MINISTRY FOR SUSTAINABLE DEVELOPMENT THE ENVIRONMENT AND CLIMATE CHANGE

MALTA

National Data Collection Programme

Under Council Regulation (EC) 199/2008,
Commission Regulation (EC) 665/2008 and
Commission Decisions 2008/949/EC, 2010/93/EU

Malta

2015 – Annual Report

Department of Fisheries and Aquaculture,
Għammieri,
Ngiered Road,
Marsa, MRS 3303
Malta

May 2016

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I General Framework

Malta carried out its National Fisheries Data Collection Programme in 2015 and was compliant with the Data Collection Framework (DCF) (Council Regulation EC 199/2008, Commission Regulation EC 665/2008 and 2010/93/EU). The present document includes the annual report and compliance tables for the reference year 2015, following the guidelines for submission of annual reports on the current Data Collection Framework (DCF) (Guidelines for the submission of Annual Report on the National Data Collection Programmes under Council Regulation (EC) 199/2008, Commission Regulation (EC) 665/2008 and Commission Decision 2010/93/EU, Version for Annual Reports 2015). It gives an overview of the required and achieved sampling together with deviations from the aim and actions undertaken.

In 2015, there were no major changes in the approach compared to the previous reference year.

Malta is actively involved in the Regional Fisheries Management Organisations (RFMOs), namely the International Commission for the Conservation of Atlantic Tunas (ICCAT) for large pelagic and tuna like species and the General Fisheries Commission for the Mediterranean (GFCM) for all the other stocks. All the data collected through the DCF is/will be made available to the respective RFMOs when requested. Malta also collaborates actively with Italian colleagues within the Sicily channel, with joint surveys, biological data collection, research projects and stock assessments. Furthermore, Malta is also working in close collaboration with regards to research projects and stock assessments with Sicily, Tunisia and Libya under the umbrella of the FAO MedSudMed regional project.

II National data collection organisation

II.A National correspondent and participating institutes

Presently Ms. Roberta Mifsud is the National Correspondent for the Maltese National Data Collection Programme. She is in charge of the overall coordination of the programme, and supervision of the economic, biological, transversal and research surveys at sea data collection variables. Her contact details are:

Ms. Roberta Mifsud
Senior Fisheries Resource Manager
Department of Fisheries and Aquaculture
Ministry for Sustainable Development, the Environment and Climate Change,
Ghammieri,
Ngiered Road,
Marsa, MRS3303
Malta
Phone: +356 2292 6829
E-mail: roberta.mifsud@gov.mt

Other contact persons at the Fisheries Resource Management Unit responsible for the co-ordination of the programme are;

- Hazel Farrugia
  Scientific Research Officer (general DCF co-ordination)
  Department of Fisheries and Aquaculture
  Ministry for Sustainable Development, the Environment and Climate Change,
  Ghammieri,
  Ngiered Road,
  Marsa, MRS3303
  Malta
  Phone: +356 2292 6867
  E-mail: hazel.farrugia@gov.mt

- Marianne Aquilina
  Economics Officer
  (Officer in charge of Economic variables)
  Department of Fisheries and Aquaculture
  Ministry for Sustainable Development, the Environment and Climate Change
  Għammieri
  Ngiered Road
  Marsa MRS 3303
  Malta
  Tel: +356 22926822
  E-mail: marianne.b.aquilina@gov.mt

- Miriam Gambin
  Scientific Officer (Officer in charge of Biological variables)
  Department of Fisheries and Aquaculture
  Ministry for Sustainable Development, the Environment and Climate Change
  Għammieri
  Ngiered Road
  Marsa MRS 3303
  Malta
  Tel: +356 22926865
  E-mail: miriam.gambin@gov.mt

- Eric Muscat
  Senior Aquaculture Officer
  (Officer in charge of Transversal variables)
  Department of Fisheries and Aquaculture
  Ministry for Sustainable Development, the Environment and Climate Change
  Għammieri
  Ngiered Road
  Marsa MRS 3303
  Malta
  Tel: +356 22926827
  E-mail: eric.muscat@gov.mt

- Reno Micallef
  Scientific Officer (Officer in charge of Research Surveys at Sea)
  Department of Fisheries and Aquaculture
  Ministry for Sustainable Development, the Environment and Climate Change
  Għammieri
  Ngiered Road
  Marsa MRS 3303
  Malta
  Tel: +356 22926810
  E-mail: reno.micallef@gov.mt

In 2015, the Fisheries Resource Unit within the Department of Fisheries and Aquaculture of the Ministry for Sustainable Development, the Environment and Climate change (MSDEC) was responsible for the implementation of the DCF and for undertaking the modules of the programme. Collaboration and consultancy with other national entities is sought.

Since the national programme is conducted by one institute, a number of internal meetings take place during the implementation period of the data collection programme; these entail discussions on planning of sampling schemes, data processing and report drafting which relate to the various modules of the programme.

A common information deposit for all the information related to the data collection framework is available and accesible to all participants within the Department of Fisheries and Aquaculture.

II.B Regional and International coordination

II.B.1 Attendance of international meetings

Table II.B.1 shows the list of international meetings that were attended by Malta.

II.B.2 Follow-up of regional and international recommendations

Reference is being made to Chapter 7 (pg 123) of STECF PLEN-15-02, which states that no new recommendations arose during discussions at the 49th plenary meeting of the STECF. In the report of the 2015 Regional Co-ordination Meeting Mediterranean and Black Sea, Large Pelagic Fisheries there were no recommendations.

III Module of the evaluation of the fishing sector

III.A General description of the fishing sector

The Maltese fishery is a relatively small industry of a typically Mediterranean artisanal type, and is frequently described as multi-species and multi-gear fishery, with the majority of the fishers switching from one gear to another several times throughout the year. The fleet as of 31 December 2015 consisted of 1,001 professional vessels of which 39.8% were professional full-time and 60.2% were professional part-time vessels. Of these professional vessels, 12 are registered as "non-operational" – i.e. vessels that are either being repaired, or have been rendered non-operational due to pending court cases. The recreational category, made up of 1,947 vessels, operated recreational fishing gear only and fish caught by vessels in this category are not commercialised.

The total gross tonnage and power (main engine) for the full-time professional vessels for 2015 were 5,875.82 GT and 43,548.49 kW respectively while for the part-time professional vessels the values were 1,086.88 GT and 29,152.38 kW. A total of 13 trawlers operated on a full-time basis, for a total power and tonnage of 4,873.84 kW and 1,878.02 GT respectively. These ranged between 19.30 to 35.00 m in overall length.

93.4% of the professional vessels were less than 12 metres in length overall and more than half of them are of a traditional design, mainly 'Luzzu' and 'Kajjik' and these operated mainly in coastal waters. Larger vessels, those over 12 metres in length, amounted to 66 vessels and mainly consisted of trawlers, long-liners and netters operating mainly in off-shore waters all year round. The length of the registered vessels ranged between 3.00 and 35.00 metres. Tables 2a to 2e show a time series of fleet data by fleet segment for the years 2006-2015.

The main landing sites are Marsaxlokk harbour and the wholesale fish-market in Valletta. Catches are generally sold by public auctions through middlemen and fish hawkers.

The main exploited species include swordfish, mackerel, dolphinfish, blue fin tuna, demersal and small-pelagic species and a number of additional species, some of which although caught in smaller quantities, have a high commercial value, such as the red shrimps. Other species such as bogue, horse mackerel, mackerel, dogfish, skate and similar species, which are less valuable commercially, are also caught in fairly large quantities.

Fishing patterns by the Maltese fishing fleet do not vary much between years and are seasonal for some fishing practices. This is due to the migratory patterns of the main target species namely the tuna and dolphin fishing season, whilst together with the swordfish which is targeted throughout the year (with the exception of March, October and November due to the closed season) are the three most important species for the economy of local fisheries.

Over the last decade the Maltese fishing industry has evolved from a virtually unrestricted activity into a highly regulated industry especially after Malta's accession in the EU with quotas primarily following recommendations by international fisheries bodies like ICCAT and GFCM.

The aquaculture industry has become increasingly important throughout the years and employs full-time and part-time persons including technical/scientific experts, farm managers, farm operators, divers and maintenance staff.

