	Arznella	
Spondyliosoma cantharus	Black seabream	Tannuta	
Squalus acanthias	Piked dogfish	Mazzola (griza)	
Squatina squatina	Angelshark	Xkatlu	
Thunnus alalunga	Albacore	Alalonga/Alonga/Tonn sekond	
Thunnus obesus	Big-eye tuna	Tonn ta' ghajnu kbira	
Thunnus thynnus	Northern bluefin tuna	Tonn	
Todarodes sagittatus	European flying squid	Tutlu	
Torpeda torpedo	Five spotted torpedo/ common torpedo	Haddiela tal-ghajnejn	
Torpeda nobiliana	Electric ray	Haddiela mdahhna	
Torpedo marmorata	Marbeled electic ray	Haddiela	
Trachinus draco	Greater weever	Tracna/Sawt	
Trachurus mediterraneus	Mediterranean horse mackerel	Sawrella	•
Trachurus trachurus	Atlantic horse mackerel	Sawrella/Sawrella kahla	•
Trigla lucerna	Tub gurnard	Gallinetta	
Trigla spp.	Gurnard	Gallina	
Trisopterus luscus	Pouting	Pouting	
Trisopterus minutus capelanus	Poor cod	Mankana	•
Trtrapturus belone	Meditrranean spearfish	Pastardella	
Umbrina canariensis	Canary drum		
Umbrina cirrosa	Shi drum	Gurbell	
Uranoscopus scaber	Stargazer	Zondu	
Xiphias gladius	Swordfish	Pixxi spad	
Xyrichthys novacula	Pearly razorfish	Rozetta/Ruzetta	
Zeus faber	John dory	Pixxi San Pietru	•

ANNEX X: Paper - Catch and Effort data of the Maltese dolphin fish fishery

Paper presented at GFCM – ICCAT working group, April 2002. Registered as ICCAT document SCRS/2002/049.

CATCH AND EFFORT DATA OF THE MALTESE DOLPHIN FISH FISHERY (2001)

Camilleri M. and Darmanin M.

Malta Centre for Fisheries Sciences, Fort San Lucian, M'Xlokk, Malta

INTRODUCTION

The Maltese dolphin fish (*Coryphaena hippurus*) or *lampuki* fishery is a traditional fishery, which has been in existence for several decades. It is managed and regulated by the Fisheries Conservation and Control Division which issues *lampuki* fishery licences only to vessels over 6 metres in length. A fishing site or *rimja* is assigned to each vessel after lots are drawn for each district. Each licensee must lay at least 35 Fish Aggregating Devices (FADs – locally known as *kannizzati*) in a straight line along the direction indicated by the Division. Fishing sites are distributed all around the Maltese Islands except for the "swordfish corridor" which is kept free from *lampuki* FADs so that swordfish fishing can be undertaken. The sites start from 7 miles offshore and FADs are laid at intervals of one half or three quarters of a mile depending on the district. Figure 1 illustrates the distribution of FADs during the 2001 fishery.

Coryphaena hippurus has recently been included in the list of priority species of the General Fisheries Commission for the Mediterranean (GFCM, 2001). In this context, the FAO sub-regional project COPEMED has coordinated and supported a catch and effort, and biological sampling programme for this species since 2000, in which Malta has actively participated. Results presented in this paper have been obtained within the framework of this programme.

DESCRIPTION OF GEAR AND FLEET

Kannizzati are anchored small rafts made of floating material onto which a few palm fronds are attached. They lure dolphin-fish (*Coryphaena hippurus*) along with other species such as pilot fish (*Naucrates ductor*) and amberjack (*Seriola dumerili*) which tend to aggregate within the shadow which is cast by these floats. Prior to the actual fishing operation, it is common practice to use feather lures or artificial bait to catch a decoy fish which attracts other fish which may be present around the FAD (DeLeiva *et al.*, 1998). When the fish are aggregated in considerable numbers, they are caught by a surrounding net similar to a purse-seine.

A total of 91 fishing vessels were registered in the 2001 dolphin fish fishery, deploying a total of 15,173 FADs, with a mean value of 167 FADs / vessel. The average size of the vessels was 11 metres (sd = 4.3) having marked differences in engine power (mean value = 274.66 kW, sd = 215.41). Although the number of vessels was greater in stratum 1, the vessel size and engine power was much greater in stratum 3, with an extensive area being covered by the high number of FADs which were deployed by each vessel in the latter. Table 1 summarises the vessel characteristics by stratum whilst the surrounding net characteristics are given in Table 2.

CATCH AND EFFORT STATISTICS

The fishing season started on August 15th and extended up to January 2002. In stratum 1 and 2 no landings were recorded in December (mainly due to bad weather conditions). The total landings were 240 tons which were largely obtained between September and October (70%), and during the month of August (17%). Landings for November accounted for only 9% of the total, whilst those for December and January were very low (3% and 1%, respectively). The main part of the landings were obtained in stratum 3 (63%), followed by stratum 2 (21%) and stratum 1 (13%). The evolution of the landings and the catch per unit effort (CPUE) by stratum and month are shown in Figures 2a, b and c. The CPUE in terms of catch per FAD and catch per vessel were calculated using the total number of FADs deployed and the total number of registered vessels respectively. It is clear that stratum 3 was the most important with respect to landings and CPUE in terms of catch per vessel throughout the season. Stratum 2 was the most important during the month of October when the CPUE in terms of catch per FAD was the highest.

Table 1. Summary of the vessel characteristics by stratum

Stratum	Number of vessels	Total FADs	FADs / vessel	Vessel size (m)	Engine power (kW)
1	45	6749	150	9.88 (sd = 3.42)	203.12 (sd = 178.38)
2	19	2515	132	11.6 (sd = 4.37)	244.8 (sd = 166.25)
3	27	5909	219	13.26 (sd = 4.82)	412.26 (sd = 241.05)

Table 2. Surrounding net characteristics

Gear type	Surrounding Net
Length (m)	130-150
Height (m)	12
Number of meshes	400
Opening of mesh (mm)	26 (19 in the bag)
Number of floats	400-500
Buoyancy	SL8
Number of weights	40kg/100m
Netting material	nylon multi-filament
Rtex	9,12,15 (27 in bag)

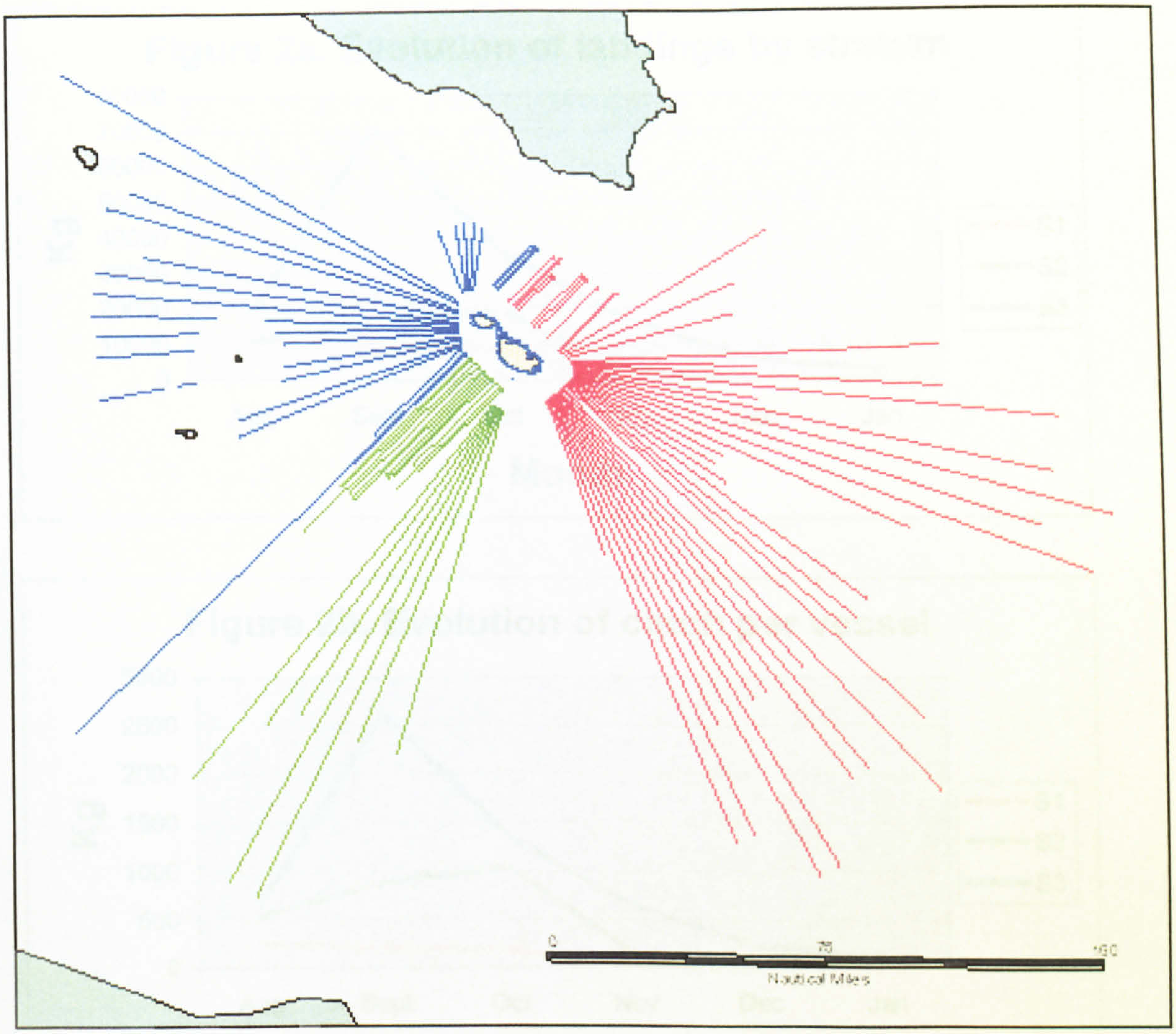


Figure 1. Distribution of FADs during 2001 *lampuki* fishery (— Stratum 1, — Stratum 2, — Stratum 3)

Figure 2a. Evolution of landings by stratum

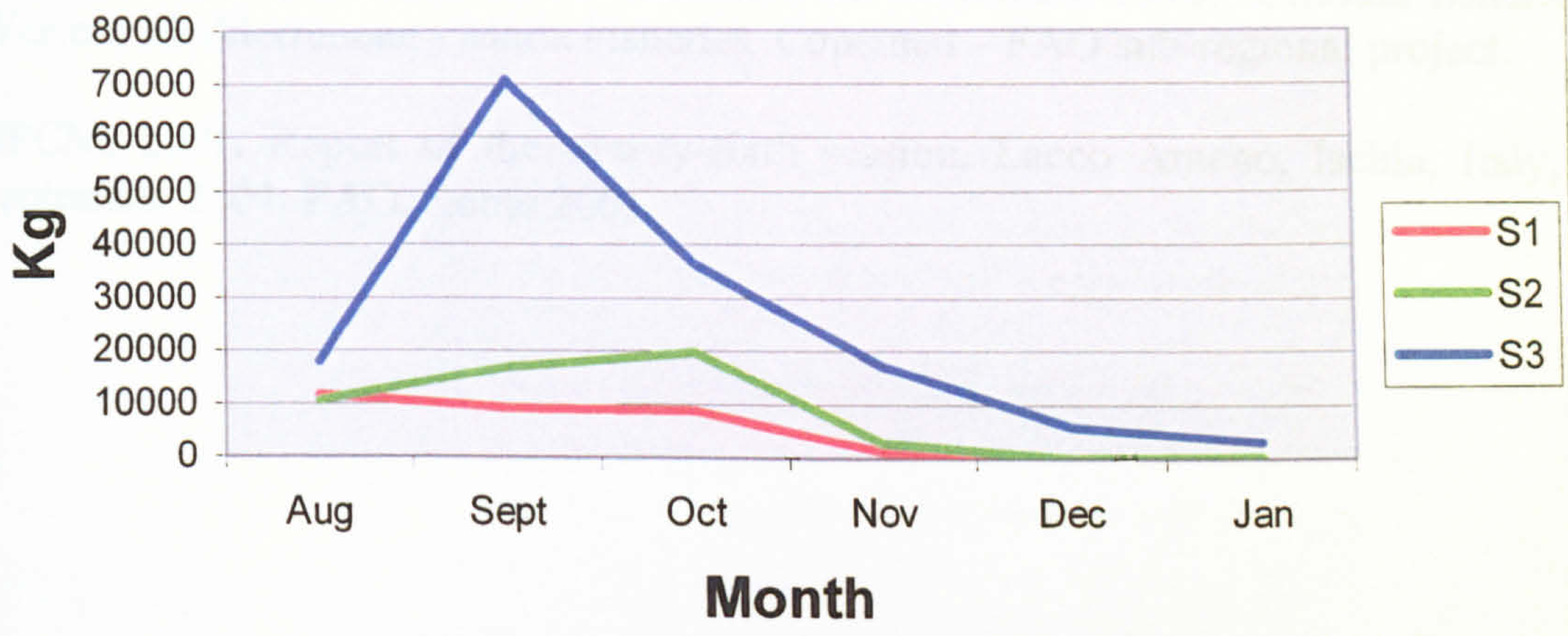


Figure 2b. Evolution of catch per vessel

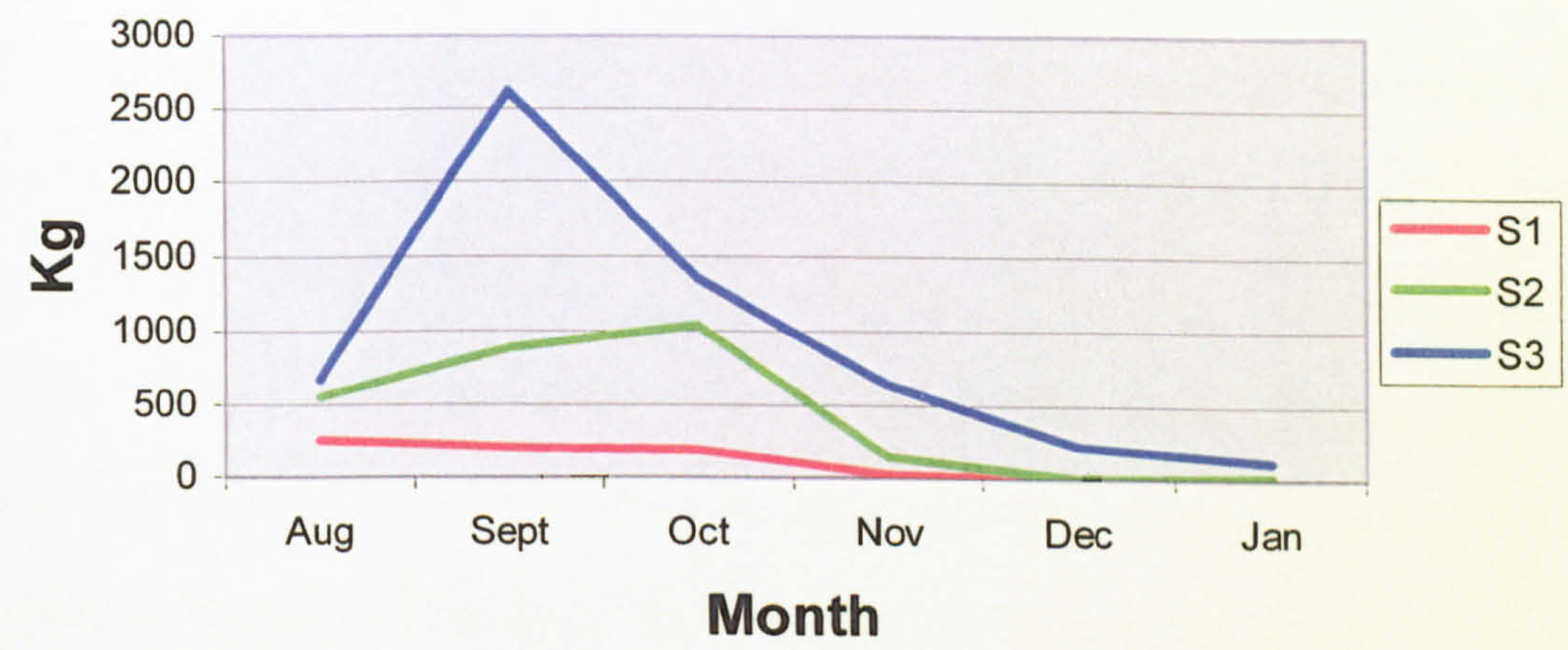
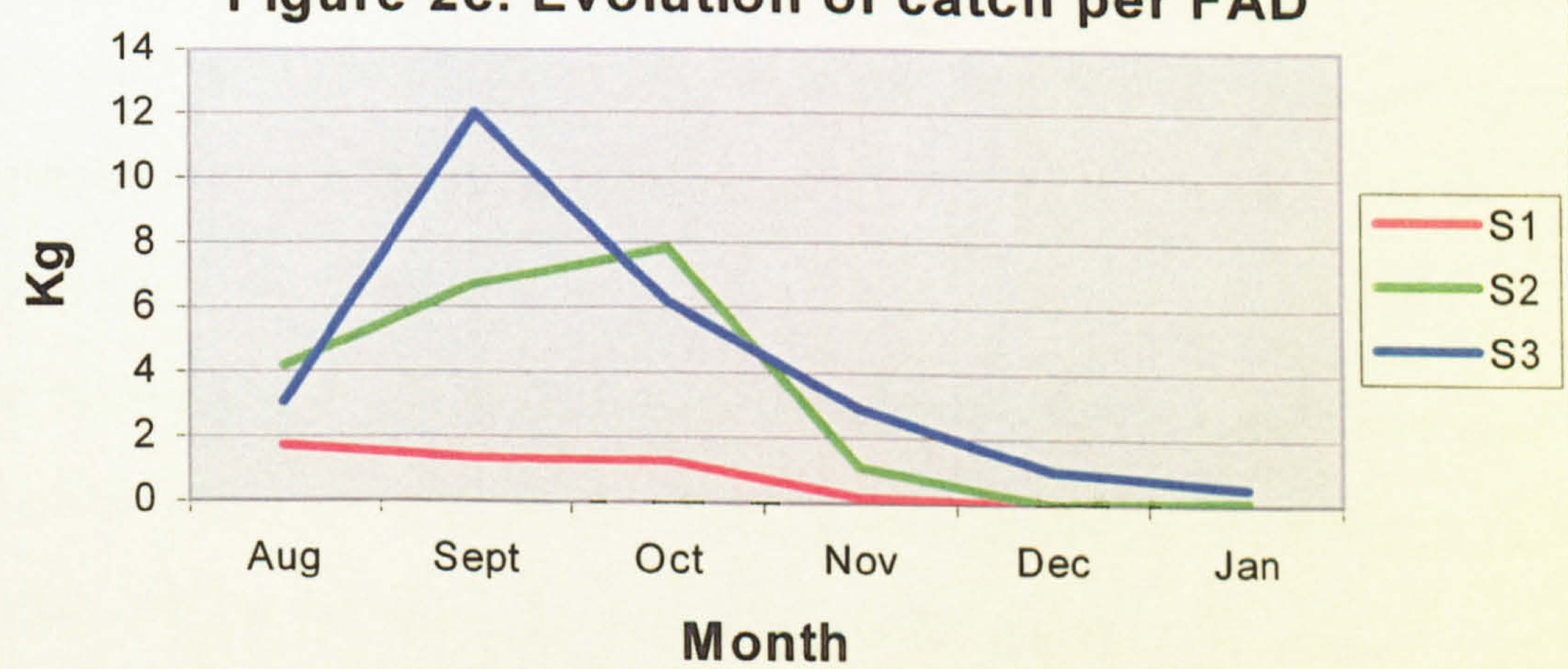