The local consumption of capture fisheries products is heavily supplemented by locally farmed fish, imported chilled and frozen fish products, as well as processed imported fish products.

There were no major changes in the Maltese fishing sector in 2015, thus it had no significant impact on the implementation of the National Programme.

III.B Economic variables

Mediterranean and Black Sea

III.B.1 Achievements: Results and deviation from National Programme proposal

For reference year 2014, economic data was collected on a census basis. The sampling frame for the collection of economic data was based on the fishing vessel register information. The sample used for the reference year 2014 was segmented according to the Community Framework for data collection (EC 949/08). The data was segmented by type of gear being mobile or passive and by fishing technique namely; drift and/or fixed netters, demersal trawlers and/or demersal seiners, pots and/or traps, hooks, polyvalent passive gears only, combination of active and passive gears, purse seiners and vessels using other active gears. The segment containing inactive vessels was included only for the data collection of the capital value and capital costs as it was required. The data was further segmented by the length of the vessel (0-6m, 6-12m, 12-18m, 18-24m and 24-40m).

The population was defined as the entire commercial Maltese fishing fleet which includes the entire full-time commercial (MFA) and part-time commercial (MFB) fishing vessels amounting to a total of 1,045 vessels in 2014. Both inactive and active vessels were considered. For all segments, a census approach was used. Direct interviews based on questionnaires were used to gather the data needed.

Malta does not cluster fleet segments therefore table III.B.2 is not applicable.

Estimation of capital value and capital costs

The reference values used for the estimation of the price per capacity unit (PPCU) are the prices of the recent constructed vessels in the sample. This provides the value of capital at current prices. Capital asset value is equal to vessel replacement value which was obtained using the Perpetual Inventory Method (PIM) in order to be in line with the recent advise from PGECON (16^{th}- 19^{th} April 2012, Salerno, Italy). The price per capacity unit was estimated by dividing the capital value of recent constructed vessels by the gross tonnage of the vessels constructed in the respective year.

The price index used as part of the calculation is 'the Retail Price Index' (RPI). The RPI takes into consideration the consumption expenditure of a fixed basket of goods and services that private households incur locally. This index is a good indicator of the impact of inflation on the cost of living. A 'heavy machinery index' is not available in the case of Malta. The only producer price index that is available is the 'Industrial Producer Price Index' which only dates back to 2005 while the oldest vessels in the Maltese fleet date back to the very early 1900's.

The depreciation rates and the service life times of assets which were used correspond to the ones provided in the general scheme excel spreadsheet provided as part of the capital valuation report of study No FISH/2005/03: 'IREPA Onlus Co-ordinator, 2006.

Capital value data derived using the PIM method is segmented according to the different asset components that are the hull, engine, electronics and other equipment (including gear). However only the replacement capital value was calculated for the reference year 2014. An

average of the share of each component as a fraction of the total value of the capital was estimated for the vessels making part of the sample. The share values of the hull, engine, electronics and other equipment (including gear) varies depending on the type of vessel and length class. Below is a detailed table showing the share of values:

Share in total investment	hull	engine	electronics	other equipment
Purse seiners	46%	25%	2%	27%
Small Scale Vessels (up to 12 metres)	35%	38%	10%	17%
Multipurpose vessels	46%	25%	2%	27%
Multipurpose vessels- passive	35%	38%	10%	17%
Trawlers	46%	25%	2%	27%

III.B.2 Data quality: Results and deviation from National Programme proposal

The planned sample had a full coverage of the population and of each segment of the fleet reflecting a positive indication of data quality. Additionally, each completed questionnaire was checked by officers and if the questionnaire was partially incomplete or incorrect the fishers were re-contacted so as to correct or complete the questionnaire. The final estimates were calculated on an individual basis depending on the type of vessel, length class, landings value and days at sea.

Calculation procedures of derived indicators;

Full-time equivalent: National and Harmonised- data with regards to the total number of hours worked per year per employee on board the vessel (excluding resting time) and the working hours on shore was collected for the purpose of the calculation of these two indicators. Based on the National reference level an employee is considered to be a full-timer when he/she works 40 hours per week. In this case and in accordance with the study FISH/2005/14 the national full-time equivalent is equal to 1. From this data the harmonised full-time equivalent was also calculated. The Harmonised full-time equivalent (FTE) is the FTE based on a threshold of 2000 hours. The calculation in the case of both indicators is the result of the ratio of the total working hours per year to the national and harmonised thresholds indicated above. The achieved sampling rate, the response rate for the data with regards to the total number of hours worked is provided in table III.B.3.

Financial Position: Data with regards to debt as at the end of the reference year was collected for the purpose of the calculation of this indicator. The calculation is the ratio of debt to total capital (using replacement value). The achieved sampling rate, the response rate for the data with regards to debt is provided in table III.B.3.

The following are the deviations from the National Programme proposal;

The sampling intensity proposed in the National Programme amounted to 389 vessels and the actual sample amounts to 709 active vessels, being a census approach. The aim of this deviation is to enhance the data quality of the survey.

The data source to estimate the gross value of landings was derived from log book and sales voucher data. Direct subsidies, income from leasing of quota or other fishing rights,

payments/lease of quota or other fishing rights were obtained from direct sources (Subsidies Unit and Fishers' Service Unit within the Ministry for Sustainable Development, Environment and Climate Change). This was also done to enhance the quality of the survey.

III.B.3 Actions to avoid deviations

The following is a list of actions which have been taken to avoid shortfalls:

- The questionnaire was reviewed and assured that only the data that is required was asked to the fishermen. Moreover, data that could be obtained from data sources was removed from the questionnaire and asked directly to the respective authority.
- Data was collected using a census approach in order to obtain a clear picture of the fishing fleet economic performance and eliminate any data quality issues.
- Data collected during an interview was individually entered, analysed and corrected at the same time by the Economics Officer of the Department of Fisheries and Aquaculture. If the questionnaires proved to be unsatisfactory, the interviewer was requested to revise the questionnaire.

III.C Metier-related variables

Mediterranean Sea and Black Sea

General Considerations

The selection of metiers to be sampled for the estimation of the quarterly volume, size and age of the species in the catches and, where relevant, the discards, was based on the metier ranking procedure described in Commission Decision 2010/93EU and carried out on data collected from logbooks, sales vouchers and the small-scale fishery sampling survey, as described in the 2013 Malta National Data Collection Programme. The level 6 metier codifications used within the present report are derived from those agreed at the 6th Regional Coordination Meeting for the Mediterranean and Black Sea (RCMMed&BS, 2009) and augment those defined within the Data Collection Framework.

As in previous years, both onboard and market sampling were carried out under a stratified sampling frame where the primary sampling unit (PSU) was the trip and the strata were the metiers. This method divided the fleet into very small segments; based on the more recent data, 21 metiers were identified from which 12 metiers were picked to be sampled by the metier-ranking system (Table III.C.1).

As detailed in the 2013 NP, for each selected metier a target number of trips from the particular stratum were set to be sampled each month. This sampling strategy excluded any trips that used more than one gear and at some instances the randomness of the sample was compromised since not all the trips could in fact be sampled. For onboard observations, some trips had to be excluded either because the boats were too small or the fishers were unwilling to allow onboard observer. Bias was also introduced in market sampling when the fish couldn't be measured at the market and the hawkers were unwilling to sell the catch to the department. Furthermore, some catches were not available at the market because they were either exported or sold via direct sales and therefore these trips were also excluded from sampling.

In response to bias that can be introduced using the Metier-based sampling technique, the WGCATCH (ICES WGCATCH, 2015) recommended that post stratification is applied. A simulation on market sampling was carried out using a vessel-based approach and it was presented in the WGCATCH working group. In the simulation the vessels were first randomly selected and then the data obtained was post-stratified into metiers. The results however showed that this method is not ideal since the chance of selecting a vessel that has sold fish on the market and has used the gear required is very low. According to the study, trawlers would be sampled at the fish market 54% of the time that they are selected and this raises the average to 18% because the chance of sampling other gears such as pots and traps could be as low as 7%. Therefore this method would in practice result in a big shortfall from DCF obligations.