Figure 2c. Evolution of catch per FAD



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ANNEX XI: Paper - PRELIMINARY ANALYSIS OF THE RELATIONSHIP BETWEEN THE STRUCTURAL CHARACTERISTICS OF MALTESE SMALL SCALE FISHING VESSELS AND CATCHES

Presented at GFCM workshop on Operational Units, Rome, April, 2003.

Preliminary analysis of the relationship between the structural characteristics of Maltese small scale fishing vessels and catches

***Camilleri, M., **Coppola, S.R. and **Scalisi, M.**

*Malta Centre for Fisheries Sciences, Marsaxlokk, Malta
**Fishery Department, Food and Agriculture Organization of the UN, Rome, Italy

INTRODUCTION

The collection of reliable catch and effort data for various segments of a fishing fleet is essential for sound fisheries management. Data related to Maltese vessels measuring over 10m in length overall are collected through a logbook scheme whereby all fishing activities are monitored. However, over 90 percent of the vessels making up the Maltese fishing fleet are under 10m in length overall and their activities are monitored through a port sampling scheme. These small-scale vessels generally use a combination of static gears and other passive methods of fishing targeting several species. The number of active vessels varies according to season, with minor ports having practically no active vessels during the winter months and as little as 25 percent of the registered vessels in major ports land fish during this period. The proportion of vessels operating in one day seldom reaches high percentages since most of them are owned by part time fishers and it is quite common for full time fishers to own more than one vessel.

It is widely accepted that Mediterranean fisheries should be managed by an effort control regime on groups of vessels or Operational Units (Camilleri *et al.* 2000; Adriamed, 2001; GFCM, 2001). Each Operational Unit would be identified by a number of specific parameters and a model for estimating fishing effort would be based on a selection of these parameters. This present study attempts to identify the structural parameters of Maltese small-scale vessels (<10m), using artisanal gears, which significantly affect catches and hence contribute to fishing effort.

MATERIALS AND METODS

Data on the activity of the Maltese small-scale fishing fleet were collected within the framework of a pilot study[25] to establish a port sampling scheme to estimate national catches and fishing effort by gear for this sector of the fleet. A total of 923 interviews were carried out over a period of 10 months in 9 major fishing ports in the Maltese Islands. Data were processed by gear class and statistics on the total catch of sampled vessels and the vessel structure parameters (length, gross tonnage and horse power) were produced. For each of the four main gear classes, as well as for all the gear classes grouped together, a multiple regression analysis was performed according to the following model:

$$\mathbf{Catch_i = b_0 + b_1{*}L_i + b_2{*}GT_i + b_3{*}HP_i + \varepsilon_i \qquad (i=1, 2, \ldots, n)}$$

where:

- n is the sample size (number of interviews per gear, during the whole 10 month period of observation)
- b_0, b_1, b_2, b_3 are the regression coefficients,
- L_i is the Length of the vessel i,
- GT_i is the Gross Tonnage of the vessel i,
- HP_i is the Engine Power of the vessel i,
- ε_i is the random error, $\varepsilon_i \sim N(0,\sigma^2)$

The regression coefficients (b_1, b_2, b_3) describe how a unit variation in the vessel structural parameters affects the catch; the higher the coefficient is, the greater the affect on the catch would be. The following list of summary statistics for each analysis were also determined:

[25] This pilot study and the development of the Catch Assessment Scheme have been carried out with the support of the FAO Mediterranean sub-regional project, COPEMED.

- N :sample size (number of interviews)
- R : goodness of fit coefficient
- F : significance of the regression model
- p : probability that the model fits the data owing to a random effect
- B : regression coefficient of variables
- t : significance of regression coefficient
- p-level : probability that the value of the regression coefficient is different from zero, owing to a random effect

RESULTS

Trammel nets

Regression summary for dependent variable (Catch)

N = 392 interviews

R = 0.245

F(3,388) = 8.2926

p< 0.00002

Variable	B	Standard error of B	T(388)	p-level
Intercept	2.326753	2.590230	0.89828	0.369593
[26]**LENGTH**	**2.549104**	**0.571080**	**4.46365**	**0.000011**
GT	-0.851083	0.775263	-1.09780	0.272973
HP	**-0.053140**	**0.023367**	**-2.27414**	**0.023503**

[26] Significant values are represented in bold

The total number of interviews for this gear class was very high (392). However, the low R value (0.245) indicated that the model did not fit the data so well in order to describe the investigated phenomenon.

The regression coefficient of the length variable was significantly different from zero. This means that the length variable affected the catch; moreover, the probability that this relationship was due to a random effect was less than 0.01%.

The HP regression coefficient was also significantly different from zero. However, the probability that the relationship between HP and the catch could be due to a random effect (2.3%) was higher than in the case of the length variable.

The analysis showed that there was no significant relationship between catch and GT for this gear class.

Longlines

Regression summary for dependent variable (Catch)

N = 143 interviews

R = 0.512

$F(3,139) = 16.438$

$p < 0.00000$

Variable	B	Standard error of B	T(139)	p-level
Intercept	-3.67604	3.926474	-0.936220	0.350784
LENGTH	1.37080	0.902753	1.518467	0.131168
GT	-0.27945	1.301203	-0.214762	0.830268
HP	**0.10765**	**0.028574**	**3.767579**	**0.000243**

The number of interviews was quite high (143) and the model fitted the data quite well (R = 0.512).

The regression coefficient of the HP variable was significantly different from zero. This means that the variable HP affected the catch, with the probability that this relationship was due to a random effect being less than 0.01%.

The analysis showed that there was no significant relationship between catch and both GT and length for this gear class.

Traps

<u>Regression summary for dependent variable (Catch)</u>

N = 176 interviews

R = 0.525

F(3,172) = 21.819

p< 0.00000

Variable	B	Standard error of B	T(172)	p-level
Intercept	0.838436	7.194008	0.116546	0.907355
LENGTH	-0.925000	1.511910	-0.611809	0.541472
GT	**6.208077**	**1.781783**	**3.484194**	**0.000626**
HP	**0.120904**	**0.056540**	**2.138367**	**0.033898**

A good number of interviews were obtained (176) and the data collected fitted the model quite well ($R = 0.525$).

The regression coefficient of the GT variable was significantly different from zero. This means that the variable GT affected the catch, with the probability of less than 0.01% that this relationship was due to a random effect.

The HP regression coefficient was also significantly different from zero. However, the probability that the relationship between HP and the catch could be due to a random effect (3.4%) was higher than in the case of GT.

The analysis showed that there was no significant relationship between catch and length for this gear class.

Trolling lines

Regression summary for dependent variable (Catch)

N = 176 INTERVIEWS

$R = 0.202$

$F(3,172) = 2.4334$

$p < 0.06666$

Variable	B	Standard error of B	T(172)	p-level
Intercept	0.04895	1.906715	0.02567	0.979550
LENGTH	**1.23423**	**0.471985**	**2.61497**	**0.009716**
GT	-1.25745	0.780149	-1.61181	0.108837
HP	-0.00395	0.016856	-0.23413	0.815163

The model did not fit the data obtained from the interviews (176) for this gear class ($R = 0.20$).

The regression coefficient of the length variable was significantly different from zero, indicating that this variable affected the catch. The probability that this relationship was due to a random effect was less than 0.9%.

The analysis showed that there was no significant relationship between catch and both GT and HP for this gear class.

All gears

Regression summary for dependent variable (Catch)

N = 923 interviews

$R = 0.367$

$F(3,919) = 47.642$

$p < 0.00000$

Variable	B	Standard error of B	T(919)	p-level
Intercept	-0.150051	2.697922	-0.055617	0.955659
LENGTH	0.514532	0.589067	0.873469	0.382636
GT	**5.342294**	**0.752216**	**7.102073**	**0.000000**
HP	-0.011426	0.022099	-0.517042	0.605251

The total number of interviews was very high (923), but the model did not fit data very well (R = 0.37). The regression coefficient of the variable GT was significantly different from zero indicating this variable affected the catch with practically no probability that it could be due to a random effect.

The analysis showed that there was no significant relationship between catch and both length and HP when all the gears were considered together.

DISCUSSION

The use of vessel structural parameters could be a good indicator of effort in artisanal fisheries. The relevant parameters, however, would depend on the gear class being used. It is clear, for example, that the size (length) of a vessel is a limiting factor for the number and size of bulky gear, such as trammel nets, which could be kept on board. On the other hand, horse power would determine the capacity (speed) in deploying and retrieving longlines and hence the length of the gear used with a particular vessel.

The generally low R values obtained in the analyses are probably not related to errors associated with the actual investigation (samples, analysis, etc.) but are a result of the deficiency of the structured regression model used in this study to explain catches. Since catches are highly variable and are a function of several factors, they cannot be explained by a model involving only structural parameters. Nevertheless, this preliminary study highlighted that, even if there are many factors affecting the catch, vessel structural parameters inherently affect it.

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ANNEX XII: Paper - Evaluation of the activity of the Maltese Small Scale Fishing Fleet

Paper presented at *Workshop on Management of small-scale deep water fisheries 27-29 November 2003;in proceedings of the FAO Deep Sea Fisheries Conference, New Zealand, December 2003*

Evaluation of the activity of the Maltese Small Scale Fishing Fleet

Camilleri, M.

1. Introduction

Maltese fisheries are of a typically Mediterranean artisanal type which are not species selective and are frequently described as multi-species and multi-gear fisheries, with fishermen switching from one gear to another several times throughout the year. There are over 2200 fishing vessels registered in Malta with more than 92 percent of them measuring less than 10m in length which, in regional terms, are considered as small scale vessels. Annual landings recorded at the central fish market normally reach about 1000 tonnes with more than two thirds of this weight being attributed to large pelagic species; most of the fish brought in to this market are caught by the larger vessels. Whilst a long time series of data on these landings is available, the activities of the small scale fleet have seldom been monitored.

The collection of reliable catch and effort data for various fleet segments is widely recognised as being essential for scientific assessments of stocks and responsible fisheries management. In this context, a catch assessment scheme for the small scale fleet has been set up in Malta to complement the monitoring of larger vessels which is undertaken through a logbook scheme.

2. Materials and methods

Fleet and gear statistics were obtained from the database and information system of the Maltese fishing fleet register, MaltaStat (Camilleri *et al.* 2003) which contains data collected by a census and is which updated on a daily basis.

Catch and effort estimates for the small scale fleet were obtained using a sampling scheme (Coppola *et al.* 2003) applied in 6 representative ports which together contain 42.5 percent of the national small scale fleet. Surveys took place in each port for six consecutive fishing days every other month between January and September, on a 12-24 hour basis obtaining a total of 881 interviews. The sampling frame for each port was adjusted each month according to the number of operational vessels. Data on catches, fishing effort, vessel activity and fishing zone were recorded by gear and species using purposely formulated interview and activity record sheets (Annex I). Fishing zones were recorded using a pre-set geographical grid of 5 minutes by 5 minutes.

Results for each port and the entire country, by day, month, species and gear were obtained by applying time and area raising factors to the sampled data (Coppola *et al.* 2003). Selections of these results were summarised in order to give a general description of the activity of the small scale fleet. An evaluation of slope (over 200m depth) fisheries was also carried out using the available data.

3. Results

3.1 Gear statistics of the small scale fleet

The total number of registered vessels under 10m in length overall (small scale fleet) was 2074 with more than 60 percent of them using either trammel nets or set bottom longlines as main gears. Almost 15 percent of the vessels used hand trolling lines and more than 8 percent of them used pots and traps. Figure 1 gives summary statistics on the main gear registered for this fleet category.

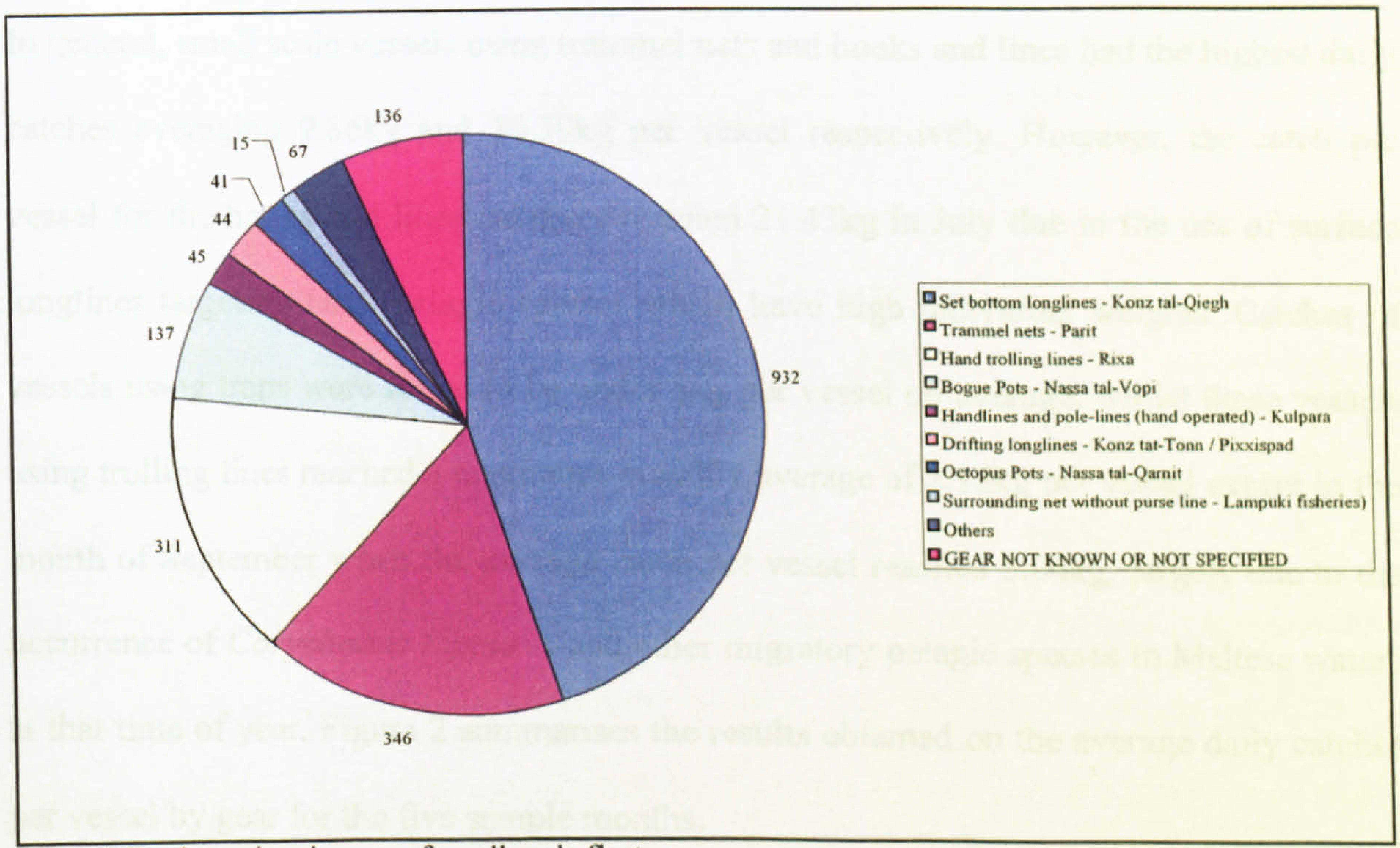

Figure 1. Registered main gear of small scale fleet

3.2 Activity of registered vessels

The percentage of registered vessels, which were operational at any given time, was on average about 67 percent. Furthermore, the fraction of operational vessels which go out fishing daily was very limited with an average of only 20 percent activity being observed over the whole sampling period in the sample ports. Table 1 summarises the operational status and activity of vessels by registered gear.