Considering the above points, the metier-based approach is not the ideal sampling strategy for the Maltese fleet. This sampling procedure segments the fleet into many small groups that are difficult to sample thus making it difficult for Malta to reach the DCF requirements. This method also leads to the introduction of bias that limits the randomness of the data.

Despite the challenges mentioned, effort was made to sample more trips during observations of the fishing operations. This was achieved for some of the metiers and it helped facilitate the collection of biological data for a wider range of target and by-catch species, including discards, as well as more accurate sub-sampling of the catches from each fishing operation during the observed trips.

Effort was also made to continue improving the standardisation and precision of data recording systems and to enhance data validation and bring quality control as close to the point of data acquisition as possible. This was achieved by further updating the sampling protocols and reference material for the identification of species during observations at sea and the integration of validation tools into the software used to process data.

III.C.1 Achievements, Results and deviation from National Programme proposal

The total number of trips sampled proposed in the National Programme was achieved for set bottom longlines, trammel nets, pots and traps, hand and pole lines and trolling lines. Set gillnets were not sampled during the year 2015, since they were not selected by the more recent metier ranking system based on data of 2013-2014

However, of the total number of trips sampled, not all the planned trips at sea could be carried out. Sampling at sea was performed for each of the chosen metiers; trawlers, surface longlines, trammel nets, FADs and lampara.

Difficulty in the collection of samples at sea for lampara was exacerbated by the very small time-windows associated with trips employing this gear given its sensitivity to both lunar and meteorological conditions.

Shortfalls in the achieved sampling at sea varied greatly between the listed gear and, for instance, the shortfall in at sea sampling of drifting longlines for bluefin tuna was mitigated via landing inspections since fishers are obliged to land their catches at port. This latter shortfall was due to the fact that data on the bluefin tuna longline fishery was carried out according to ICCAT specifications (14-04 BFT Part II CPC Observer Programme), covering 20% of the fleet actively using that gear for the duration of the fishing season. Given the brevity of the season and variation in activity between vessels, the sampling of twelve trips proposed could not be ensured and, indeed, was not met.

Trammel nets is an artisanal fishery in Malta and the gear is mostly employed by small polyvalent vessels below 10m LOA. Two onboard observations for trammel nets were managed this year but the rest of the information about the catches and effort for these metiers were taken from questionnaires with no direct access to the fish.

A bilateral agreement (Annex I) was signed between Cyprus and Malta on 27 January 2009. Said agreement concerned sampling of bottom otter trawlers targeting mixed demersal and deep sea species in GSA 15. It was agreed that Cyprus trawlers involved in the shared metier landing their catch in Maltese ports would be included in the Maltese sampling scheme for collection of biological metier-related variables. The Maltese sampling scheme samples three types of bottom otter trawlers – demersal, mixed demersal and deep sea. Even though the Cypriot vessels in question were sampled alongside the Maltese fleet, the total number of planned trips was not reached. For mixed deepwater and demersal species 2 onboard

observations were conducted. For demersal species 3 trips were sampled onboard and 9 trips were sampled at the landing/market.

This shortfall was partly attributed to the limited number of trawlers (13 operational that use this gear when compared to the total number of planned trips (36 trips). Additionally, the time these vessels spend trawling was limited since they were also involved in other activities including the transportation of tuna in the Mediterranean. Apart from these limitations, difficulties were also encountered to accommodate observers; these trips usually span over several days and some of the vessels did not have enough space to accommodate onboard observers for more than 1 night.

In the PGMed report (2015), the number of sampling trips by metiers exploiting a shared stock in certain zones (including the number of trips for the OTB metiers in zones 15 and 16) was estimated. According to this report, based on both the percentage of catches and the percentage of effort Malta has to sample 1 trip for each of the deepwater, demersal and mixed trawling metiers..

Despite all the difficulties encountered, more onboard observations for this metier were conducted in 2015 than in the previous year. Following an internal reshuffling during the year, two field recorders were specifically appointed to work on onboard observations, so that more onboard trips could be sampled. Further improved results should be seen for the reference year 2016. The shortfall in onboard observations for this gear was partly mitigated via market sampling.

Some metiers were over sampled. The large number of trips sampled from shore for the swordfish longline fishery is due to the large volume of catch data that is recorded at landing for this fishery. No extra costs were therefore incurred during the sampling of this fishery. Similarly for FADs, more trips were sampled via measurements recorded at market with the limited purchase of samples for the collection of stock-related variables for the target species *Coryphaena hippurus*. The measurement of samples at market also contributed to the inflated number of trips sampled for set bottom longlines, pots and traps and trolling lines. Pots and traps are used in different fisheries to target different species (*Octopus vulgaris* and *Boops boops*) and sampling was carried out on both fisheries. As detailed in Table III.C.3, this was achieved at port and market without the need to purchase the catch and thus there were no extra costs to get these samples.

III.C.2 Data quality issues

The reproducibility of data processing and analysis has continued improving with the progressive migration of such procedures into the R environment. The use of R scripts has led to greater efficiency and precision in data cleaning as well as highlighting inconsistencies and errors in the data. Though not implemented during the reference sampling year, ongoing work is being carried out to convert biological data from its native format into a form compatible with COST tools. It is expected that the COST tools will aid in the optimisation and quality control of sampling. Malta will be involved in the regional discussion for this implementation and it will proceed according to the decisions taken. Also, to further improve data validation, Malta is trying to obtain copies of the R scripts from JRC or other relevant data end users to perform data checks.

III.C.3 Actions to avoid deviations

In the collection of metier-related variables, Malta has made several efforts to ensure that the data collection requirements are met, and was mostly successful in meeting the overall achieved number of trips for 2015, despite the greater emphasis for several gears on market sampling rather than onboard observations as planned. During the year, an internal reshuffling was made and two field recorders were specifically appointed to work on onboard observations. While improvement in the number of onboard observations reached in 2015 was made over the previous year, further improvements will be noted in 2016.

III.D Recreational fisheries

Mediterranean Sea and Black Sea

III.D.1 Achievements: Results and deviation from National Programme proposal

The recreational fishery in Malta is conducted throughout the year, weather permitting, with higher fishing intensities during the summer months. The total catches from recreational fisheries constitute a very low percentage of the total catches.

Malta is exempted from collecting data on the recreational fishery for eel. In Malta, there is no recreational fishery for eel and, for this reason, Malta had requested a derogation not to sample this fishery. The request was approved and Malta was exempted from the obligation to prepare an Eel Management Plan in accordance with Council Regulation (EC) No 1100/2007. Malta can confirm that recreational fisheries do not target sharks, although sharks are caught as by-catch. The results of a 2005 study indicated that catches of Maltese recreational and sports fishers consisted primarily of frigate mackerel, common octopus, Atlantic little tuna, and common dolphinfish. The remainder of the catch was composed of: Atlantic bonito, albacore, bluefin tuna, common squid, amberjack, swordfish and comber. A number of remaining species individually contributed to less than 2% of the catch (Pilot Study Report, 2006).

Gaudin & de Young (2007, p. 10) found that: *"Bycatch or non-targeted species, terms often associated with commercial fisheries, also occur in RF. Non-targeted species in the Mediterranean comprised species such as sharks and rays, but also species resembling target species, such as Spanish bream and sharpsnout seabream, living in the same grounds as pandora and white seabream."*

Recreational fishers are only allowed to use minor gears such as set bottom longlines, traps, trolling lines and jigging, as stipulated in Article 17 of Council Regulation (EC) 1967/2006. Such gears are not appropriate to target sharks and the main target species are *Diplodus sargus*, *Octopus vulgaris*, *Boops boops*, *Coryphaena hippurus*, *Seriola dumerili*, *Loligo vulgaris*, *Illex* spp. and *Todarodes* spp.

Malta has the obligation to collect data exclusively on blue fin tuna caught by recreational fishery. Recreational landings of bluefin tuna make a small contribution to the overall recreational landings of tuna and tuna-like species (Pilot Study Report, 2006). Landing officers were present at landing sites to collect information on catches of bluefin tuna by recreational fishing for all landings. In 2015, the total gilled and gutted weight for bluefin tuna landed via recreational fisheries amounted to 1,702.9kg. The necessary data was collected through a census approach.

III.D.2 Data quality issues

There were no issues in the data collection.

III.D.3 Actions to avoid deviations

The data was collected through a census.

III.E Stock-related variables

Mediterranean Sea and Black Sea

III.E.1 Achievements: Results and deviation from National Programme proposal

Tables III.E.1 – III.E.3 were updated with the information collected during the sampling year.

Malta is obliged to collect stock-related variables only for three species; *Thunnus thynnus, Xiphias gladius* and *Coryphaena hippurus*. Malta is exempted from sampling the other species as their landings by weight correspond to less than 10% of the total Community landings from the Mediterranean Sea and/or less than 200 tonnes. Table III.E.1 shows the average landings in the years 2011-2013 and the proportion of Malta's landings to the total EU landings in 2013 according to Eurostat. Malta still collects some stock-related variables for the species mentioned in the NP, since it is sometimes possible to collect this data while carrying out metier-related sampling.

The sampling planned for stock-related variables in 2015 was for Group 1 and for some Group 2 species as specified in the NP. With regard to the sharks, following the recommendation of PGMED during 2010, stock-related data for these species was collected during the MEDITS scientific surveys and also when encountered and could be sampled when sampling for metier-related variables – principally during sampling at the fish market and during onboard observations.

For swordfish and tuna, over-sampling was observed, however this was done to be in-line with ICAAT regulations and did not incur any extra costs.

III.E.2 Data quality issues

There were no issues in the data quality.

III.E.3 Actions to avoid deviations

There were no significant shortfalls for the stock-related data in 2015. Malta would like to point out that it provided stock related data on a voluntary basis for species that it was not obliged to provide data for (i.e. catches greater than 200 tonnes or 10% of the total Community landings on average over the previous 3 years). Therefore planned minimum number of individuals to be measured at a national level is only applicable to *Thunnus thynnus*, *Xiphias gladius* and *Coryphaena hippurus*. For these three species, sampling effort will be combined at the end of three year period covered by the programme.

III.F Transversal variables

III.F.1 Capacity

III.F.1.1 Achievements: Results and deviation from National Programme proposal

All Maltese fishing vessels are registered in the Fishing Vessel Register of the Department of Fisheries and Aquaculture of the Ministry for Sustainable Development, the Environment and Climate change (MSDEC). Apart from other information, the Fishing Vessel Register database includes the following information related to each vessel:

- Typology
- Registration number
- Age (age of the hull)
- Dimensions: GT, length, width, draught.
- Engine power, type and age;
- Ownership
- Health and safety equipment

The information in the Vessel Register is updated on a continuous basis. Malta obtained the capacity variables from the Fleet Vessel Register as a census. Table III.F.1 was updated on this data.

Malta is aware that the DCF has no provisions for the exclusion of any part of the vessel population from the data collection. No part of the Maltese fleet was excluded from data collection for Capacity in 2015.

III.F.1.2 Data quality: Results and deviation from National Programme proposal

The software used conducts standard automatic checking and validation. Moreover, quality checking of the data was carried out by the officers responsible of the Fleet Vessel Register.

Although no shortfalls were present in the results obtained, and the National Programme proposal was followed, Malta is aware of the following weaknesses in its Fleet Vessel Registry system:

- Licenses for fishing vessels are now issued every year on their different expiring date. Commission Decision 93/2010 requires to base economic variables on the fleet as at 1st January of the reference year. Thus, this issuing system will not give the best picture of the fleet register for a reference year.

No precision estimates were calculated as the data obtained covered all the vessels (census).

III.F.1.3 Actions to avoid deviations

Not applicable.

III.F.2 Effort

III.F.2.1 Achievements: Results and deviation from National Programme proposal

Malta is aware that the DCF has no provisions for the exclusion of any part of the vessel population from the data collection. No part of the Maltese fleet was excluded from sampling. Table III.F.1 was updated with the information collected during the sampling year.

Malta gathered information on fishing effort by technique according to Appendix VIII (of the Commission Decision EC 949/2008), on a monthly basis.

The required data has been collected and includes all the information requested (Commission Decision EC 949/2008).

For vessels over 10 metres (LOA), data from logbooks were used. A census was conducted for the effort data obtained for the vessels > 10 metres.

For vessels less than 10 metres (LOA) the sampling scheme described in the National Programme (National Data Collection Programme Proposal, 2011-2013) was employed. This method ensures that all the required information on catches, landings and effort by fleet segment is obtained.

A census was performed when the number of vessels in a segment was low (this is to ensure that the data obtained is representative) and the sampling rates were increased for other segments as necessary. Moreover, data on discards by species (although rarely recorded) started to be collected during 2012 and continued in 2015.

Precision estimates were calculated for the data obtained from the Catch Assessment Scheme which was used to collect effort data for vessels with a length of < 10 m. For the remaining vessels, precision estimates were not calculated since data was collected through a census, and therefore all vessels larger than 10 m were covered.

Data on fishing effort, aggregated as required can be provided.

III.F.2.2 Data quality: Results and deviation from National Programme proposal

Table III.F.1 was updated with the values of the accuracy indicators (where applicable). The sampling rates, response rates and the precision levels achieved are very good. No shortfalls were present in the achieved accuracy.

III.F.2.3 Actions to avoid deviations

Data was cross-checked with different sources such as checking logbooks data with sales vouchers and checking the Catch Assessment survey data with sales vouchers.

III.F.3 Landings

III.F.3.1 Achievements: Results and deviation from National Programme proposal

The required data has been collected and includes all the information requested. Table III.F.1 was updated with the information collected during the sampling year.

Malta collected data on commercial landings mentioned in Appendix VIII (of the Commission Decision EC 949/2008, EC 93/2010). Landing figures were based on exhaustive data reported in logbooks (for vessels over 10 metre LOA), by sampling landings (for vessels under 10 metre LOA) and on sales notes/vouchers (>10m and <10m) from the official fish market.

Data on commercial landings are available by:

- Species
- Vessel
- Quarter
- Geographic area: Division (according to level 2 of geographical disaggregating defined in Appendix I of the Regulation) or for stocks mentioned in Appendix XII in the DCF, commercial landings can be disaggregated as in that Appendix
- Gear employed

Malta is aware that the DCF has no provisions for the exclusion of any part of the vessel population from the data collection. No part of the Maltese fleet was excluded from sampling.

III.F.3.2 Data quality: Results and deviation from National Programme proposal

Table III.F.1 was updated with the required information. No shortfalls were present in the results obtained.

III.F.3.3 Actions to avoid deviations

Not applicable.

III.G Research surveys at sea

III.G.1 Achievements: Results and deviation from National Programme proposal

Malta planned two scientific surveys for 2015; the MEDITS and the MEDIAS survey.

1. Mediterranean International Trawl Survey (MEDITS)

The aim of this survey is to produce basic information on the demersal resources in terms of population distribution as well as demographic structure, on the continental shelves and along the upper slopes at a global scale in the Mediterranean.

MEDITS 2015 was carried out following the MEDITS protocol (Version 7, 2013), in GSA 15 where 45 stations were sampled (Figure 1). The survey was conducted in August onboard the fisheries vessel DEGRE, MFA 0081. The abundance and weight of all the species trawled were recorded. Biological parameters (length, weight, sex and age where applicable as per the revised MEDITS protocol (Version 7, 2013) from the target species caught were measured. Following this protocol, otoliths for age reading are being collected. Age readings from 2012, 2013 and 2014 samples are now available. 2015 samples are being processed and work is being conducted to issue a new tender for 2016-7 samples is ongoing.

At the national level, data is being stored using ATrIS (AdriaMed Trawl Information System) by which data can then be transferred into TA, TB, TC files as specified by the MEDITS protocol in order to facilitate storage and exchange at the international level.