Gear	% operational vessels*	% daily activity of operational vessels**
Trammel nets	65.23	33.90
Hooks and lines	47.21	6.06
Traps	75.42	21.91
Trolling lines	80.97	19.05
MEAN	**67.21**	**20.23**

* number of vessels present in port / number of registered vessels in port *100

** number of vessels fishing daily / number of operational vessels*100

Table 1. Estimates of vessel activity by gear based on data collected from all sample ports during the whole sampling period

3.3 Vessel production

In general, small scale vessels using trammel nets and hooks and lines had the highest daily catches averaging 9.86kg and 10.79kg per vessel respectively. However, the catch per vessel for the hooks and lines category reached 21.43kg in July due to the use of surface longlines targeting large pelagic species which have high individual weights. Catches of vessels using traps were found to be under 5kg per vessel on average, whilst those vessels using trolling lines reached a maximum monthly average of 2.15kg per vessel except in the month of September when the average catch per vessel reached 5.04kg, largely due to the occurrence of *Coryphaena hippurus* and other migratory pelagic species in Maltese waters at that time of year. Figure 2 summarises the results obtained on the average daily catches per vessel by gear for the five sample months.

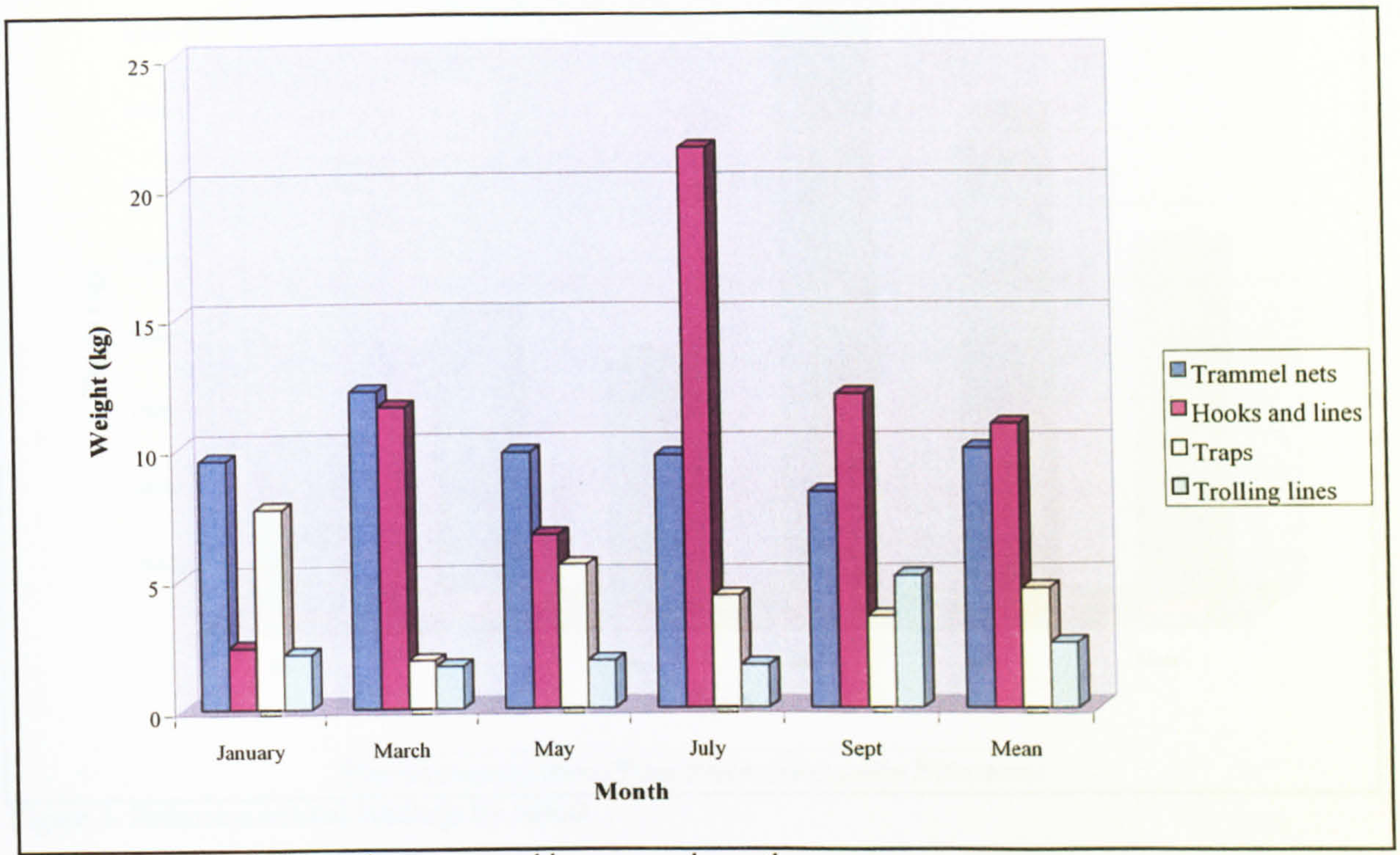

Figure 2. Average daily catches per vessel by gear and month.

3.4 Estimates of landings

The average monthly landings for the whole sampling period was about 24 tonnes with the highest value being obtained in the month of July for which a total landing of almost 39 tonnes was estimated. The elevated production of the small scale fleet in July and September is largely attributed to the landings of large pelagic species and other migratory species which are caught during this time of year. The landings of species[27] which are normally abundant in fishing grounds deeper than 200m depth (i.e. the slope) were found to be very limited and averaged about 1 tonne per month. Estimate values of monthly landings are shown in figure 3.

[27] *Phycis* spp, *Conger conger, Lophius* spp., *Helicolenus dactylopterus, Merluccius merluccius* and *Lepidopus caudatus*

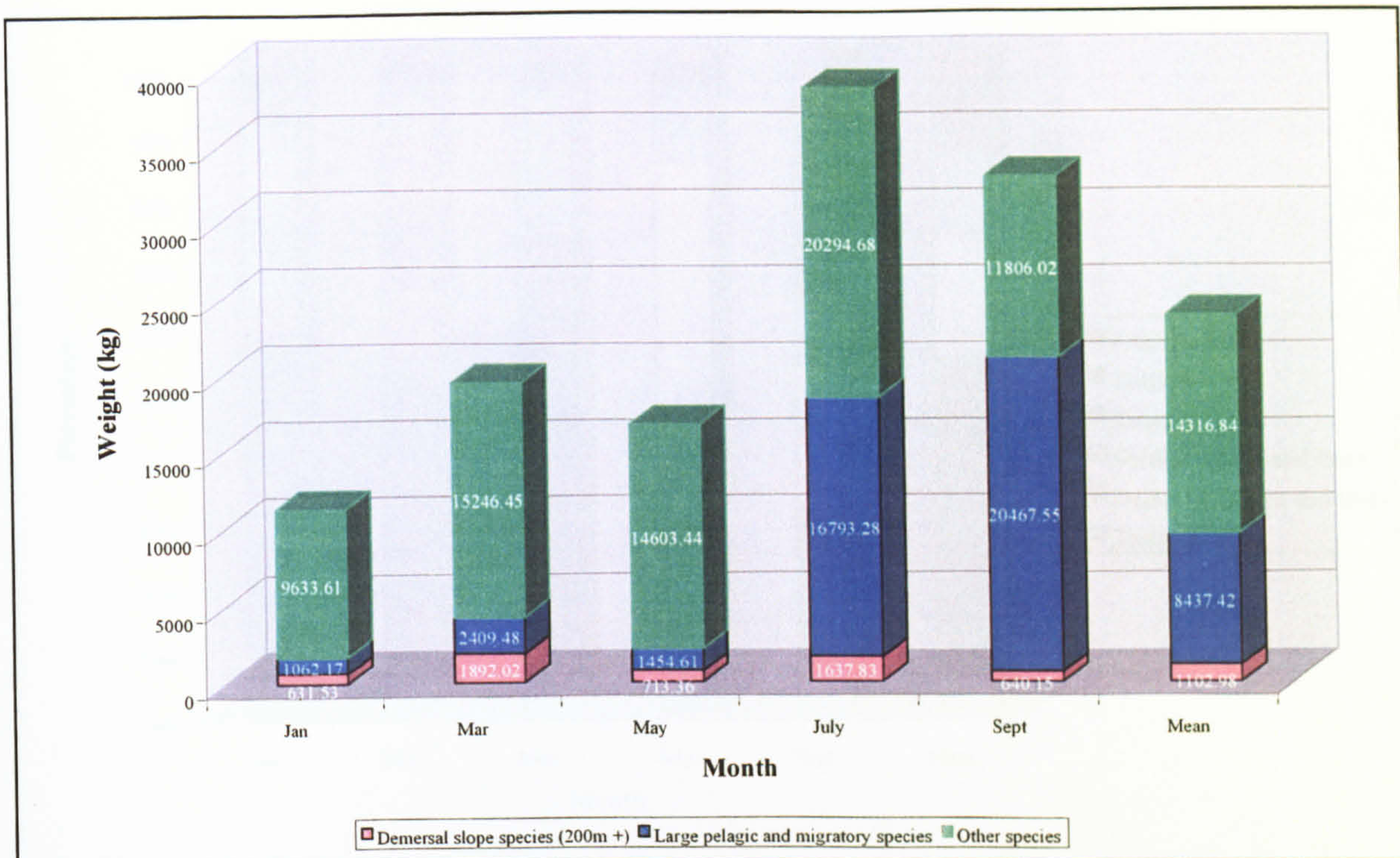

Figure 3. Estimates of total landings by month

3.5 Relative importance of gears

Trammel nets and demersal hooks and lines were generally the most important in terms of production with an average of 54 percent of landings and almost 90 percent of the landings originating from these two gears for the whole sample period and for the month of March respectively. Traps and trolling lines both contributed significantly to landings in all sample months, whilst surface hooks and lines and trolling lines jointly caught 52 percent of the catch in the month of September. More than 38 percent of the catches in July were caught by surface hooks and lines. Contributions from the *Coryphaena* FAD fishery were detected in the month of September when the fishery commences. Figure 4 illustrates the percentage distribution by gear or fishery during the sampling period.

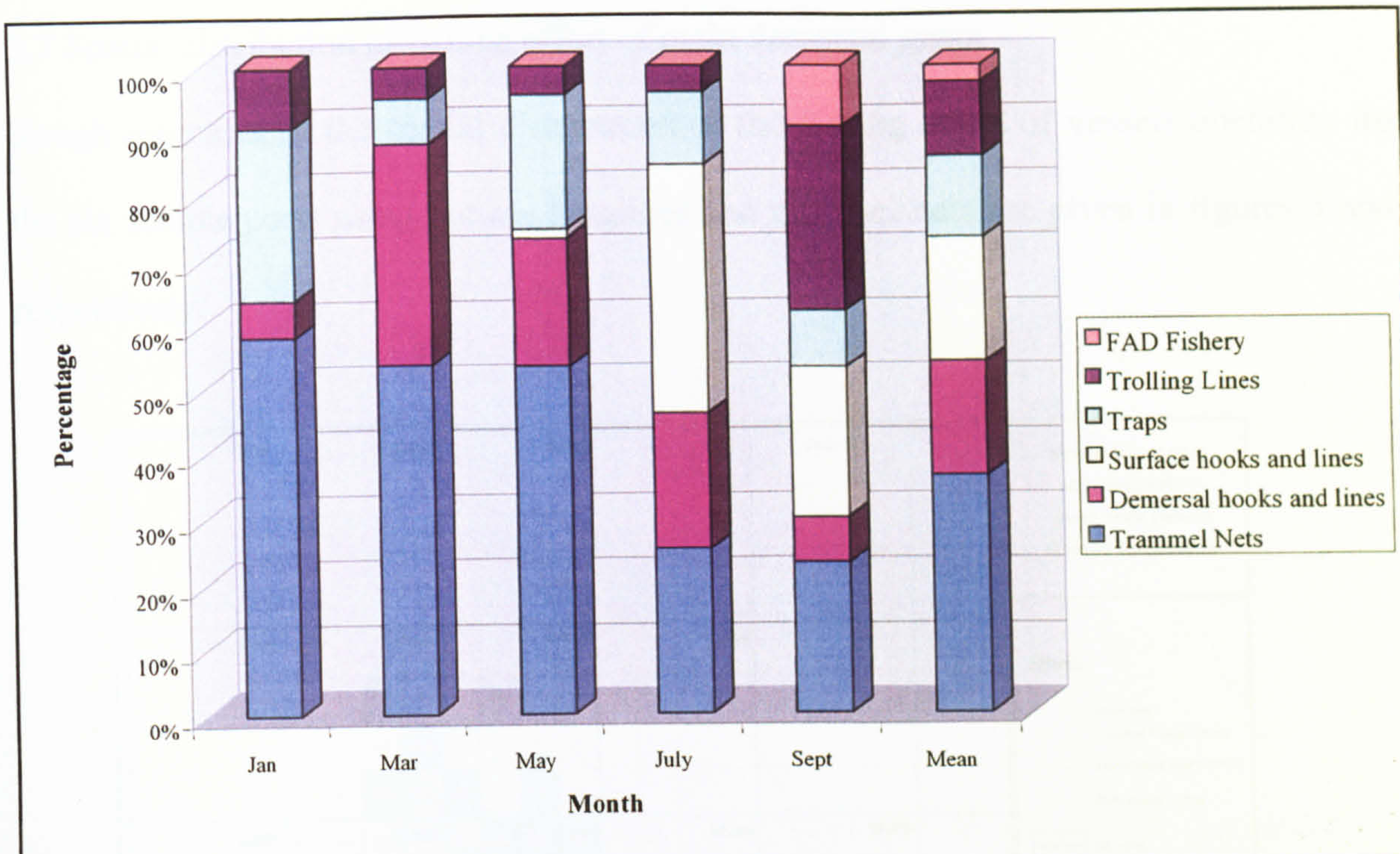

Figure 4. Percentage distribution of catches by gear or fishery

3.6 Operational statistics of main demersal gears

Summary statistics related to trammel net and bottom longline fishing operations are listed in table 2. Results show that fishing trips were typically of less than one day and the gear dimensions were relatively small. Landings of both gears were of a highly multi-species nature.

	Gear	
	Trammel nets	**Bottom longlines**
Average fishing time	13hrs 42min	10hrs 30min
Average length of net	128m	/
Average height of net	1.2m	/
Average number of hooks	/	646
Average number of species landed*	23	15

*Excluding unidentified and mixed box category

Table 2. Gear dimensions, fishing time and number of species landed.

3.7 Spatial distribution of fishing effort of main demersal gears

Rough estimates of the spatial distribution of the fishing effort of vessels operating from the six sample ports using bottom longlines and trammel nets are given in figures 5 and 6 respectively.

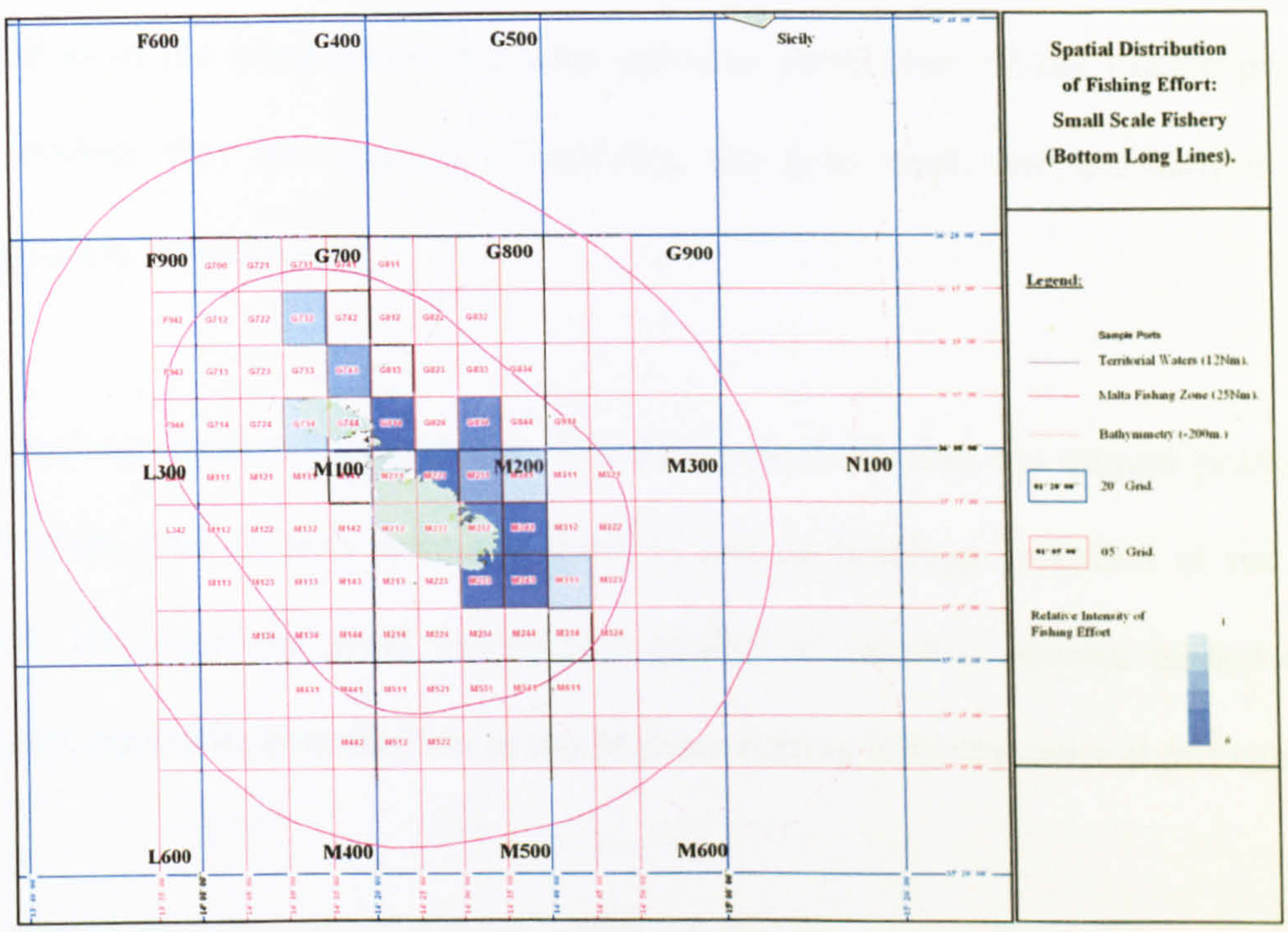

Figure 5. Spatial distribution of fishing effort of vessels operating from six sample ports using bottom longlines

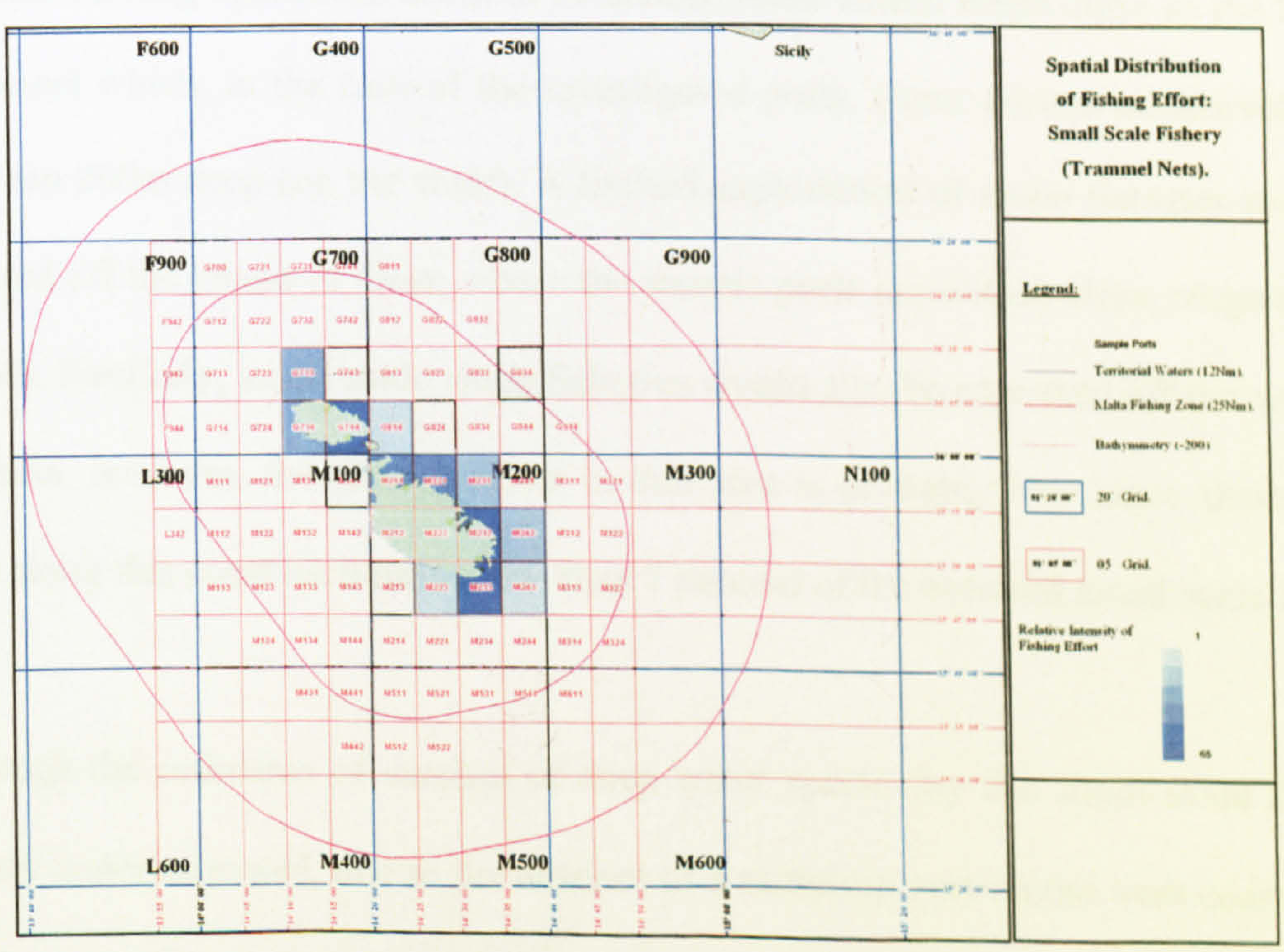

Figure 6. Spatial distribution of fishing effort of vessels operating from six sample ports using trammel nets

4. Discussion

Despite the large number of registered small scale vessels, the results obtained clearly suggest that the fishing effort exerted by this fleet category is relatively small and is a function of the operational status and daily activity of the fleet, the effective fishing time, as well as of the dimensions and other physical parameters of the fishing gear used. It is also evident that the amount of activity, the gear used, the production and species composition are seasonal.

The landings estimates obtained in this survey indicate that the annual production of the small scale fleet is less than one third of annual landings recorded at the central fish market. However, the great variety and quality of valuable species landed by this fleet category, makes its contribution to the Maltese fishing industry quite significant.

The spatial distribution of fishing effort of the two main demersal gears show similar patterns. Fishing operations seem to be concentrated within areas close to the base port of the vessel which, in the case of the investigated ports, occur almost exclusively in waters less than 200m deep (on the shelf). A limited exploitation of slope fisheries resources was detected off the island of Gozo where the sample ports are within close range of the 200m isobath. Similarly, small scale slope fisheries would also be expected off the western coast of Malta, however, the fishing effort in this area is probably low since there are only 4 ports along this coast harbouring less than 7 percent of the national small scale fleet.

Although the estimates of catches of deep water species by the small scale fleet may be slightly underestimated, due to the absence of a sampling port on the west coast of Malta, it could be concluded that deep water small scale fisheries are responsible for only 4 to 5 percent of the landings of this fleet category. However, there is evidence from recent trawl surveys, which have been carried out within the framework of a regional programme (Bertrand *et al.* 1997), that the abundance of demersal resources in Maltese waters on the slope (and shelf), is relatively high in comparison to other areas in the region and that they have not been adversely affected by excessive fishing pressure. This suggests that the areas where the small scale fleet operates are not determined by the spatial distribution and abundance of the resources but by the geographical location of the base ports. This situation points to the fact that there may be fishing grounds, even in coastal areas, which are slightly exploited or maybe even non-exploited by the Maltese small scale fishing fleet.

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MINISTRY OF AGRICULTURE AND FISHERIES - MALTA
Department of Fisheries and Aquaculture
Smallscale fishery (<10 m. L) Catch and Effort Sample Survey of Small Scale Fishery

COPEMED

Daily Landings of Sampled Fishing Units

(a) Interviewer's Name: ________________ Code: ______ (b) Stratum: ____ (c) Site Name: ______________________ Code: ______ (d) Date: __/__/____ Time: ______

(e) Sampled Unit Type: ______________ Code: ______ (f) Registry Number: __________ (g) Auxiliary Boats: ______ (h) Prof. Fishermen: ______ (i) Part Time: ______

(l) Number of Trips in the Day: ______ (m) Fishing Area: ______________________ Code: ______ (n) Time Spent in Fishing: ______ (Hrs) Boat Sample N: ______

Ref. N.	(o) Gear Name	(p) Gear Code	(q) Number of Sets	(r) Size, Length (m) or Number of units	Total (q*r)*o	(s) Gear Ref.	(t) Species Name	Species Code	(u) Number of Boxes (B) or Number of Animals (A)	B/A	(v) Box Weight (Kg) or Average Weight of the Animal (Kg)	(z) Total Weight (Kg)
1	Trammel Nets height(m): ____		Number of Net used	Length (m) of each net	(q*r)*o				Number of boxes	B	Box Weight	
									Number of Fish	A	Average Weight	
2	Long Lines		Number of Lines	Number of Hooks per line	(q*r)							
3	Traps		1	Number of Traps per line	(q*r)							
4	Trawls		Number Trawls used	Mouth opening of the net (m)	(q*r)							
5	Gill Nets		Number of Net used	Length (m) of each net	(q*r)							
6	Trolling Lines		Number of Lines	Number of Hooks per line	(q*r)							
7	Surrounding Nets		Number of Net used	Length (m) of each net	(q*r)							
8	Kannizzati Fisheries		1	Number of Kannizzati fished	(q*r)							
9	Other Specify											
											Total Kg	

Number of boats sampled: ______

Comment

MaltaCas Form 2.3

Restricted data - For statistical purpose only

MINISTRY OF AGRICULTURE AND FISHERIES - MALTA
Department of Fisheries and Aquaculture
Smallscale fishery (<10 m. L) - Monthly Sample Activity Data Sheet

Stratum: G1 Site name: Marsalforn Code: G11 Reference period (month/year): January / 2003

Recorder: E. Muscat Code: 11

Number of fishing days in the month: 29 Number of sampled days: 6

Sample day	day 1		day 2		day 3		day 4		day 5		day 6		day 7		
Date	25/01/2003		26/01/2003		30/01/2003		10/01/2003		12/01/2003		20/01/2003				
Number of boats Landed by gear class	Total	Daytime	Total	Daytime	Total	Daytime	Total	Daytime	Total	Daytime	Total	Daytime	Total	Daytime	All days
Trammel Nets															0
Long Lines															0
Traps								1		1					2
Trawls															0
Gill Nets															0
Trolling Lines															0
Surrounding Nets															0
Kannizzati															0
Others: specify															0
Total Boats Landed	0		0		0		1		1		0				2
Total Boats Sampled	0		0		0		1		1		0				2

Comments: N.B. number of fishing days per month is let blank due to that by the end of January the 6 day sample period was incomplete due to bad weather.

Source: MaltaStat CAS database: Malta2003.cas MaltaCas Form 2.4 30/05/2003 Page 1 of 12

Insert total landings for 24hrs periods, and insert day-time landings from 7:00 to 16:00;

ANNEX XIII: PAPER - EVALUATING AGE AT SEXUAL MATURITY IN *SCIAENA UMBRA* LINNAEUS, 1758 (OSTEICHTHYES, SCIAENIDAE) ON THE BASIS OF OTOLITH MICROSTRUCTURE.

Biol. Mar. Medil. (2002), 9 (I): 789-791

S. RAGONESE, M. CAMILLERI*, S. GANCITANO, P. RIZZO, G. BONO, F. FIORENTINO

Istituto di Ricerche sulle Risorse Marine e l' Ambiente, IRMA - CNR, Via Luigi Vaccara, 61 – 91026
Mazara del Vallo, Trapani, Italy.
*Malta Centre for Fisheries Sciences, MCFS, Fort San Lucian, Marsaxlokk, Malta.

EVALUATING AGE AT SEXUAL MATURITY IN *SCIAENA UMBRA* LINNAEUS, 1758 (OSTEICHTHYES, SCIAENIDAE) ON THE BASIS OF OTOLITH MICROSTRUCTURE

STIMA DELL 'ETA DI MATURAZIONE SESSUALE IN SCIAENA UMBRA *LINNAEUS,* 1758 *(OSTEICHTHYES, SCIAENIDAE) ANALIZZANDO LA MICROSTRUTTURA DEGLI OTOLITI*

Abstract

A spawning aggregation of Sciaena umbra *was sampled, during an experimental trawl survey,* in *low-exploited fishing grounds off Maltese coasts (Strait of Sicily). The age structure was estimated by otolith thin section reading, resulting* in *a maximum age* in *the samples of 17 and* 26 *years in males and females respectively. According to the interpretation of otolith microstructure, the spawning of brown meagre occurred at three years of age, reaching the age of massive reproduction (100% of mature specimens) the following year:*

Key-words: Sciaena umbra, brown meagre, sexual maturity, Strait of Sicily.

Introduction

The brown meagre is a moderate size fish (up to 50 cm total length; TL), occurring in the coastal waters of the Mediterranean and the Eastern Atlantic (Chao, 1986). According to both experimental observations (Harmelin, 1991) and historical statistics (Fiorentini *et al.,* 1997) clear signs of depletion are evident in the Mediterranean populations. Given that the biology of the brown meagre is poorly known, an unusual significant catch of spawners provided the opportunity to obtain information on the maturing condition and demographic structure of spawners, and to evaluate the age at sexual maturity.

Material and methods

A total of 234 specimens (whole weight of 127 kg) of S. *umbra* were caught in one half-hour haul off the Maltese coast (35°60' N; 14°27' E; mean depth of 47 m). The haul was carried out during an international experimental bottom trawl survey (Bertrand *et al.*, 1997), on 7 June 2000 from 05:40 to 06: 10 (solar time). The specimens were found to be mature and hence 180 fish were randomly selected for laboratory analyses. Total length (TL: 0.5 cm), somatic and gonad weights (SW; GW: 0.1 g), and sex were determined after defrosting. The Gonadosomatic index (GSI = GW /SW* 100) was calculated. Thin transverse sections of otolith *(sagitta)* were read in water under reflecting light. Given that the laying of the hyaline zone occurred in winter (Arneri *et al.,* 1998), ages were determined by counting the number of dark zones by two experienced readers. Only when the duplicate readings were the same, the otoliths were used for aging.

Fish showing otoliths with a sharp discontinuity in the width of the hyaline zone from the nucleus towards the peripheral margin were considered to have achieved maturity (Massuti *et al.,* 2000).

Results

In both sexes (51 females and 129 males), the gonads were found to be in advanced stages of maturation or fully mature. Considering the fully mature specimens, the mean gonadosomatic index (GSl:tse) values were 1O.3:t3.3 in females and 6.9:t2.0 in males.

The otoliths appeared clear to read, with a well defined sequence of hyaline and opaque zones. All the *sagittae* showed an opaque margin (Fig. 1).