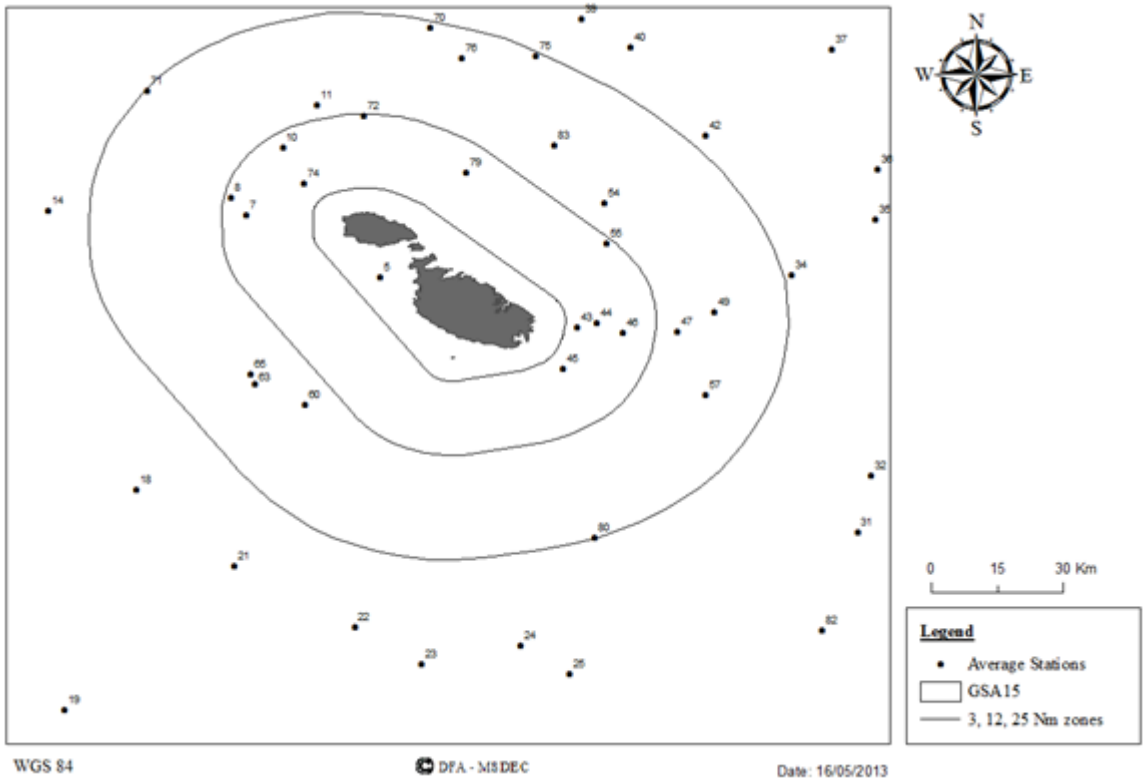

Figure 1. Position of the achieved MEDITS trawl survey stations for 2015

MEDiterranean Acoustic Survey (MEDIAS)

The survey MEDIAS was held on board RV "G. Dalla Porta", with the aim of conducting an interdisciplinary research to estimate the spatial distribution and abundance of pelagic organisms on the southern continental platform of Sicily and Maltese waters, between Marsala and Capo Passero, on an area of about 2700 m^2. This survey was done in collaboration with the group of Oceanography of the IAMC-CNR section of Capo Granitola institute in Sicily.

Acoustic measurements of small pelagic fish stocks (*Engraulis encrasicolus* and *Sardina pilchardus)* were conducted with a multi-frequency scientific echo-sounder. Measurements of physical-chemical parameters of the water column were also collected. The positions of the transects sampled are shown in Figure 2 below.

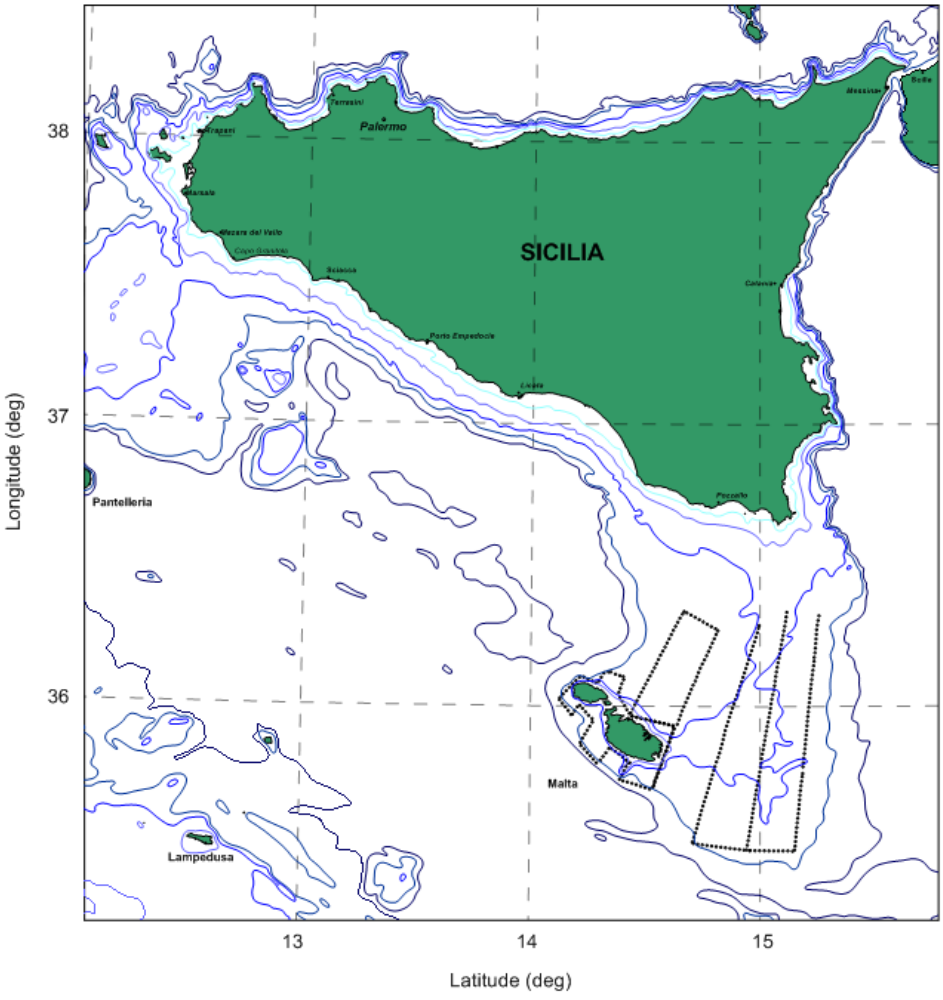

Figure 2. Position of transects for the MEDIAS survey in GSA 15

III.G.2 Data quality: Results and deviation from National Programme proposal

Data collected from MEDITS is suitable to analyse indicators 1 to 4 listed in Appendix XIII (Commission Decision EC 949/2008) since all the necessary data is collected. The survey

covers the largest proportion of the marine region annually in the same area using the same gear.

The results obtained from MEDITS and MEDIAS were satisfactory and barring the availability of age-reading data, no shortfalls that may impair quality of indices occurred.

III.G.3 Actions to avoid deviations

Not applicable.

IV Module of the evaluation of the economic situation of the aquaculture and processing industry

IV.A Collection of data concerning the aquaculture

IV.A.1 Achievements: Results and deviation from National Programme proposal

Aquaculture farms were segmented according to the major species that the companies' farm based on the value of sales and 'cages' is the fish farming technique used for all the companies in the population. One company farms sea bream, sea bass, amberjack and blue fin tuna, another company farms sea bream, sea bass and meagre. Additionally, another four companies farm blue fin tuna only. The target population and planned sample do not differ as a census was planned.

The frame for the collection of economic data was based on the aquaculture operations managed by the Department of Fisheries and Aquaculture within the Ministry for Sustainable Development, the Environment and Climate change and includes all operative aquaculture farms during the reference year.

Data collection has been completed through collaboration with the National Statistics Office since both entities collect similar data. The data was collected on a census basis based on company accounts. The data collected is currently being finalised in time for the relevant data call. The method used for collecting the data has slightly deviated from the proposed method in the NP Proposal for the years 2014-2016. Data is not collected directly by questionnaires by the Department of Fisheries and Aquaculture within the Ministry for Sustainable Development, the Environment and Climate Change but through questionnaires performed by the National Statistics Office . The estimates of the parameters are the same as those proposed in the National Programme proposal for the years 2014-2016.

IV.A.2 Data quality: Results and deviation from National Programme proposal

No deviations from the National Programme proposal were reported.