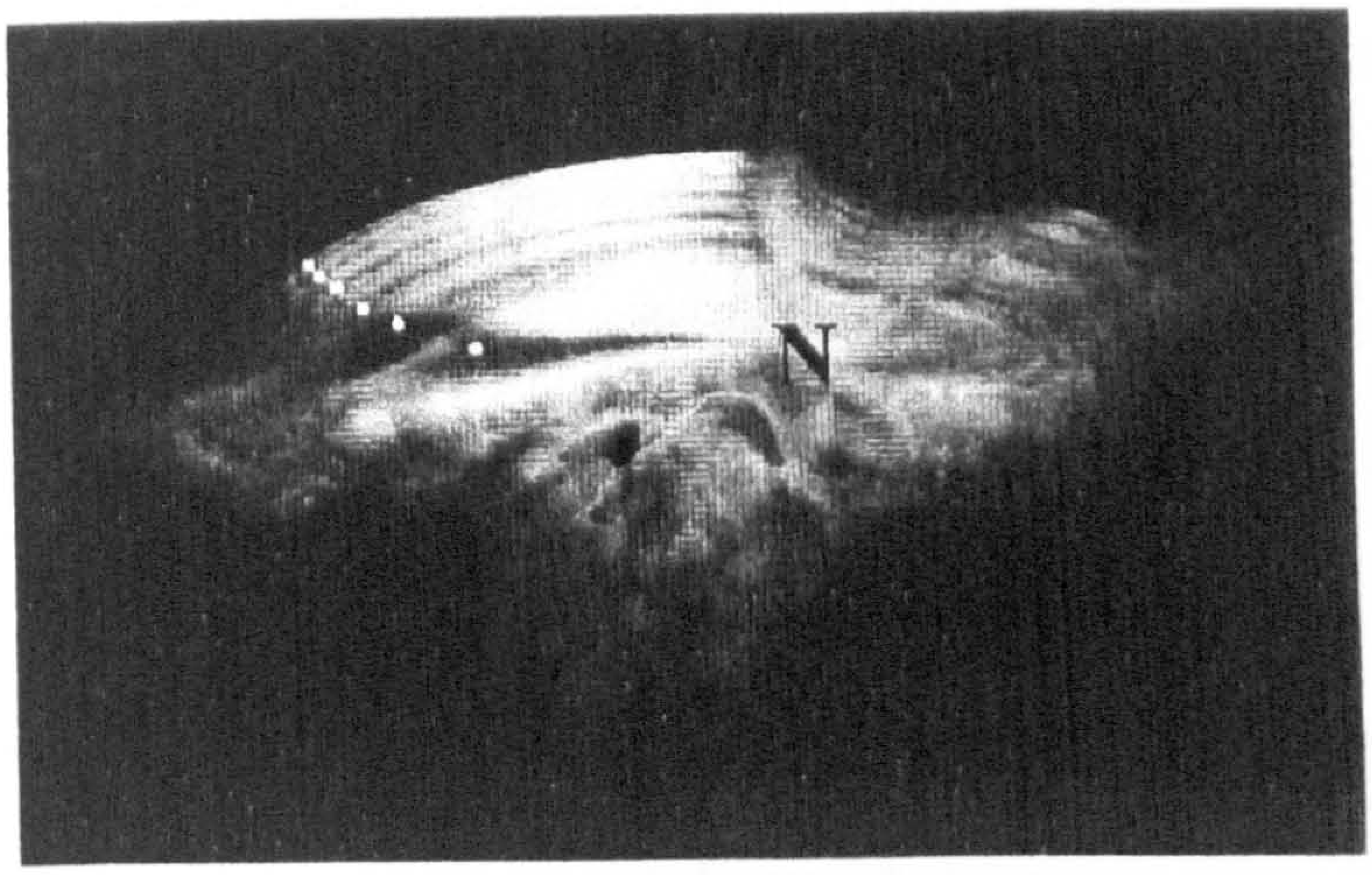

Fig. I - Otolith thin section of *Sciaena umbra* belonging to a male (365 mm TL) aged 6 years. The width of the hyaline zone suddenly decreases after the second year (9x).
Sezione sottile di *otoTite* di *un maschio* di 365 *mm* di *lunghezza totale* e di *sei anni* di *eta. L 'ampiezza delle bande iaTine decresce dopo il secondo anno (ingrandito* 9 *volle).*

Up to 14 groups were identified in the samples, ranging from a minimum age of 2 (females) and 3 (males) years to a maximum of 17 (1 male) and 26 years (1 female). Most of the samples were aged between 3 and 5 years.

Tab. I - Occurrence of the first narrow hyaline zone (NHZ) in *Sciaena umbra.*
Comparsa della prima banda latina sottile (NHZ) in S. umbra.

			Females			Males			Total	
Age	NHZ	Freq.	%	Cum.%	Freq.	%	Cum. %	Freq.	%	Cum. %
0+	I	0	0.0	**0.0**	0	0.0	**0.0**	0	0.0	**0.0**
1+	2	I	2.0	**2.0**	I	0.8	**0.8**	2	1.1	**1.1**
2+	3	35	68.6	**70.6**	90	70.2	**70.9**	126	69.7	**70.8**
3+	4	15	29.4	**100.0**	37	28.3	**99.2**	52	28.6	**99.4**
4+	5	0	0.0		1	0.8	**100.0**	I	0.6	**100.0**
	Total	51	100.0		129	100.0		180	100.0	

Most of the examined specimens showed the decreasing of hyaline zone between two and three years (about 70%), although this feature also occurred when the specimens were one year older (about 28-29% between three and four years, Tab. 1).

Discussion and conclusions

Present results correspond with the reproductive period (March-August) reported for the Mediterranean populations (Chao, 1986; Chauvet, 1991; Chakroun-Marzouk & Ktari,2001).

According to our interpretation, the occurrence of the first narrow hyaline zone should be laid down during the winter before the first spawning. This analysis suggests that most of the brown meagre in the area should spawn for the first time, regardless of sex, when are approximately three years old. The age at massive reproduction, i.e. the age at which all individuals are mature, occurred one year later. The present estimation of age at maturity agreed with the results for the populations inhabiting the coasts off Tunisia. In particular, Chauvet (1991) reported the presence of the youngest specimens with eggs in advanced vitello-genesis at age three, and Chakroun-Marzouk & Ktari (2001), showed that all specimens resulted mature from 23-24 cm (standard length), which correspond to age four.

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MEDITS 2000
Biological Report - Region M3 –Maltese waters

1. Introduction

The 2000 Medits survey (MED2000) in the Maltese waters was carried out between the 6th to 8th June using the professional stern trawler "Sant'Anna". It is worth noting that this was the first activity of its kind to be carried out in this region. Hauls took place within the 25 nautical miles Maltese exclusive fishing zone.

A total of 6 hauls were performed, of which only 5 were valid, covering each depth stratum.

In all hauls a miniature data logger (MINILOG-TD), recording both temperature and depth, was mounted on the head rope of the gear. It was not possible to monitor the gear performance directly (SCANMAR equipment was not available), but haul duration was recorded according to the average effective time on the bottom. The horizontal opening of the gear in each haul was estimated on the basis of the formula derived from previous trials carried out by IRPEM-CNR (Ancona, Italy) technicians using SCANMAR equipment.

Both haul registration and processing of biological samples were accurately performed according to MEDITS protocol.

Given the limited number of samples (only 1 haul per stratum), it was only possible to estimate the mean abundance for the overall sub-region and macro-stratum (shelf and slope). For the same reason, the corresponding coefficients of variation (CV) were not reported. The length range was calculated by the IndMed program for the 37 Medits target species (short list); before analysing data, errors were checked by CheckMed program. The overall range of the length frequency distribution are expressed as total length (TL; cm), carapace length (CL; mm) and mantle length (ML; cm) for fish, crustaceans and cephalopods respectively, according to the MEDITS "Manual of protocols"

The observed catches, both in number (N) and weight (kg), are referenced to a standardised area of 1 km^2, and hereby expressed as "Density index" (DI= N/km^2) and "Biomass index" (BI= kg/km^2) for each stratum, for the shelf (10-200m; i.e., 1st, 2nd and 3rd stratum combined; hereby defined as shelf-index) and slope (200-800m; i.e., 4th and 5th stratum combined; hereby defined as slope-index) bottoms and for the overall sub-region.

Given the heterogeneity of Maltese bottoms, the small number of hauls available, the lack of previous analyses and the lack of information on trawlable grounds (the strata were considered to be entirely trawlable), the abundance estimates and the overall length structure presented in this report must be considered only as indicative.

A total of 82 different species (63 fish, 7 crustaceans, and 12 cephalopods) were identified in the catch. 28 out of 37 species of the reference ("short") list (hereby defined as "target" species, or more simply targets) were also identified.

No specimen of the fish species *Lepidorombus boscii, Lophius piscatorius, Micromesistius poutassou, Pagellus acarne, Pagellus bogaraveo, Solea vulgaris* and *Trachurus mediterraneus*, were caught. In addition, the crustaceans *Aristeus antennatus* and *Nephrops norvegicus* were not caught in MED2000.

2. Comments by species groups

Only 11 of the target fish species yielded a BI higher than 5.0 kg/km^2 in the M3d sub-region: *Spicara smaris* (87.4 kg/km^2), *Raja clavata* (77.2), *Spicara flexuosa* (59.5), *Zeus faber* (40.2), *Pagellus erythrinus* (29.0), *Merluccius merluccius* (28.8), *Mullus barbatus* (26.3), *Scyliorhinus canicula* (23.8), *Mullus surmuletus* (13.5), *Lophius budegassa* (13.3) and *Citharus macrolepidotus* (5.9).

Considering the abundance in number, a sub-regional DI higher than 100 N/km^2 was observed in 9 fish: *Spicara smaris* (4296 N/km^2), *Spicara flexuosa* (2607), *Merluccius merluccius* (1000), *Mullus barbatus* (610), *Pagellus erythrinus* (400), *Mullus surmuletus* (267), *Citharus macrolepidotus* (248), *Scyliorhinus canicula* (194) and *Trachurus trachurus* (148).

Two crustacean species yielded an abundance higher than 5.0 kg/km^2 and 100 N/km^2: *Parapenaeus longirostris* (BI=16.7 kg/km^2; DI=2944 N/km^2) and *Aristaeomorpha foliacea* (11.1; 501). No specimen of *Aristeus antennatus* and *Nephrops norvegicus* were caught despite records of landings of these species by local fishermen.

Two species of cephalopods went above the arbitrary limit of 5.0 kg/km^2 or 100 N/km^2: *Illex coindetii* (BI=23.1 kg/km^2; DI=1324 N/km^2) and *Sepia officinalis* (5.9; 14). A high BI was obtained for *Octopus vulgaris* in the shallower strata (first:10-50m: 20.1 kg/km^2 and second: 51-100 m: 27.1 kg/km^2).

2.1. Fish

Aspitrigla cuculus

This species was only found on the shelf (depth range: 82-132 m). In the whole sub-region, this species gave a BI of 2.8 kg/km^2 and a DI of 44 N/km^2. Considering that *Aspitrigla cuculus* was absent on the slope, the shelf indices were BI=6.3 kg/km^2 and DI=98 N/km^2. The highest abundance was observed in the 3rd stratum with a BI of 7.7 kg/km^2 and DI of 110 N/km^2.

The range of the total length was 15-22 cm (mean=18.1).

Citharus macrolepidotus

This species was collected on the shelf and at the upper edge of the slope (82-208m). The sub-regional BI and DI were 5.9 kg/km^2 and 248 N/km^2 respectively. When comparing the values of the shelf to those of the slope, it is clear that there is a higher abundance on the former (shelf: 10.5; 481; slope: 2.3; 62). The 3rd stratum yielded the highest abundance with a BI of 15.4 and a DI of 705.

The overall range of the total length was 7-20 cm (mean=14.5).

Eutrigla gurnardus

This species was caught once on the shelf at a depth of 132 m. An overall BI of 2.6 kg/km^2 and DI of 32 N/km^2 were obtained, but since this species was only found in the 3rd stratum the values for the shelf alone were considerably higher (5.8; 72). When the 3rd stratum is considered alone the BI and DI are 8.8 kg/km^2 and 110 N/km^2 respectively.

The overall range of the total length was 13.5-32.0 cm (mean=18.7).

Helicolenus dactylopterus

The black mouth rockfish was collected only on the slope (208-601m). The sub-regional BI and DI were 1.3 kg/km^2 and 34 N/ km^2 respectively. The abundance on the slope was found to be 2.3 (BI) and 61 (DI). The BI (3.0) and DI (99) in the 4th stratum were the highest values.

The range of the total length was 6.0-21.0 cm (mean=12.4).

Lepidorhombus boscii

This species was not caught during MED2000 in the Maltese waters.

Galeus melastomus

This shark was found once on the slope at 601m. Even when only considering the slope, a poor index of abundance was obtained: the BI was 0.8 kg/km^2 and the DI was 4 N/km^2. When considering the whole sub-region M3d, these values were obviously even lower (BI=0.5; DI=2). Even when only taking into account the 5th stratum, the abundance remained quite low (BI=2; DI=10).

The total length of the single specimen caught was 40 cm.

Lophius budegassa

This species was collected over a wide depth range (82-601 m). Considering the sub-region, this Angler fish yielded a BI of 13.3 kg/km^2 and a DI of 24 N/km^2; however, the abundance was higher on the shelf (18.8; 35) than on the slope (8.9; 16). The 2nd stratum showed the highest abundance with a BI of 20.8 kg/km^2 and DI of 21 N/km^2.

The range of the total length was 20.5-45.0 cm (mean=30.8).

Lophius piscatorius

No specimen of this species was caught during the MED2000 in the Maltese waters.

Merluccius merluccius

The Mediterranean hake was fished at all explored depths and was found between 82 and 601 m. In the sub-region, this species revealed a BI and a DI of 28.8 kg/km2 and 1000 N/km^2 respectively. The shelf-indices, both as BI and DI, were higher than the slope-indices (56.8 vs. 6.4 and 2167 vs. 66). The highest abundance indices were obtained in the 3rd stratum (79.3; 3262).

The range of the total length was 6.0-40.0 cm (mean=13.2).

Micromesistius poutassou

No specimen of this species was caught during the MED2000 in the Maltese waters.

Mullus barbatus

The Red mullet was caught almost exclusively on the shelf (82-208 m). Considering the whole sub-region M3d, the resulting indices were 26.3 kg/km^2 and 619 N/km^2. However, referring to the "true" distribution area of the species (the shelf), higher indices were obtained (52.2; 1253). The highest indices, (BI=145.8 kg/km^2 and DI=3583 N/km^2) were obtained, in the 2nd stratum.

The range of the total length was 11.0-20.5 cm (mean=15.6).

Mullus surmuletus

This species was caught both on the shelf and the slope (48-601 m). For the whole sub-region, this species gave a BI of 13.5 kg/km^2 and DI of 267 N/ km^2. The shelf-indices were 26.0 and 535, which were somewhat higher than the slope-indices (3.6; 54). The highest indices were obtained in the 2nd stratum (BI=82.3 kg/km^2 and DI=1687 N/km^2).

The range of the total length was 11.5-23.0 cm (mean=16.5).

Pagellus acarne

No specimen of this species was caught during the MED2000 in the Maltese waters.

Pagellus bogaraveo

No specimen of this species was caught during the MED2000 in the Maltese waters.

Pagellus erythrinus

This typical neritic sparid species, was fished only on the shelf at a depth of 82 m. The sub-regional indices of abundance were 29.0 kg/km^2 and 400 N/km^2. However, when only the shelf catches were considered, the indices increased up to 65.3 and 901. Furthermore, when considering only the 2nd stratum the abundance values are remarkable (208.3 and 2875).

The range of the total length was 9.5-26.0 cm (mean=16.0).

Sparus pagrus

This species was found only on the shelf (48-82 m).

The range of the total length was 11.0-21.0 cm (mean=14.7).

Phycis blennoides

This species was found only at 601 m. Combining strata, the indices were 0.2 kg/km^2 and 17 N/km^2. Slightly higher indices resulted when considering only the slope captures: 0.3 kg/km^2 (BI) and 30 N/km^2 (DI). The BI and DI values for the 5th stratum were 0.7 and 69 respectively.

The range of the total length was 7.0-19.5 cm (mean=10.1).

Raja clavata

This skate was caught down to the edge of the shelf (82-208 m). Considering the abundance indices at sub-regional level, the values were 77.2 kg/km^2 (BI) and 60 N/km^2 (DI). The shelf-indices were 133.2 and 56. The highest values of abundance were obtained in the 3rd stratum (BI=185.1) and in the 4th stratum (DI=88).

The range of the total length was 22.5-72.5 cm (mean=50.6).

Scyliorhinus canicula

This small sized shark was found down to the edge of the shelf (82-208 m). For the whole sub-region, this species gave a BI of 23.8 kg/km^2 and a DI of 194 N/km^2. The shelf BI (11.3) was lower than that of the slope (33.8). Likewise, the DI was higher on the slope (321) than on the shelf (35). The highest BI (59.3) and DI (564) values were obtained in the 4th stratum.

The range of the total length was 14.5-50.0 cm (mean=30.6)

Solea vulgaris

No specimen of this species was caught during the MED2000 in the Maltese waters.

Spicara flexuosa

This species was fished only on the shelf, between 82 and 132 m depth. Considering the overall depth range, the abundance indices were 59.5 kg/km^2 (BI) and 2607 N/km^2 (DI). The shelf indices were obviously higher: 133.8 (BI) and 5866 (DI). The 2nd stratum yielded the highest indices (229.2 and 13292).

The range of the total length was 10.0-19.0 cm (mean=13.4).

Spicara smaris

Likewise the congener species, *S. smaris* was caught only on the shelf, between 48 and 82 m. Considering the overall depth range, the abundance indices were 87.4 kg/km^2 (BI) and 4296 N/km^2 (DI). The shelf-indices were 196.8 (BI) and 9670 (DI). The highest indices, 625 (BI) and 30416 (DI), were obtained in the 2nd stratum.

The range of the total length was 7.0-18.0 cm (mean=10.5).

Trachurus mediterraneus

No specimen of this species was caught during the MED2000 in the Maltese waters.

Trachurus trachurus

This species was caught down to the edge of the shelf (82-208 m). The abundance indices for the whole sub-region were 2.9 kg/km^2 (BI) and 148 N/km^2 (DI). Standing alone, the shelf indices were 5.1 (BI) and 297 (DI). The highest value, expressed as BI, was obtained in the 2nd stratum (9.4), and expressed as DI in the 3rd stratum (375).

The range of the total length was 5.0-22.5 cm (mean=12.6).

Trigloporus lastoviza

This species was caught exclusively on the shelf (48-82 m). Considering the whole sub-region, this species showed a BI of 0.7 kg/km^2 and a DI of 31 N/km^2. The shelf indices obtained were 1.5 (BI) and 70 (DI). The highest indices, 5.4 (BI) and 208 (DI), were obtained in the 1st and 2nd stratum respectively.

The range of the total length was 7.0-17.5 cm (mean=13.2).

Trisopterus minutus capelanus

The poor cod was found only at 132 m. The abundance indices, combining all strata, were 0.5 kg/km^2 (BI), and 26 N/km^2 (DI). For the shelf alone, the indices were 1.0 (BI) and 58 (DI). The values of the 3rd stratum were 1.5 and 88.

The range of the total length was 11.5-14.5 cm (mean=12.6).

Zeus faber

This species was caught both on the shelf and on the upper edge of the slope (48-208 m). Combining all strata, the abundance indices were 40.2 kg/km^2 (BI) and 37 N/km^2 (DI). The shelf indices were 79.8 (BI) and 77 (DI). The highest BI value (121.2) was found in the 3rd stratum and the highest DI value (161) was found in the 1st stratum.

The range of the total length was 6.0-50.0 cm (mean=29.0).

2.2. Crustaceans

Aristeus antennatus

The blue and red shrimp was not caught during the MED2000 in the Maltese waters.

Aristaeomorpha foliacea

The red giant shrimp was caught only in the deep waters at 601 m. The overall indices were 11.1 kg/km^2 (BI) and 501 N/km^2 (DI), but become higher (BI=20.0; DI=901) when only the slope strata are considered. The values for the 5th stratum were 46.5 (BI) and 2097 (DI).

The range of the carapace length was 21-63 mm (mean=38).

Nephrops norvegicus

No specimen of this species was caught during the MED2000 in the Maltese waters.

Parapenaeus longirostris

The rose shrimp was found both on the shelf and slope (132-601 m). For the sub-region, the abundance indices were 16.7 kg/km^2 (BI) and 2944 N/km^2 (DI). The shelf BI was lower than that of the slope (13.0 vs. 19.6), however the DI was higher for the shelf (2610) than for the slope (3211). The highest abundance in Maltese waters expressed as BI occurred in the 5^{th} stratum (20.8) and in the 3^{rd} when considering the DI (3989).

The range of the carapace length was 12-32 mm (mean=21).

2.3. Cephalopods

Eledone cirrhosa

Only 1 specimen of this species, whose mantle length was 8.5 cm, was found at 208 m. The overall abundance indices were 0.6 kg/km^2 (BI) and 3 N/km^2 (DI). The shelf-indices were 1.1 (BI) and 6 (DI). The values for the 4^{th} stratum were 2.0 (BI) and 10 (DI).

Eledone moschata

Only 1 specimen of this species, whose mantle length was 9 cm, was caught at 82 m. The overall abundance indices were 0.5 kg/km^2 (BI) and 3 N/km^2 (DI). The shelf-indices were 1.2 (BI) and 7 (DI). The values for the 2^{nd} stratum were 3.8 (BI) and 21 (DI).

Illex coindetii

This squid was found down to the edge of the shelf (82-208 m). The shelf-indices, both BI and DI, were higher than the slope-indices (34.7 vs. 13.8 kg/km^2 and 2782 vs. 158 N/km^2).

Combining all the depths, the following indices were derived: 23.1 (BI) and 1324 (DI). The highest abundance occurred in the 3rd stratum: BI =52.9; DI =4231.

The range of the mantle length was 3.5-17.5 cm (mean=8.8).

Loligo vulgaris

The common squid was fished only on the shelf at 82 m. Shelf-indices were 0.4 kg/km^2 (BI) and 13 N/km^2 (DI); on the other hand, considering all strata, indices decreased to 0.2 and 6 respectively. The abundance indices for the 2nd stratum were 1.3 (BI) and 42 (DI).

It is worth noting that the catch was represented only by small size specimen; in fact, the range of the mantle length was 4.0-14.5 cm (mean=9.3).

Octopus vulgaris

The common octopus was caught exclusively on the shelf at a depth between 48 and 82 m. Abundance indices of the shelf were 9.1 kg/km^2 (BI) and 27 N/km^2 (DI), which, obviously, reduced to lower values when considering the combined strata (BI=4.1 and DI=12). The highest abundance was recorded in the 2nd stratum (BI=27.1; DI=83).

The range of the mantle length was 7.0-11.5cm (mean=9.0).

Sepia officinalis

This cuttlefish was caught exclusively on the shelf (48-132 m). Considering all strata, this species showed a BI of 5.9 kg/km^2 and a DI of 14 N/km^2. When only the shelf catches are considered, the indices increase up to 13.2 (BI) and 31 (DI). The highest indices, 36.3 (BI) and 107 (DI), were obtained in the 1st stratum.

The range of the mantle length was 8.5-18.5 cm (mean=12.6).

3. Comments by stratum

The six most abundant target species by stratum were ranked according to the biomass index (BI; kg/km^2) values in each stratum. The same procedure was followed to identify the species most represented in number (DI; N/km^2).

3.1. 1st Stratum (A: 10-50 m)

A total of 6 target species were found in this stratum including 4 bony fish species and 2 cephalopods with no records of crustaceans. *Sepia officinalis* and *Spicara smaris* were found in "pole position" in the BI and DI tables respectively; the data of the other most abundant targets are set out below:

SPECIES	Maltese waters kg/km^2	CV%
Sepia officinalis	36.3	-
Spicara smaris	29.6	-
Octopus vulgaris	20.1	-
Zeus faber	14.8	-
Trigloporus lastoviza	5.4	-
Mullus surmuletus	5.4	-

SPECIES	Maltese waters N/km^2	CV%
Spicara smaris	4297	-
Mullus surmuletus	188	-
Zeus faber	161	-
Trigloporus lastoviza	134	-
Sepia officinalis	107	-
Octopus vulgaris	27	-

Among the "minor" species (those included in the "Complementary list"), only two fish were caught: *Serranus cabrilla* (36.3 kg/km^2) and *Spicara maena* (4.0 kg/km^2).

3.2. 2nd Stratum (B: 50-100 m)

A total of 18 target species consisting of 13 fish (11 bony and 2 cartilaginous) and 5 cephalopods were caught within this depth range. It is worth noting that the most abundant species comprised only of fish and that no crustacean was caught in this stratum.

	Maltese waters	
SPECIES	kg/km^2	CV%
Spicara smaris	625.0	-
Spicara flexuosa	229.2	-
Pagellus erythrinus	208.3	-
Mullus barbatus	145.8	-
Mullus surmuletus	82.3	-
Raja clavata	38.5	-

	Maltese waters	
SPECIES	N/km^2	CV%
Spicara smaris	30416	-
Spicara flexuosa	13292	-
Mullus barbatus	3583	-
Pagellus erythrinus	2875	-
Mullus surmuletus	1687	-
Trigloporus lastoviza	208	-

Among the other target species caught, only *Illex coindetii* yielded less than 1 kg/km^2 (BI=0.4 kg/km^2). The other most relevant captures, ranked by decreasing BI, were: *Octopus vulgaris* (27.1 kg/km^2; 83 N/km^2), *Lophius budegassa* (20.8; 21), *Merluccius merluccius* (15.6; 104), *Trachurus trachurus* (9.4; 167), *Sepia officinalis* (6.2; 42), *Aspitrigla cuculus* (4.2; 83), *Trigloporus lastoviza* (4.2; 208), *Eledone moschata* (3.7; 21), *Scyliorhinus canicula* (3.7; 21), *Citharus macrolepidotus* (1.2; 62) and *Loligo vulgaris* (1.2; 42).

Only 7 "minor" species were caught in this stratum: *Lepidotrigla cavillone* (BI=25.0 kg/km^2), *Conger conger* (24.0), *Sepia orbignana* (15.6), *Serranus cabrilla* (11.5), *Boops boops* (7.3), *Scomber japonicus* (1.7) and *Trachurus picturatus* (0.4).

3.3. 3rd Stratum (C: 100-200 m)

A total of 15 target species were caught in this stratum: 12 fish (10 bony and 2 cartilaginous), 1 crustacean and 2 cephalopods. Four fish, one cephalopod and one crustacean yielded the highest abundance in weight.

	Maltese waters	
SPECIES	kg/km^2	CV%
Raja clavata	185.1	-
Zeus faber	121.2	-
Spicara flexuosa	94.8	-
Merluccius merluccius	79.3	-
Illex coindetii	53.0	-
Parapenaeus longirostris	19.8	

	Maltese waters	
SPECIES	N/km^2	CV%
Illex coindetii	4231	-
Parapenaeus longirostris	3989	-
Merluccius merluccius	3262	-
Spicara flexuosa	2600	-
Citharus macrolepidotus	705	-
Trachurus trachurus	365	-

A further 6 target species were found at an abundance greater than 5.0 kg/km^2: *Lophius budegassa* (18.7 kg/km^2; 44 N/km^2), *Sepia officinalis* (15.4; 22), *Scyliorhinus canicula* (15.4; 44), *Mullus barbatus* (9.9; 198), *Eutrigla gurnardus* (8.8; 110), and *Aspitrigla cuculus* (7.7; 110).

Among the "minor" catches, only 4 species yielded a BI over the threshold of 5.0 kg/km^2: *Lepidotrigla cavillone* (BI=99.2), *Serranus cabrilla* (43.0), *Sepia orbignyana* (37.5) and

Argentina sphyraena (25.3). *Boops boops* and *Sardina pilchardus* yielded a BI of 4.4 and 0.4 kg/km^2 respectively.

3.4. 4th Stratum (D: 200-500 m)

13 of the target species were found in this stratum. Fish species were the most numerous (8 bony and 2 cartilaginous), whereas there were 1 and 2 species of crustaceans and cephalopods respectively. The most abundant species in the 4th stratum are listed below.

	Maltese waters	
SPECIES	kg/km^2	CV%
Scyliorhinus canicula	59.3	-
Raja clavata	56.3	-
Illex coindetii	24.2	-
Parapenaeus longirostris	18.8	-
Lophius budegassa	14.8	-

	Maltese waters	
SPECIES	N/km^2	CV%
Parapenaeus longirostris	3638	-
Scyliorhinus canicula	564	-
Illex coindetii	277	-
Mullus barbatus	198	-
Citharus macrolepidotus	109	-

Only another three target species yielded a BI higher than 5 kg/km^2: *Mullus barbatus* (9.9), *Merluccius merluccius* (7.9) and *Mullus surmuletus* (5.9). Below this threshold it is worth mentioning *Citharus macrolepidotus* (4.0), *Helicolenus dactylopterus* (3.0), *Trachurus trachurus* (2.0) and *Eledone cirrhosa* (2.0).

Among the taxa included in the "Complementary list", only 3 species were caught: *Lepidotrigla cavillone* (BI=24.7 kg/km^2), *Argentina sphyraena* (3.0) and *Sepia orbignyana* (37.5).

3.5. 5th Stratum (E: 500-800 m)

Eight targets were collected from this stratum (5 bony fish, 1 cartilaginous fish and 2 crustaceans).

It is interesting to note that no target cephalopods were caught in MED2000 at these depths. Catches were generally poor, with all fish species yielding less than 5.0 kg/km^2, except for *Aristaeomorpha foliacea* and *Parapenaeus longirostris*.

	Maltese waters	
SPECIES	kg/km^2	CV%
Aristaeomorpha foliacea	46.5	-
Parapenaeus longirostris	20.8	-
Merluccius merluccius	4.4	-
Galeus melastomus	2.0	-
Helicolenus dactylopterus	1.5	-
Lophius budegassa	1.0	-

	Maltese waters	
SPECIES	N/km^2	CV%
Parapenaeus longirostris	2512	-
Aristaeomorpha foliacea	2097	-
Phycis blennoides	69	-
Mullus surmuletus	20	-

The presence of two other target species, *Phycis blennoides* (0.7 kg/km^2) and *Mullus surmuletus* (0.5 kg/km^2), was also recorded.

It is relevant to note that, despite the low DI (10 N/km^2) obtained for *Merluccius merluccius, Lophius budegassa* and *Helicolenus dactylopterus,* these species were represented by relatively large specimen.

Only one "minor" species (*Conger conger* ;BI=2.5 kg/km^2) was caught in this stratum.

4. Discussion

Since this trawl survey was a preliminary one, comparison to data collected in previous years was obviously not possible. However it is interesting to compare the data collected during 2000 for the Maltese sub-region (M3d) with the other three sub-regions (M3a,b and c), whilst bearing in mind that a limited number of hauls were performed in this sub-region.

The abundance, expressed as BI, of the 5 most commonly found species in each stratum for each sub-region obtained from MED2000 were compared in order to get a rough idea of the sub-regional variation by stratum.

The first five most abundant species in the 1st stratum for each sub-region are presented in the following table:

M3a		M3b		M3c		M3d	
Species	BI	Species	BI	Species	BI	Species	BI
Pagellus erythrinus	**22.2**	***Pagellus acarne***	**88.3**	***Trachurus trachurus***	**53.5**	***Sepia officinalis***	**36.3**
Mullus barbatus	20.5	*Pagellus erythrinus*	69.4	*Eledone moschata*	32.5	*Spicara smaris*	29.6
Spicara flexuosa	19.8	*Mullus barbatus*	62.8	*Spicara flexuosa*	19.7	*Octopus vulgaris*	20.1
Trachurus trachurus	8.4	*Spicara smaris*	45.7	*Merluccius merluccius*	13.3	*Zeus faber*	14.7
Pagellus acarne	4.8	*Spicara flexuosa*	41.1	*Trachurus mediterraneus*	12.5	*Mullus surmuletus*	5.4

The common presence of four out of five species in the two sub-regions belonging to the South Tyrrhenian Sea (M3a and M3b) is important to note, despite the differences in the biomass values and rank. The five top species of the two sub-regions of the Strait of Sicily (M3c and M3d) were different, albeit both are characterised by the presence of cephalopods in good rank.

The top five target species in the 2nd stratum of the four sub-regions were more similar, though with very large differences in biomass values. The BIs detected in Maltese waters (M3d) were higher than those of the Italian waters. The results are presented in the following table:

M3a		M3b		M3c		M3d	
Species	BI	Species	BI	Species	BI	Species	BI
Merluccius merluccius	26.3	*Spicara smaris*	74	*Spicara flexuosa*	140.2	*Spicara smaris*	625.0
Mullus barbatus	24.5	*Pagellus erythrinus*	55.0	*Trachurus trachurus*	68.7	*Spicara flexuosa*	229.2
Trachurus trachurus	23.7	*Spicara flexuosa*	46.9	*Raja clavata*	68.0	*Pagellus erythrinus*	208.3
Spicara flexuosa	18.9	*Mullus barbatus*	45.3	*Merluccius merluccius*	52.8	*Mullus barbatus*	145.8
Octopus vulgaris	12.2	*Pagellus bogaraveo*	44.4	*Octopus vulgaris*	30.7	*Mullus surmuletus*	82.3

The abundance of the top five target species within the 3rd stratum of the four sub-regions was highly variable as can be seen in the tables presented below. It is evident that the BIs in the Strait of Sicily were very much higher than those found in the Tyrrhenian Sea and that the indices of the Maltese waters were the highest of the M3 region. As in shallower strata The importance of cephalopods in the shallower strata of the Strait of Sicily was highlighted by high indices of squid *Illex coindetii*. The abundance of skate *Raja clavata* and *Zeus faber* in Maltese waters is remarkable.

M3a		M3b		M3c		M3d	
Species	BI	Species	BI	Species	BI	Species	BI
Merluccius merluccius	**30.4**	***Trachurus trachurus***	**18.8**	***Trachurus trachurus***	**133.4**	***Raja clavata***	**185.1**
Eledone cirrhosa	11.6	*Merluccius merluccius*	15.3	*Spicara flexuosa*	71.9	*Zeus faber*	131.2
Mullus barbatus	7.7	*Lophius budegassa*	11.5	*Merluccius merluccius*	30.3	*Spicara flexuosa*	94.8
Trisopterus minutus c.	6.5	*Spicara flexuosa*	10.8	*Illex coindetii*	19.7	*Merluccius merluccius*	79.3
Trachurus trachurs	6.4	*Parapenaeus longirostris*	7.2	*Parapenaeus longirostris*	19.1	*Illex coindetii*	52.9

In the 4th stratum, only the anglerfish was common to the four sub-regions, albeit with *Lophius piscatorius* found in M3a and M3c, while *L. budegassa* was caught in M3b and M3d. In the M3a sub-region only fish occurred in the top ranks, whereas crustaceans were present in M3b (*Parapenaeus longirostris*), M3c (*Parapenaeus longirostris* and *Nephrops norvegicus*) and M3d (*Parapenaeus longirostris*). It is worth noting the importance of target cartilaginous fish and squid in Maltese waters, which are found in the first three ranks. It is also important to note that the blue whiting *Micromesistius poutassou* had a high BI only in the South Tyrrhenian Sea.