IV.A.3 Actions to avoid deviations

One of the major problems is the lack of cooperation from the companies to provide the data requested in a timely manner. Postal questionnaires were followed by direct interviews when necessary so as to increase the accuracy of the data collection and most importantly make the process quicker. The companies were contacted by email and by phone several times however some companies still did not respond. So as to forestall this, the DFA has signed a memorandum of understanding with the National Statistics Organisation (NSO) to collect data together and to avoid duplication of work seeing as in previous years the NSO carried out its own aquaculture surveys independently. As from 2014 (reference year 2013), aquaculture data was collected through this method.

IV.B Collection of data concerning the processing industry

IV.B.1 Achievements: Results and deviation from National Programme proposal

A census is planned for all the variables requested by Commission Decision 2010/93/EU in Appendix XII. The collection of economic data is based on the Maltese business directory and processed fisheries products for sale on the local market.

The planned sampling rate equals to 100%, and data collection is currently underway.

The methods used for collecting the data and for estimating the variables requested are the same as those proposed in the NP proposal for the years 2011-2013 and 2014-2016 and therefore no deviations are present.

As opposed to what was proposed in the latest version of the National Programme proposal 2011-2013 and 2014-2016, the data with regard to net financial costs does not take into account financial income and will be collected in accordance with the definition found in Article 23, item C.13 of the IVth Council Directive 78/660/EEC.

IV.B.2 Data quality: Results and deviation from National Programme proposal

Data is currently being finalised. This will be submitted once the relevant data call will be issued.

IV.B.3 Actions to avoid deviations

The major problem in collecting this data is the lack of cooperation from the companies to provide the data requested in a timely manner. Postal questionnaires are followed by direct interviews when deemed necessary so as to increase the accuracy of the data collection and most importantly quicken the process. Malta will continue contacting the companies to try to collect the data from the five fish processing companies which did not provide the data until the processing industry economic data call is published.

V Module of evaluation of the effects of the fishing sector on the marine ecosystem

V.A Achievements: Results and deviation from National Programme proposal

The data requirements to calculate the ecosystem indicators 1-4 are available from the Mediterranean International Trawl Survey (MEDITS; see section III.G.1). The trawl survey data is available since 2004 for the GFCM GSA 15.

For the indicators 5-7 the VMS data required is available. This data is available for all the Maltese fishing fleet > 12 m in the Mediterranean and is recorded every 2 hours, and data is available at this resolution.

Indicator 8, rate of discarding can be estimated from the on-board observation data for the fleets Malta surveyed and the transversal data (see section IIIC and IIIF).

For indicator 9, data collected through the economic survey and transversal data (see section IIB and IIIF) are required, and these were successfully collected. Such data is collected at the fleet and length segment level as required by the current regulation. For the estimation of the indicator, however, this needs to be by gear.

There were no shortfalls in the achieved data collection. Table V.1 was updated accordingly.

V.B Actions to avoid deviations

Not applicable.

VI Module for management and use of the data

VI.A Achievements: Results and deviation from National Programme proposal

The data collected within the framework of the DCF has been used for scientific purposes both for national and international needs. The data has been submitted to international organisations for stock assessment purposes and scientific analysis. Malta has submitted/will be able to submit (for data calls that have not been issued yet) data collected within the framework of the Data collection to the following international bodies:

i) Joint Research Centre (JRC) of the European Commission

- Official call for capacity, landings, effort and economic data (Fleet Economic data call)
- Official call for data on landings, catches, length and age compositions, effort and trawl surveys in the Mediterranean
- Official call for data concerning the EU fish processing industry (Processing Industry data call)
- Official call for data concerning the Aquaculture (Aquaculture data call)
-

ii) International Commission for the Conservation of Atlantic Tunas (ICCAT)

- Form I fleet characterisation
- Task I nominal catch estimates
- Task II catch and effort statistics
- Task II size sampling
- Task II catch at size estimates

iii) General Fisheries Commission for the Mediterranean (GFCM)

- Dolphinfish annual reporting form
- Task I statistical matrix

iv) RCM Med:

- Mediterranean Planning Group for Methodological Development (PGMed)
- RCM for the Mediterranean & Black Sea & Large Pelagics Fisheries (RCM MED&BS-LP)
-

VI.B Management of data

There were no shortfalls in the achieved actions compared to what was planned in National Programme Proposal.

At present, the national set-up for storing and managing the different categories of DCF data is via separate excel sheets. Checking and validation of data is carried out both through using specifically created R scripts, and manually. Data for the Mediterranean International Trawl

Survey (MEDITS), part of the Module A3 (Surveys at Sea), is stored in the AdriaMed Trawl Surveys Information Systems (ATrIS). The system is MS/Access based and was originally developed by the FAO AdriaMed project. This data is checked using Rome; an R-script provided and recommended by the MEDITS Steering Committee.

Since the first quarter 2015, data is being stored in a single shared read-only folder created on a NAS (Network Access Storage) device with raid 6 configuration. To ensure security and integrity of data, access is controlled via a username/password combination, with editing rights being reserved to two officers.

The Fisheries Information System (FIS) has been implemented according to the specifications originally drawn up, with all the modules being fully operational. The FIS has been developed to meet the regulatory references laid down in Council Regulation (EC) No 1224/2009, establishing a Community control system for ensuring compliance with the rules of the common fisheries policy, and Commission Implementing Regulation (EU) No 404/2011 laying down detailed rules for the implementation of Council Regulation (EC) No 1224/2009 establishing a Community control system for ensuring compliance with the rules of the Common Fisheries Policy.

As automated data entry validations were included but in a somewhat limited way, presently enhancements are being planned on the e-logbook both to automate the catchment of data where possible, to carry out data validation where manual entry has to occur and also introduce automated cross validation of data (e.g. fishing authorisation vis-à-vis catch declared regarding specimen and weight, and catch weight vis-à-vis weight sold) and to provide reports on a "management by exception" basis. These enhancements will be part of the e-logbook update to meet the requirements spelt out in the EU Regulation 1962/2016.

As above, MEDITS is being tackled through ATrIS – however the possibility of using a new database – Fishtrawl is currently being evaluated. Fishtrawl is similar to ATrIS, in that it has the possibility for data analysis/presentation. One key difference is that the database is hosted on a server, as opposed to a local database. Furthermore, Fishtrawl is adapted to receive age reading data. The JRC has been chosen as the database host, with Member States paying a maintenance fee. At present however, nothing has been signed and the database itself is still currently in trial mode. If adopted, data rights will belong to the MS.

A regional database is to be developed for EU MSs in the Mediterranean and Black Sea Region (Med&BS-RDB). Following discussions during the Regional Coordination Meeting for the Mediterranean and the Black Sea (RCM Med&BS) 2013, the said database will be hosted and maintained by the GFCM. Malta is aiming to form part of this database. Data for data calls will be uploaded there. Such a regional database should have the added benefits of the data being readily available to end users, including GFCM and ICCAT, upon request, as well as having fixed deadlines and fixed templates for data upload.

The choice of the development platform will be dependent on the infrastructure and established development tools that the GFCM is willing to put at the disposal of MSs. It is understood that specific portions of source code addressing sensitive statistical algorithms (T-SQL queries, R scripts or C# routines) might be made available to MS for iterative discussions and evolutions. During RCM Med&BS 2013 it was agreed that for the time being the Med&BS-RDB will include biological, economic and transversal data, although the format and what data should be incorporated will be discussed at the next meeting. With

regard to the surveys at sea, both MEDITS and MEDIAS are developing a separate regional database.

VI.C Data transmission

There were no issues in data provision.

VI.D Actions to avoid deviations

Not applicable.