M3a		M3b		M3c		M3d	
Species	BI	Species	BI	Species	BI	Species	BI
Merluccius merluccius	**18.9**	***Micromesistius poutassou***	**52.2**	***Parapenaeus longirostris***	**49.0**	***Scyliorhinus canicula***	**59.3**
Micromesistius poutassou	17.2	*Merluccius merluccius*	21.4	*Merluccius merluccius*	20.0	*Raja clavata*	56.9
Galeus melastomus	16.1	*Aspitrigla cuculus*	17.4	*Lophius piscatorius*	11.6	*Illex coindetii*	24.2
Lophius piscatorius	11.2	*Parapenaeus longirostris*	15.8	*Nephrops norvegicus*	6.5	*Parapenaeus longirostris*	18.8
Phycis blennoides	9.5	*Lophius budegassa*	10.0	*Phycis blennoides*	6.3	*Lophius budegassa*	14.8

In the 5th stratum, only two species were common to the four sub-regions - *Galeus melastomus* and *Aristaeomorpha foliacea*. As indicated by the following values, these two species mainly contributed to the catches. The higher homogeneity within each of the two different basins is outstanding: the South Tyrrhenian Sea (sub-regions M3a and M3b) was characterised by *Aristeus antennatus* and *Phycis blennoides*, while the Strait of Sicily (M3c and M3d) showed the highest abundance of particular target species such as *Helicolenus dactylopterus*.

M3a		M3b		M3c		M3d	
Species	BI	Species	BI	Species	BI	Species	BI
Aristaeomorpha foliacea	**20.8**	***Aristaeomorpha foliacea***	**19.5**	***Galeus melastomus***	**51.0**	***Aristaeomorpha foliacea***	**46.5**
Galeus melastomus	17.2	*Galeus melastomus*	3.3	*Aristaeomorpha foliacea*	40.4	*Parapenaeus longirostris*	20.8
Phycis blennoides	5.2	*Phycis blennoides*	3.1	*Phycis blennoides*	14.1	*Merluccius merluccius*	4.5
Merluccius merluccius	3.3	*Aristeus antennatus*	2.7	*Merluccius merluccius*	8.2	*Galeus melastomus*	2.0
Aristeus antennatus	3.1	*Parapenaeus longirostris*	2.5	*Helicolenus dactylopterus*	7.8	*Helicolenus dactylopterus*	1.5

The MED2000 survey results obtained for the Maltese waters are very interesting and important for future comparison between fishing grounds which are theoretically under different geographical and exploitation conditions. However it must be stressed that, at present, Maltese data must be treated only as indicative, given the small sample size (only 5 hauls) and the lack of time series data for the M3d sub-region. Nevertheless, even the rough comparison presented above suggests that there is a higher similarity in terms of top ranked species between sub-regions M3d and M3c, which belong to the Strait of Sicily, than those situated in the South Tyrrhenian Sea (M3a and M3b).

MEDITS 2001
Biological Report - Region M3d - Maltese waters

1. Introduction

The 2001 Medits survey (MED'01) in the Maltese waters was carried out between the 24th to 25th June using the professional stern trawler "Sant'Anna". Hauls were carried out within the 25 nautical miles exclusive fishing zone.

A total of 11 hauls were performed, of which 9 were valid, covering each depth stratum.

In all hauls a miniature data logger (MINILOG-TD), recording both temperature and depth, was mounted on the head rope of the gear. It was not possible to monitor the gear performance directly (a SCANMAR equipment was not available), but haul duration was recorded according to average effective time on the bottom and the horizontal opening of the gear in each haul was estimated on the basis of the formula derived from previous trials carried on by IRPEM-CNR (Ancona, Italy) technicians using SCANMAR equipment.

Both haul registration and processing of biological samples were accurately performed according to MEDITS protocol.

Despite the limited sample size (2 hauls per stratum except for the deepest stratum in which only 1 was performed), an estimate of the mean abundance and corresponding CV was obtained for the overall sub-region, macro-stratum (shelf and slope) and for each stratum. The length range was calculated by the IndMed program for the 37 Medits target species (short list); before analysing data, errors were checked by CheckMed program. According to the MEDITS "Manual of protocols", the overall range of the length frequency distribution are expressed as total length (TL; cm), carapace length (CL; mm) and mantle length (ML; cm) for fish, crustaceans and cephalopods respectively.

The observed catches, both in number (N) and weight (kg), are referenced to a standardised area of 1 km^2, and hereby expressed as "Density index" (DI= N/km^2) and "Biomass index" (BI= kg/km^2) by each stratum, and for shelf (10-200m; i.e., 1st, 2nd and 3rd stratum combined; hereby defined as shelf-index) and slope (200-800m; i.e., 4th and 5th stratum combined; hereby defined as slope-index) bottoms for the overall region.

Given the heterogeneity of Maltese bottoms, the small number of hauls available and that only one previous analysis had been carried out (with the strata being considered entirely trawlable), the abundance estimates and the overall length structure presented in this report must be considered only as indicative.

A total of 99 different species (79 fish, 8 crustaceans, and 12 cephalopods) were identified in the catch. 32 out of 37 species of the reference ("short") list (hereby defined as "target" species, or more simply targets) were also identified.

With regards to fish, no specimen of *Micromesistius poutassou, Pagellus acarne, Pagellus bogaraveo* and *Trisopterus minutus capellanus* were caught. In addition, the cephalopod *Eledone cirrosa was* not caught in MED'01.

2. Comments by species groups

Considering the target fish, 10 species yielded BI higher than 5.0 kg/km^2 in the M3d sub-region: *Mullus surmuletus* (BI= 58.3 kg/km^2; CV= 18.5%), *Spicara smaris* (38.5; CV=

83.3), *Scyliorhinus canicula* (21.6; CV= 41.3), *Pagellus erythrinus* (17.1; CV=17.3), , *Lophius budegassa* (14.8; CV= 43.5), *Merluccius merluccius* (14.1; CV= 40.8), *Raja clavata* (13.5; CV= 56.7), *Trachurus trachurus* (10.2; CV= 99.7), *Aspitrigla cuculus* (5.7; CV=66.7), *Mullus barbatus* (5.6; CV=41.2).

Considering the abundance in number, a sub-regional DI higher than 100 N/km^2 was observed in 7 fish: *Spicara smaris* (DI=3049 N/km^2; CV=85.0%), *Trachurus trachurus* (1004; CV=100.4), *Mullus surmuletus* (901; CV=23.2), *Merluccius merluccius* (339; CV=48.0), *Scyliorhinus canicula* (228; CV=58.8), *Pagellus erythrinus* (192; CV=10.3) and *Mullus barbatus* (123; CV=35.8).

When crustaceans are considered, 2 species yielded an abundance higher than 5.0 kg/km^2 and 100 N/km^2: *Parapenaeus longirostris* (BI=23.8 kg/km^2, CV= 49.0; DI=5870 N/km^2, CV= 59.3) and *Aristaeomorpha foliacea* (BI= 8.1; DI= 266; corresponding CVs could not be calculated due to only one haul being performed in the 5th stratum). During MED'01, *Aristeus antennatus* and *Nephrops norvegicus,* which were not recorded in MED'00, were also caught.

Three species of cephalopods went above the arbitrary limit of 5.0 kg/km^2 :*Octopus vulgaris* (BI= 14.8 kg/km^2; CV= 9.5), *Illex coindetii* (10.2.; CV= 85.0), *Sepia officinalis* (BI= 6.4; CV= 40.0); only *Illex coindetii* went above the 100N/km^2 threshold (254; CV= 73.9).

It is interesting to note that small pelagic species such as *Engraulis encrasicolus* and *Sardina pilchardus* were not caught.

2.1. Fish

Aspitrigla cuculus

This species was collected only on the outer margin of the shelf (depth range: 130-210 m). In the whole sub-region, this species gave an overall BI of 5.7 kg/km^2 (CV= 66.7) and a DI of 65 N/km^2 (CV= 64.1). The highest abundance was observed in the 4th stratum with a BI of 10.7 kg/km^2 (CV= 46.3) and DI of 121 N/km^2 (CV=46.3)

The range of the total length was 16.5 – 25.0 cm (mean=20.4).

Citharus macrolepidotus

This species was collected on the shelf and at the upper edge of the slope (80-210m). The overall sub-regional BI and DI were 2.0 kg/km^2 (CV= 40.9) and 90 N/km^2 (CV= 51.0) respectively. When comparing the values of the shelf to those of the slope, it is clear that there is a higher abundance on the former: BI= 3.8 (CV= 44.6) and DI= 181 (CV=55.7). The 3rd stratum yielded the highest abundance with a BI of 4.8 (CV= 15.4) and a DI of 226 (CV= 20.0).

The overall range of the total length was 10.5 –18.0 cm (mean=14.1).

Eutrigla gurnardus

This species was caught once on the shelf at a depth of 130 m and only in M3d sub-region. The shelf BI was 1.0 kg/km^2 (CV= 100.5) and shelf DI was 20 N/km^2 (CV=100.5). The overall range of the total length was 16.0 – 21.0 cm (mean=18.0).

Galeus melastomus

This shark was collected once on the slope at 594m. Even when only considering the slope, a poor index of abundance was obtained: the BI was 0.53 kg/km^2 and the DI was 4 N/km^2.

Even when considering only the 5th stratum, the abundance remained quite low (BI=1.2; DI=10).

The total length of the single specimen caught was 32.0 cm.

Helicolenus dactylopterus

The black mouth rockfish was collected both on the outer shelf and upper slope (180 – 414m). The overall sub-regional BI and DI were 2.25 (CV= 11.6) and 38 (CV= 41.3) respectively. In the 4th stratum the highest values were recorded: BI=6.5 (CV= 4.2); DI= 63 (CV=9.9).

The range of the total length was 6.0-27.0 cm (mean=15.0).

Lepidorhombus boscii

This species was not caught during MED'00 in the Maltese waters but has been caught during Med'01 at 210 – 414m. The slope abundances were BI= 1.5 (CV=43.6), DI= 11 (CV= 41.8). The highest abundances were recorded in the 4th stratum: BI= 2.7 (CV= 19.8), DI= 19 (CV= 21.9). The total length was 25.5 – 26.5cm (mean=25.8).

Lophius budegassa

This species was collected over a wide depth range (130 - 594m). Considering the sub-region, this Angler fish yielded a BI of 14.8 kg/km^2 (CV= 43.5) and DI of 21 N/km^2 (CV=30.8); however, the abundance was higher on the shelf when considering biomass (BI= 21.5, CV= 63.0; DI= 13, CV <1%) but higher on the slope when considering numbers (BI= 9.4, CV= 42.8; DI= 27, CV=43.3). The 3rd stratum showed the highest abundance with a BI of 32.8 kg/km^2 (CV= 19.7). However the highest DI was observed in the 4th stratum: 39 (CV= 23.5).

The range of the total length was 16.0 – 56.5 cm (mean=30.8).

Lophius piscatorius

This species was collected at a depth range of 74 - 210m. The overall abundances indices were BI=1.0 (CV= 87.2) amd DI = 8 (CV= 49.0). The highest abundances were observed in the 4th stratum in terms of biomass (BI=2.7, CV= 46.3) and in the 2nd in terms of numbers (DI=21, CV=29.5). The range of the total length was 8.0-34.5cm (mean=16.1).

Merluccius merluccius

The Mediterranean hake was found between 74 and 414 m. In the sub-region, this species revealed a BI and a DI of 14.1 kg/km2 (CV= 40.8) and 339 N/km^2 (CV=48.0) respectively. The shelf-indices, both as BI and DI, were slightly higher than the slope-indices (15.2 (CV=19.3) vs. 13.1 (CV=66.6) and 399 (CV=21.5) vs. 290 (CV=98.1) respectively). The highest captures were observed in the 4th stratum (BI=23.0 (CV=34.8)) and in the 3rd stratum (DI=585 (CV=6.9).

The range of the total length was 5.5 –43.0 cm (mean=14.8).

Micromesistius poutassou

No specimen of this species was caught during the MED'01 in the Maltese waters.

Mullus barbatus

The Red Mullet was caught almost exclusively on the shelf (80-210 m). Considering the whole sub-region M3d, the resulting indices were 5.6 kg/km^2 (CV=41.3) and 123 N/km^2 (CV= 35.8). However, referring to the "true" distribution area of the species (the shelf), higher indices were obtained BI=8.1 (CV=30.0); DI=195 (CV=27.0)). The highest indices, (BI=10.3 kg/km^2; CV=9.2) and (DI=246 N/km^2; CV=7.6) were obtained, in the 3rd stratum. The range of the total length was 12.0-21.0 cm (mean=16.0).

Mullus surmuletus

This species was caught almost exclusively on the shelf (49-210 m). For the whole sub-region, this species gave a BI of 58.3 kg/km^2 (CV= 18.5) and DI of 901 N/ km^2 (CV=23.2). The shelf-indices were BI=124.8 (CV=18.8) and DI=1927 (CV=23.8). The highest indices were obtained in the 2nd stratum (BI=343.5 kg/km^2 (CV= 6.6) and DI=5239 N/km^2 (CV=8.5).

The range of the total length was 10.5-25.5 cm (mean=16.6).

Pagellus acarne

No specimen of this species was caught during the MED'01 in the Maltese waters.

Pagellus bogaraveo

No specimen of this species was caught during the MED'01 in the Maltese waters.

Pagellus erythrinus

A typical neritic species, this sparid was fished only on the shelf at depth of 49 – 80m. The shelf indices of abundance were 38.4 kg/km^2 (CV=17.3) and 431 N/km^2 (CV=10.3). Considering only the 2nd stratum a very good catch was obtained (BI=122.4 (CV= 5.3) and DI=1363 (CV=3.4)).

The range of the total length was 8.0-26.0 cm (mean=17.5).

Phycis blennoides

This species was found only on the slope between 414 - 594m. Considering only the slope captures: 3.8 kg/km^2 (BI) (CV=86.7) and 8.9 N/km^2 (DI) (CV=15.3). The BI and DI values for the 4th and 5th stratum were 5.8 (CV=44.6) and 174 respectively.

The range of the total length was 5.5-48.0 cm (mean=12.5).

Raja clavata

This skate was caught on the outer shelf and upper slope (180 - 414m). Considering the abundance indices at sub-regional level, the values were 13.5 kg/km^2 (BI) (CV=56.7) and 26 N/km^2 (DI) (CV=24.0). The slope-indices were BI=20.6 (CV=64.6) and DI=36 (CV=9.5). The highest values of abundance were obtained in the 4th stratum (BI=36.1 (CV=29.3); DI=63 (CV=4.3)).

The range of the total length was 21.0 - 58.5 cm (mean=41.4).

Scyliorhinus canicula

This small sized shark was found between 74 and 414 m. For the whole sub-region, this species gave a BI of 21.6 kg/km^2 (CV= 41.3) and a DI of 228 N/km^2 (CV=58.8). The highest BI (32.5 (CV=16.4) and DI (421 (CV=29.5)) values were obtained in the 4th and 3rd stratum respectively.

The range of the total length was 10.5-50.5 cm (mean=28.7).

Solea vulgaris

This species was collected only at 54m. The total length of the specimen was 29.5cm.

Sparus pagrus

This species was found only on the shelf (49-74 m). The shelf abundance indices were BI=4.4 (CV=77.8), DI=54 (CV=72.8). The highest abundances were observed in the 1st stratum (BI= 26.5 (CV <1%), DI=411 (CV=3.5).

The range of the total length was 12.0-24.5 cm (mean=15.7).

Spicara flexuosa

This species was fished only on the shelf, between 74 and 130 m depth. The shelf-indices were: BI=4.2 (CV=76.2) and DI=114 (CV=75.0). The 3rd stratum yielded the highest indices (BI=4.6 (CV=31.4) and DI=123 (CV=31.4)).

The range of the total length was 10.5-18.0 cm (mean=14.8).

Spicara smaris

Similarly, the congener species, *S. smaris* was caught only on the shelf, between 49 and 80 m depth. The shelf-indices were BI= 86.7 (CV=83.3) and DI=6862 (CV=85.0). The highest and very impressive indices, BI= 2570.1 (CV=23.8) and DI= 208690 (CV=23.8), were obtained in the 1st stratum.

The range of the total length was 7.5-18.5 cm (mean=11.3).

Trachurus mediterraneus

This species was collected only once at a depth of 74m. The total length of the specimen was 21.5cm.

Trachurus trachurus

This species was caught only on the shelf (80-130 m). Standing alone, the shelf-indices were 23.0 (BI) (CV=99.7) and 2259 (DI) (CV=100.4). The highest values were obtained in the 3rd stratum: BI=34.9 (31.4), DI= 3447 (CV=31.4)

The range of the total length was 6.0-19.5 cm (mean=9.1).

Trigloporus lastoviza

This species was caught exclusively on the shelf (49-80 m). Considering only the shelf indices a BI of 4.9 (CV= 71.8) and a DI of 126 (CV=63.8) were obtained. The highest indices, 15.0 (BI) (CV=23.0) and 376 (DI) (20.8), were obtained in the 2nd stratum.

The range of the total length was 4.5-20.0 cm (mean=13.5).

Trisopterus minutus capelanus

No specimen of this species was caught during the MED'01 in the Maltese waters.

Zeus faber

This species was caught almost exclusively on the shelf (49-210 m). The shelf indices were 7.8 (BI) (CV=65.0) and 43 (DI) (CV=33.8). The highest BI value (20.7 (CV=22.8)) and the highest DI value (172 (CV= 16.5)) were found in the 1st stratum.

The range of the total length was 5.5-36.5 cm (mean=17.0).

2.2. Crustaceans

Aristaeomorpha foliacea

The red giant shrimp was caught only in the deep waters at 594 m in only one haul (BI=33.8, DI=1115). For comparison with other regions, the slope indices were 14.5 kg/km^2 (BI) and 479 N/km^2 (DI).

The range of the carapace length was 32-63 mm (mean=43).

Aristeus antennatus

The blue and red shrimp was caught only in the deep waters at 594 m in only one haul (BI=3.3, DI=113). For comparison with other regions, the slope indices were 1.4 kg/km^2 (BI) and 48 N/km^2 (DI).

The range of the carapace length was 32-49 mm (mean=44).

Nephrops norvegicus

The norway lobster was caught only at a depth of 414 m in only one haul (BI=10.7, DI=233). For comparison with other regions, the slope indices were 6.1 kg/km^2 (BI) and 133 N/km^2 (DI).

The range of the carapace length was 28-54 mm (mean=41).

Parapenaeus longirostris

The rose shrimp was found both on the shelf and slope (130-594 m). For the sub-region, the abundance indices were 23.8 kg/km^2 (BI) (CV= 49.0) and 5870 N/km^2 (DI) (CV=59.3). The shelf indices were higher than that of the slope: BI=34.2 (CV=75.9), DI= 9566 (CV=81.9). The highest abundance in Maltese waters were observed in the 3rd stratum: BI= 52.3 (CV= 23.7), DI= 14619 (CV= 25.6). The range of the carapace length was 9-29 mm (mean=19).

2.3. Cephalopods

Eledone cirrhosa

No specimen of this species was caught during the MED'01 in the Maltese waters.

Eledone moschata

This species was caught exclusively on the shelf at a depth of 74-130m. The shelf-indices were 4.2 (BI) (CV=57.1) and 27 (DI) (CV=58.2). The values for the 2nd stratum were 11.3 (BI) (CV=19.9) and 64 (DI) (CV=21.4).

The range of the mantle length was 6.5-11.0 cm (mean=8.5).

Illex coindetii

This squid was found down to the edge of the shelf (80-210 m). Combining all the depths, the following indices were derived: 10.2 (BI) (CV=85.0) and 254 (DI) (CV=73.9). The slope indices were BI= 14.9 (CV= 101.9), DI=288 (CV=101.9) The highest abundance occurred in the 4th stratum: BI =26.2 (CV=46.3); DI =504 (46.3).

The range of the mantle length was 5.5-16.0 cm (mean=10.7).

Loligo vulgaris

The common squid was fished only on the shelf between 74 and 80m depth. Shelf-indices were 4.9 kg/km^2 (BI) (CV=13.9) and 34 N/km^2 (DI) (CV= 3.3. The abundance indices for the 2nd stratum were 15.6 (BI) (CV=4.3) and 107 (DI) (CV= 1.0).

The range of the mantle length was 12.0-20.0 cm (mean=16.9).

Octopus vulgaris

The common octopus was caught exclusively on the shelf at a depth between 49 and 130m. Abundance indices of the shelf were 33.4 kg/km^2 (BI) (CV= 9.5) and 70 N/km^2 (DI) (CV= 10.6). The highest abundance was recorded in the 1st and 2nd stratum (BI~87, DI~190).

The range of the mantle length was 5.5-14.0cm (mean=9.4).

Sepia officinalis

This cuttlefish was caught exclusively on the shelf (49-130 m). When only the shelf catches are considered, the indices increase up to 14.4 (BI) (CV=40.0) and 94 (DI) (CV=43.0). The highest indices, 25.2 (BI) (CV=1.7) and 236 (DI) (CV=15.6), were obtained in the 2nd stratum.

The range of the mantle length was 5.5-18.0 cm (mean=8.8).

3. Comments by stratum

The most abundant target species by stratum were sorted considering an arbitrary threshold of 500 N/km^2 and 10 kg/km^2. The respective coefficient of variation (CV; %) were also presented in the table. The difference in abundance indices between MED'00 and MED'01 surveys is also tabled and expressed as "R" which is calculated by: R = index MED'01 / index MED'00.

For the sake of simplicity, only the mean DI indices were reported for the other representative species, included in the complementary list.

3.1. 1st Stratum (A: 10-50 m)

A total of 9 target species were found in this stratum including 7 bony fish species and 2 cephalopods with no records of crustaceans. *Spicara smaris* showed a remarkable increase in abundance from the MED'00 survey whilst all other species except *Sepia officinalis* also showed increases. *Sparus pagrus* caught in considerable amounts in MED'01 was absent from the catches of MED'00 in this stratum.

	2001		R
SPECIES	N/km^2	CV	
Spicara smaris	208690	23.8	48.6
Mullus surmuletus	928	11.5	4.9

SPECIES	2001		R
	kg/km^2	CV%	
Spicara smaris	2570.8	23.8	86.8
Octopus vulgaris	86.2	9.01	4.3
Mullus surmuletus	31.2	8.5	5.8
Sparus pagrus	26.5	<1	-
Sepia officinalis	24.5	13.8	0.7
Zeus faber	20.7	22.8	1.4

Among the "minor" species (those included in the "Complementary list"), only *Serranus cabrilla* (DI=3248) went over the threshold.

3.2. 2nd Stratum (B: 50-100 m)

A total of 19 target species consisting of 14 fish (13 bony and 1 cartilaginous) and 5 cephalopods were fished within this depth range. All species showed an increase in abundance in MED'01 except for *Pagellus erythrinus* and *Spicara smaris,* the latter being exceptionally lower. *Raja clavata* was not caught during MED'01 despite the high abundance recorded in MED'00.

SPECIES	2001		R
	N/km^2	CV	
Mullus surmuletus	5239	8.5	3.1
Pagellus erythrinus	1363	3.2	0.5

SPECIES	2001		R
	kg/km^2	CV%	
Mullus surmuletus	343.5	6.6	4.2
Pagellus erythrinus	122.4	5.3	0.6
Octopus vulgaris	88.0	<1	3.2
Sepia officinalis	25.2	1.7	4.1
Loligo vulgaris	16.6	4.3	13.8
Trigoloporus lastoviza	15.0	23.0	3.6
Scyliorhinus canicula	14.5	17.9	3.9
Sparus pagrus	11.3	29.5	-
Spicara smaris	11.3	20.8	0.02
Eledone moscata	11.3	19.9	3.0

Only 1 "minor" species, *Serranus cabrilla* had an abundance (DI=1685) over the threshold indicated above.

3.3. 3rd Stratum (C: 100-200 m)

A total of 19 target species were fished in this stratum: 14 fish (12 bony and 2 cartilaginous), 1 crustacean and 4 cephalopods. Besides *Merluccius merluccius,* which is included in table below, *Raja clavata, Zeus faber, Spicara flexuosa and Illex coindetii* were more abundant in MED'00 than in MED'01 where their abundance was below the threshold.

	2001		R
SPECIES	N/km^2	CV	
Parapenaeus longirostris	14619	25.6	3.7
Trachurus trachurus	3447	31.4	9.4
Merluccius merluccius	585	6.9	0.2

	2001		R
SPECIES	kg/km^2	CV%	
Parapenaeus longirostris	52.3	23.7	2.6
Trachurus trachurus	34.9	31.4	~14
Lophius budegassa	32.8	19.7	1.75
Scyliorhinus canicula	31.8	27.0	2.1
Mullus surmuletus	24.6	3.7	~10
Merluccius merluccius	20.0	5.8	0.2
Mullus barbatus	10.3	9.2	1.0

Among the "minor" catches, only 2 species yielded DI over the threshold of 500 N/km^2: *Argentina sphyraena* (17994), *Lepidotrigla cavillone* (2944),

3.4. 4th Stratum (D: 200-500 m)

16 of the target species were found in this stratum. Fish species were the most numerous (11 bony and 2 cartilaginous), whereas there were 2 and 1 species of crustaceans and

cephalopods respectively. Generally, the same species were representative of the highest abundances in MED'00 and MED'01, with *Merluccius merluccius* having a much larger abundance in MED'01. *Nephrops norvegicus* was not caught in MED'00 but has appeared in considerable abundance in MED'01.

	2001		R
SPECIES	N/km^2	CV	
Parapenaeus longirostris	4626	3.4	1.3
Merluccius merluccius	509	44.5	~10
Illex coindetii	504	46.6	1.8

	2001		R
SPECIES	kg/km^2	CV%	
Raja clavata	36.1	29.3	0.6
Scyliorhinus canicula	32.5	16.4	0.5
Illex coindetii	26.2	46.3	1.1
Parapenaeus longirostris	23.3	10.5	1.2
Merluccius merluccius	23.0	34.8	2.9
Lophius budegassa	14.6	22.0	1.0
Aspitrigla cuculus	10.7	46.3	~4
Nephrops norvegicus	10.7	44.6	-

Among the taxa included in the "Complementary list", only 2 species had an abundance greater than 500 N/km^2: *Lepidotrigla cavillone* (1382) and *Argentina sphyraena* (5868).

3.5. 5th Stratum (E: 500-800 m)

Six targets were collected from this stratum (2 bony fish, 1 cartilaginous fish and 3 crustaceans). In general there was a substantial decrease in abundance in MED'01 when compared to values obtained in MED'00.

It is worth noting that, as in MED'00, no target cephalopods were caught in MED'01 at these depths.

	2001		R
SPECIES	N/km^2	CV	
Aristaeomorpha foliacea	1115	-	0.5
Parapenaeus longirostris	645	-	0.3

	2001		R
SPECIES	kg/km^2	CV%	
Aristaeomorpha foliacea	33.8	-	0.7

With the exception of *Conger conger* (1 specimen), no "minor" species were caught.

4. Discussion

In order to obtain a reasonable comparison of abundances by stratum between the sub-regions, the most important commercial species were selected in each case and the corresponding BI were tabulated. The highest abundance for each species appears in bold.

1st stratum

	M3a	M3b	M3c	M3d
Species	BI	BI	BI	BI
Pagellus erythrinus	7.8	**96.2**	3.2	1.9
Mullus barbatus	22.2	**148.0**	2.0	0
Mullus surmuletus	0.2	0.3	0	**31.2**
Trigloporus lastoviza	0.2	0.1	1.2	**7.3**
Zeus faber	0.1	0.7	0.3	**20.7**
Octopus vulgaris	2.1	18.0	6.7	**86.2**
Sepia officinalis	9.0	0.7	2.9	**24.5**

Five out of seven species are most abundant in Maltese waters whilst the other two are more abundant in M3b. This could reflect that this stratum is fully (Malta) and partially (Gulfs of Castallammare and of Patti in the Northern coast of Sicily) protected from trawling. It is worth noting that there is an inverse situation for the abundances of the *Mullus* species in M3d and M3b.

2nd stratum

	M3a	M3b	M3c	M3d
Species	BI	BI	BI	BI
Pagellus erythrinus	15.6	64.6	22.9	**122.4**
Merluccius merluccius	12.7	**30.8**	22.8	6.8
Mullus barbatus	18.4	**67.9**	56.6	4.3
Mullus surmuletus	0.2	0	40.9	**343.5**
Trigloporus lastoviza	0.2	0.3	14.4	**15.0**
Zeus faber	6.9	**70.8**	16.5	7.7
Octopus vulgaris	12.3	0	14.7	**88.0**
Sepia officinalis	2.7	0	16.6	**25.2**

Five out of eight species are most abundant in Maltese waters whilst the other three species are most abundant in M3b. As in the first stratum the high presence of the different species of *Mullus* in M3b and M3d could be noticed. There is a remarkably high abundance of cephalopods in Maltese waters.

3rd stratum

	M3a	M3b	M3c	M3d
Species	BI	BI	BI	BI
Lophius budegassa	1.7	1.7	0.2	**32.8**
Merluccius merluccius	18.1	**29.1**	25.3	20.0
Mullus barbatus	**12.4**	8.1	3.2	10.3
Mullus surmuletus	0.2	2.9	1.7	**24.6**
Raja clavata	0	0	**14.6**	7.2
Zeus faber	2.0	1.7	**12.9**	7.2
Eledone cirrosa	**25.2**	5.2	4.6	0
Parapenaeus longirostris	5.0	6.3	21.2	**52.3**

In this stratum there is no sub-region which dominates in terms of high abundances. However, the abundances of *Lophius budegassa* and *Mullus surmuletus* in M3d are very much higher than in all other regions. In this stratum, it appears that the protection from trawling in M3b did not show any effect.

4th stratum

	M3a	M3b	M3c	M3d
Species	BI	BI	BI	BI
Helicolenus dactylopterus	3.8	1.9	3.5	**6.5**
Lophius budegassa	4.8	9.3	7.1	**14.5**
Merluccius merluccius	16.2	18.5	22.2	**23.0**
Phycis blennoides	8.2	**9.2**	6.3	5.8
Raja clavata	2.9	0	8.0	**36.1**
Scyliorhinus canicula	1.0	0.8	3.5	**32.5**
Parapenaeus longirostris	9.4	11.4	**36.5**	23.3
Nephrops norvegicus	4.2	1.1	6.6	**10.7**

Six out of eight species showed highest abundances in Maltese waters, with *Raja clavata* and *Scyliorhinus canicula* yielding much higher values than for the other sub-regions. The other two species were found in greatest abundances in M3b and M3c.

5th stratum

	M3a	M3b	M3c	M3d
Species	BI	BI	BI	BI
Helicolenus dactylopterus	0.8	0.3	**1.9**	0
Lophius budegassa	0.5	1.5	**4.9**	2.6
Merluccius merluccius	0.4	3.0	**3.4**	0
Phycis blennoides	6.8	5.9	**10.0**	1
Galeus melastoma	32.8	19.1	**33.1**	1.2
Aristeomorpha foliacea	17.7	11.6	30.3	**33.8**
Aristeus antennatus	5.4	**7.4**	3.3	3.3

Only *Aristeomorpha foliacea* yielded the highest abundance in Maltese waters, but in any case the value was similar to that in other sub-regions. It is interesting to note that red shrimp comprises a large percentage of landings of Maltese trawlers. Five out of eight species were in greatest abundances in M3c, whilst M3b had the highest abundance value for *Aristeus antennatus*.

From the analyses carried out in this discussion, one can conclude that in twenty out of thirty eight cases, the abundance was higher in Maltese waters. This could be attributable to a much lower trawling fishing effort in this sub-region and to differences in oceaographical and benthic physical factors. However, this analysis should only be considered as indicative since only few hauls have been performed in M3d.

ANNEX XVI: RECORD OF INVOLVEMENT OF AUTHOR IN DATA COLLECTION PROGRAMMES ASSOCIATED WITH THE PRESENT STUDY

1. The fleet census and the MaltaStat fishing vessel database and information system

- Coordination of census of fishing vessels – 1999.
- Development of the MaltaStat fishing vessel database and information system
- Supervision of data entry, database management and data debugging - 1999 to date.
- Identification of national and international reporting requirements and formats for fleet statistics and development of automatic outputs - 1999 to date.
- Development of a "selective scan" facility in order to generate specific outputs using a combination of any of the fields (over 200) making up the inventory of fishing vessels – 1999-2000

2. The catch assessment survey (CAS) and the MaltaStat CAS database

- Analysis of fleet census data and conduction of pilot study – January –October, 2002
- Development of MaltaStat CAS database and information system and the integration of routine calculations using raising factors – completed in 2003 but continually being improved.
- Field work supervision, coordination and data collection – 2003 to date.
- Supervision of data entry, database management and data debugging - 2003 to date.
- Design of reporting formats for use in scientific assessments and compliant with national and international data submission obligations – 2003 to date.

3. Medits trawl surveys

- National coordinator and focal point – since 2000
- Member of scientific crew

4. Dolphin fish catch and effort study

- National coordinator of COPEMED dolphin fish project and CORY working group of the Scientific Advisory Committee of the GFCM – since 2000
- Survey design, field work supervision and data collection – 2000 to date

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