VII List of acronyms and abbreviations

AER	Annual Economic Report
ATrIS	AdriaMed Trawl Information System
BFT	Blue fin Tuna
DCF	Data collection Framework
DCR	Data Collection Regulation
DES	Demersal species
EC	European Commission
EU	European Union
GFCM	General Fisheries Commission for the Mediterranean
FAD	Fish Aggregating Devices
FIS	Fisheries Information System
GIS	Geographical Information System
GSA	Geographical Sub-Area
GT	Gross Tonnage
IAMC-CNR	Institute for Coastal Marine environment – Centre for National Research
ICCAT	International Commission for the Conservation of Atlantic Tuna
ICES	International Council for the Exploration of the Sea
JRC	Joint Research Centre
LOA	Length Over All
MAREA	Mediterranean hAlieutic Resources Evaluation and Advice
MEDIAS	Mediterranean International Acoustic Survey
MEDISEH	Mediterranean Sensitive Habitats
MEDITS	Mediterranean International Trawl Survey
MFA	Professional Fishing Vessels – Full-Time
MFB	Professional Fishing Vessels – Part-Time
MS	Member state
MSDEC	Ministry for Sustainable Development, the Environment and Climate change
NP	National Programme
OTB	Bottom Otter Trawl
PGMed	Mediterranean Planning Group on Methodological Development
PPCU	Price Per Unit Capacity
PSU	Primary Sampling Unit
RCM Med&BS	Regional Co-ordination Meeting for the Mediterranean and Black Seas
RCM-NA	Regional Coordination Meeting - North Atlantic
RFMO	Regional Fisheries Management Organisation
RPI	Retail Price Index
RV	Research Vessel
SGECA	Subgroup on Economic Assessment
SGRN	Sub group for Research Needs
STECF	Scientific, Technical and Economic Committee for Fisheries
TA	Type of MEDITS data file
TB	Type of MEDITS data file
TC	Type of MEDITS data file
VMS	Vessel Monitoring System
WGCATCH	Working group on commercial catches

VIII Comments, suggestions and reflections

Not applicable.

IX References

Commission Decision 2010/93/EU adopting a multiannual Community programme for the collection, management and use of data in the fisheries sector for the period 2011-2013.

Commission Decision EC 949/2008 adopting a multi annual Community programme pursuant of Council Regulation (EC) No. 199/2008 establishing a Community framework for the collection, management and use of data in the fisheries sector and support for scientific advice regarding the Common Fisheries Policy. Version 2008.

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Guidelines for the submission of Annual Report on the National Data Collection Programmes under Council Regulation (EC) 199/2008, Commission Regulation (EC) 665/2008 and Commission Decision 2010/93/EU. Version for Annual Reports 2015.

ICES WGCATCH 2015. Report of the Working Group on Commercial Catches (WGCATCH), Lisbon, Portugal, 9-13th November, 2015.

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PG ECON 2013. Report on the 2nd Planning Group on Economic Issues (PGECON), 13th to 16th May, The Hague, 58 pp.

PGMed 2010. Report of the 4th Meeting of the Mediterranean Planning Group for Methodological Development (PGMed), Lisbon, 1st – 6th March 2010.

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Pilot study report, 2005: An assessment of the recreational fishing activities in Malta. As part of Malta's National Fisheries Data Collection Programme (2005) in line with Regulations EC 1639/2001 and EC 1581/2004 – October 2006.

RCM 2009. Report of the 6th Regional Coordination Meeting for the Mediterranean and Black sea (RCMMed&BS), Italy, Venice, 13–16th October 2009.

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Scientific, Technical and Economic Committee for Fisheries (STECF) – 49th Plenary Meeting Report (PLEN-15-02). 2015. Publications Office of the European Union, Luxembourg, EUR 27404 EN, JRC 97003, 127 pp.

Vigneau J., Mahevas S. (2007). Detecting sampling outliers and sampling heterogeneity when catch-at-length is estimated using the ratio estimator. *ICES Journal of Marine Science*, 64, (5) 1028-1032.

X Annexes

Annex 1- Bilateral agreements

Cyprus-Malta Bilateral agreement

ANNEX I

Department of Fisheries and Marine Research

MALTA CENTRE FOR FISHERIES SCIENCES

Bilateral Agreement between Cyprus and Malta
for the sampling of a shared metier in GSA 15 within their National Programmes
under the Data Collection Framework
(EC Regulations 199/2008, 665/2008 and Decision 2008/949/EC)

The following agreement has been made between Cyprus and Malta concerning the sampling of their shared metier *Bottom otter trawl targeting mixed demersal and deep sea species* in GSA 15, selected by both countries to be sampled as part of their National Data Collection Programmes:

The Cyprus trawlers involved in the shared métier and landing their catch in Maltese ports will be included in the sampling scheme organized by Malta for the collection of biological-métier-related variables. This agreement will apply until further notice.

Signed for Cyprus: Date: January 27th, 2009

Myrto Ioannou
National Correspondent of Cyprus

Signed for Malta: Date: January 27th 2009

Mark Dimech
National Correspondent of Malta

Annex 2 – R Scripts to compile tables

Table III.C.3

```
# Generic script to calculate the number of trips sampled at: a) market, b) onboard

rm(list=ls())
library(plyr)

setwd("C:/Users/pacem117/Desktop/Nicaragua/1. DCF data")
filename <- "C:/Users/pacem117/Desktop/Nicaragua/1. DCF data/2015.03.03_BIO DATA
2014 (Compiled).csv"
biodat <- read.csv(filename)

# Set data & variables
Day <- "Day"
Month <- "Month"
Year <- "Year"
StartDate <- "Date..Start.trip.Fishing."
EndDate <- "Date..End.trip.Fishing."
Registration.No. <- "Registration.No."
Gear <- "Gear"
Onboard.market <- "Onboard.market"
Scientific.Name <- "Scientific.Name"

SampleYear <-2014

biodat <- biodat[biodat[,Year]==SampleYear,]# select only sample year

biodat$Date <- as.character(paste(biodat[,Day],biodat[,Month],biodat[,Year],sep="/")) #
Creation of date field
biodat$Date <- as.Date(biodat$Date,"%d/%m/%Y")
biodat[,StartDate] <- as.Date(biodat[,StartDate],"%d/%m/%Y")
biodat[,EndDate] <- as.Date(biodat[,EndDate],"%d/%m/%Y")

#' Important to distinguish between onboards and market sourced samples when creating the
TripID
#' By convention, the trip date is taken as the date when the samples were landed. Therefore,
in
#' the case of market sourced samples, the trip date is the date of when the sampless were
#' purchased as this is the closest date to the landing date. In the case of onboards, this is the
#' date recorded as "Trip End".
#'
DateInd <- is.na(biodat[,EndDate]) # Index to indentify records where trip start/end dates are
not available
biodat$TripID[DateInd] <-
as.factor(paste(biodat[,"Date"],biodat[,Registration.No.]))[DateInd] # True
biodat$TripID[!DateInd] <-
as.factor(paste(biodat[,EndDate],biodat[,Registration.No.]))[!DateInd] # False
```

```
biodattrip <- ddply(biodat,c(Gear,Onboard.market),summarise,N.trips =
length(unique(TripID)))

write.csv(biodattrip,"Ntrips.csv")
```

Table III.C.5

```
# Generic script to calculate the number of fish sampled by: a) landings, b) discards
# per species, per gear

rm(list=ls())
library(plyr)

setwd("C:/Users/pacem117/Desktop/Nicaragua/1. DCF data")
filename <- "C:/Users/pacem117/Desktop/Nicaragua/1. DCF data/2015.03.03_BIO DATA
2014 (Compiled).csv"
biodat <- read.csv(filename)

# Set data & variables
Year <- "Year"
Registration.No. <- "Registration.No."
Gear <- "Gear"
Landings.Discards <- "Landings.Discards"
Scientific.Name <- "Scientific.Name"
Length_mm <- "Length_1_.mm."
Length_cm <- "Length_1_.cm."

SampleYear <-2014

biodat <- biodat[biodat[,Year]==SampleYear,]# select only sample year

biodat$Length <- biodat[,Length_mm] # Account for missing length measurements for a
given unit by combining into one length field
biodat$Length[is.na(biodat[,Length_mm])] <-
biodat[,Length_cm][is.na(biodat[,Length_mm])]*10

biodatlength <-
ddply(biodat,c(Gear,Scientific.Name,Landings.Discards),summarise,N.Specimens =
length(Length))

write.csv(biodatlength,"Nlength.csv")
```

Table III.E.3

```
##================================================================
=============##
##  Script for calculating CVs developed in PGMed and adapted to Maltese data   ##
##================================================================
=============##

rm(list=ls())
```

```
setwd("~/DFA/DCF/Malta Technical Report/2014/Calculations and Data")

## read the data
d <- read.csv("CV.2014.s@l.v2.csv",header=TRUE)

t <- aggregate(d$No..individuals.sampled,by=list(d$Species,d$Metier),
            sum,na.rm=TRUE)
# No of individuals sampled per sp per gear

ff <- function(x) {
  x2 <- length(unique(x))
  return(x2)
}
# Returns count of unique elements in the vector
ff2 <- function(x) {
  x2 <- as.character(unique(as.character(x)))
  return(x2)
}
# Returns count of unique elements in the numeric vector

t2 <- aggregate(d$Trip.Code,by=list(d$Species,d$Metier),ff)
# number of trips per sp per metier

t3 <- aggregate(d$MS,by=list(d$Species,d$Metier),ff2)
# number of countries per sp per metier


t <- data.frame(t,simplify2array(t3),t2$x)[,-c(4,5)]

t <- t[,c(1,2,4,3,5)]
colnames(t) <- c('Species','Metier','MS','Number of individuals',
              'Number of sampled trips')
## select cases
ind <- which(t[,4]>100 & t[,5]>1)
# select cases where there are more than a 100 individuals and more than one
# trip (index)
t2 <- t[ind,-c(4,5)]
# select the instances according to the index 'ind' and remove no of individuals and
# number of trips
tcases <- t2
cases <- vector(mode='list')
for (i in 1:nrow(tcases)) {
  cases[[i]] <- list(Species=as.character(tcases[i,1]),
                  Metier=strsplit(as.character(tcases[i,2]),',')[[1]],
                  MS=strsplit(as.character(tcases[i,3]),',')[[1]])
}
# put tcases in list format with three layers (sp, metier and ms)


## length weight data
```

```
lw <- read.table("LW_fuckingallofthem.2.csv",header=TRUE,sep=',',
              colClasses =c('character','numeric','numeric','character',
                            'character'))

## LOOP over possibilities with more than 100 individuals and in the dataset
CVF <- data.frame(CV=NA,N=NA)
# create data frame to put CVs in
name <- NA
library(reshape2)
library(reshape)


for (case in 1:length(cases)) {
  ind <- which(d$Species %in% cases[[case]][[1]] & d[,4] %in% cases[[case]][[2]])
  # select rows from data set that match with the cases
  d2 <- d[ind,]
  # select the cases in the index

  ## if there is more than one trip code ##
  if (length(unique(as.character(d2[,5])))>1) {
    ## if there is a and b data
    if (length(which(lw$sp==cases[[case]][[1]]))>0) {
      weight <- lw$a[which(lw$sp==cases[[case]][[1]])]*
        (d2$Length..cm.)^(lw$b[which(lw$sp==cases[[case]][[1]])])/1000
      # calculate weight from length of every individual

      d2 <- data.frame(d2,weight=weight)
      # add weight to the data frame

      ## REMOVE CRAZY SIZES
      ind.crazy <- which(d2$Length..cm.>(mean(d2$Length..cm.)+
                                  3*sd(d2$Length..cm.)) | d2$Length..cm. < (
mean(d2$Length..cm.) -
                                                          3*sd(d2$Length..cm.) ))
      # if length is bigger than the mean plus sd*3 or smaller than the mean minus
      # sd*3, the size is crazy

      if (length(ind.crazy)>0) {
        d2 <- d2[-ind.crazy,]
      }
      # crazy sizes removed

      ## remove tails (5 percent)
      ag <- aggregate(d2[,8],by=list(d2$Length..cm.),sum,na.rm=TRUE)
      # sum of lengths for each length
      ag <- data.frame(Size=ag$Group.1,pcent=cumsum(ag$x/sum(ag$x))*100)
      # data frame with cumulative percentile of each length 'segment'
      smin <- ag$Size[which.min(abs(ag$pcent - 5))[1]]
      # find length 'segment' which will be the minumum once smallest 5% are
      # removed
      smax <- ag$Size[which.min(abs(ag$pcent - 95))[1]]
```

```
# find length 'segment' which will be the maximum once largest 5% are
# removed
d2 <- d2[which(d2$Length..cm.>smin & d2$Length..cm.<smax),]
# select only the sizes bigger than the smallest 5% and smaller than the
# largest 5%
##

## At this point d2 contains only the sp and metier of interest; for species
## with more than one trip; with weights added if we had a and b; also the
## crazy sizes (v diff from mean) and the tails have been removed
mat <- cast(d2, Length..cm. ~ Trip.Code , sum,
          value = 'No..individuals.sampled',na.rm=TRUE)
# create a table with each length 'segment' as row and trips as columns and
# count of corresponding lengths in d2

matW <- cast(d2, Length..cm. ~ Trip.Code , sum, value = 'weight',na.rm=TRUE)
# create a table with each length 'segment' as row and trips as columns and
# count of corresponding weights in d2
mat <- mat[,-1]
matW <- matW[,-1]
# Remove 'label' column

## remove all trips below threshold individuals
threshold <- 0
ind.trip <- which(apply(mat,2,sum,na.rm=TRUE)>threshold)
# select trips where some fish have been sampled (or number of fish is above
# threshold if threshold is more than 0)
if (length(ind.trip)>1) { #if you have more than one trip with data...
  # ... else it would just add NAs
  mat <- mat[,ind.trip]
  # remove trips where no fish have been sampled
  matW <- matW[,ind.trip]
  # remove trips where no fish have been sampled

  ## total weight of each sample DIVIDED BY 1000 TO CONVERT TO TONS
  weight.avg <- apply(mat*matW,2,sum,na.rm=TRUE)/1000
  ## total weight OF EVERYTHING
  weight.total <- sum(weight.avg,na.rm=TRUE)
  ## sum by size.class; NO OF INDIV SAMPLED IN EACH LENGTH 'SEGMENT'
  sum.size <- apply(mat,1,sum,na.rm=TRUE)
  ## COMPUTE DELTA MATRIX (difference)
  mat2 <- matrix(NA,dim(mat)[1],dim(mat)[2])
  colnames(mat2) <- colnames(mat)
  rownames(mat2) <- rownames(mat)
  # first create empty matrix
  ## loop over trips and size classes
  for (i in 1:dim(mat2)[1]) {
    for (j in 1:dim(mat2)[2]) {
      mat2[i,j] <- mat[i,j]-(sum.size[i]/weight.total)*weight.avg[j]
    }
  }
```

```
      # difference between number of indiv per length 'segment' per trip
      # and number of individuals in length 'seg' divided by tot weight multiplied
      # by weight in the trip

      ## VAR MATRIX
      var.mat <- mat2*mat2
      # multiply matrix 2 by itself for some reason

      ## VAR SUM PER SIZE CLASS
      var.sum <- apply(var.mat,1,sum,na.rm=TRUE)
      # sum of rows of the matrix you've multiplied with itself

      ## var per size.class - I don't know where this formula is from
      var.size <- (3/(weight.total^2))*(var.sum*0.5)
      # vector for each length segment

      ## var Dj
      vardj <- var.size*(sum(d2$Meusured.Whole.Weight..kg.))^2
      ## NBLT
      nblt  <- round(sum.size*(sum(d2$Meusured.Whole.Weight..kg.))/weight.total)
      ## CV
      CV <- sqrt(vardj)/nblt*100
      ## N landed*CV
      NLcv <- nblt*CV
      ## CV final
      CVF <- rbind(CVF,data.frame(CV=sum(NLcv,na.rm=TRUE)/sum(nblt),
                           N=length(unique(d2$Trip.Code))))
      # gives final table with CV and number of trips for that species and metier
      # combo
      name <- cbind(name,paste(case))
     } else {
      ## CV final
      CVF <- rbind(CVF,data.frame(CV=NA,
                           N=NA))
      name <- cbind(name,'NA')
     }
    }
  }
}
CVF <- CVF[-1,]
tab <- cbind(tcases,CVF)
tab <- tab[order(tab$Species),]
ng <- gsub('c|\\(|\\)|\\"',",tab$MS)
tab$MS <- ng
colnames(tab)[5] <- 'Number of sampled trips'
tab
write.csv(tab, file = "s@l.final.csv", row.names=T)
```