

## Responsible National Bodies for implementation of Work Plan

### National Coordination:

- Direcção-Geral dos Recursos Naturais, Segurança e Serviços Marítimos/Directorate General for Natural Resources, Safety and Maritime Services (DGRM)

### Participating Entities:

- Direcção-Geral dos Recursos Naturais, Segurança e Serviços Marítimos/Directorate General for Natural Resources, Safety and Maritime Services (DGRM)
- Instituto Português do Mar e da Atmosfera / Portuguese Institute for Sea and Atmosphere (IPMA)
- Direção Regional das Pescas da Região Autónoma dos Açores/Regional Directorate for Fisheries in Azores (RAA)
- IMAR - Instituto do Mar do Departamento de Oceanografia e Pescas / IMAR - Institute of Marine Research of the Department of Oceanography and Fisheries (IMAR/DOP)
- Direção Regional de Pescas da Região Autónoma da Madeira/ Regional Directorate for Fisheries in Madeira (DRPM/RAM)

### Council Regulation (EC) No 199/2008 of 25 February 2008

concerning the establishment of 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

### Commission Regulation (EC) No 665/2008 of 14 July 2008

laying down detailed rules for the application of Council Regulation (EC) No 199/2008

Commission Implementing Decision (EU) 2016/1251 of 12 July 2016  
adopting a multiannual Union programme for the collection, management and use of data in  
the fisheries and aquaculture sectors for the period 2017-2019

# PORTUGAL

## Work Plan for data collection in the fisheries and aquaculture sectors

2018-2019

November 15, 2017

# CONTENTS

Pilot Study 1.1: Relative share of catches of sea bass recreational fisheries compared to commercial fisheries in Mainland .....	3
Pilot Study 1.2: Relative share of catches of recreational fisheries compared to commercial fisheries .....	5
Pilot Study 1.3: Relative share of catches of elasmobranchs and highly migratory species recreational fisheries compared to commercial fisheries in Azores (ICES area X) .....	6
Pilot Study 1.4: Relative share of catches of highly migratory species recreational fisheries compared to commercial fisheries in Madeira (CECAF 34.1.2).....	7
Text Box 1E: Anadromous and catadromous species data collection in fresh water.....	8
Pilot Study 2: Level of fishing and impact of fisheries on biological resources and marine ecosystem .....	9
Text Box 1G: List of research surveys at sea .....	10
<b>SECTION 2: FISHING ACTIVITY DATA</b> .....	22
Text Box 2A: Fishing activity variables data collection strategy .....	22
<b>SECTION 3: ECONOMIC AND SOCIAL DATA</b> .....	23
Text Box 3A: Population segments for collection of economic and social data for fisheries .....	23
Pilot Study 3: Data on employment by education level and nationality .....	25
Text Box 3B: Population segments for collection of economic and social data for aquaculture .....	25
Pilot Study 4: Environmental data on aquaculture .....	27
Text Box 3C: Population segments for collection of economic and social data for the processing industry.....	27
<b>SECTION 4: SAMPLING STRATEGY FOR BIOLOGICAL DATA FROM COMMERCIAL FISHERIES</b> .....	27
<b>Text Box 4A.1: ICES Division IXa</b> .....	27
<b>Text Box 4A.2: IOTC</b> .....	30
<b>TB 4A.2 At-sea sampling (IOTC longline)</b> .....	30
<b>Text Box 4A.3: NAFO</b> .....	31
<b>Text Box 4A.4: ICES Division X</b> .....	33
<b>Text Box 4A.5: CECAF 34.1.2.</b> .....	35
<b>Text Box 4A.6.: ICCAT</b> .....	38

## SECTION 1: BIOLOGICAL DATA

### Pilot Study 1.1: Relative share of catches of sea bass recreational fisheries compared to commercial fisheries in Mainland

#### PS1.1

##### 1. Aim of pilot study

The few studies conducted on recreational fisheries in the Portuguese coast indicate that this activity involves a large number of fishermen. It is also referred that this activity may have a high impact on some fish stocks (e.g. Erzini *et al.*, 2008; Rangel & Erzini, 2007; Veiga *et al.*, 2010; Veiga, *et al.*, 2013). Nevertheless, as the activity of recreational fishing in Portugal remains insufficiently monitoring, DGRM has in course a preliminary study, developed by “Centro de Ciências do Mar e do Ambiente” in “Fundação da Faculdade de Ciências da Universidade de Lisboa” (MARE/FCUL), to obtain an overview on sea bass recreational fishing and to define a data collection methodology to this species. With those outcomes, available in December 2016, DGRM will launch a pilot study to obtain consistent information on sea bass recreational fishing activity namely catches estimates, fishing areas and seasons, catch composition and released catches.

The pilot study will be developed by an external entity. The study has to be ordered through a tendering process.

##### 2. Duration of pilot study

Taking into account the duration of administrative procedures, it is expected that the pilot study will start in the second semester of 2017. The duration is estimated to be of 3 semesters as the pilot study shall be developed during a whole fishing season.

##### 3. Methodology and expected outcomes of pilot study

Recreational fishing in Portugal includes three segments, onshore fishing (“pesca apeada”), boat fishing and spear fishing. In mainland the highest number of licenses is from onshore fishing. In 2015, 112.467 licenses were issued for onshore fishing followed by boat fishing with 64.171 licenses. The number of licenses may not match with the number of the recreational fishermen who exercised this activity as a significant number of licenses are granted for periods less than one year and, each year, a fisherman may acquire several licenses. Moreover, recreational fishing without gears does not need a fishing authorization.

##### 3.1. Population

The population is all recreational fishermen in a given year or period, who carry on their activity in the Portuguese coast, integrating the three segments: onshore fishing; boat fishing and spear fishing. The universe of the population corresponds to the total number of allowances allocated to these three groups.

##### 3.2. Sampling

Sampling is expected to include some/all of the following components:

- Surveys by questionnaire available on the Internet and distributed among members of the recreational fisheries associations;
- Surveys by questionnaire conducted by observers during sampling surveys in coastal areas and recreational marinas, on dates randomly settled;
- Surveys in fishing competitions (sport fishing).

Sampling shall be stratified by recreational segments: onshore fishing; boat fishing and spear fishing and by coastal areas (NUTS II i.e. North, Centre, Lisbon area, Alentejo and Algarve).

For fishing competitions, sampling will be focused in five fishing contests.

Surveys of active fishermen in coastal areas will be carried out according to "roving creel surveys" method, based on the work of Malvestuto *et al.* (1978), Pollock *et al.* (1994) and Lockwood (2000). This method is particularly suitable for application in large areas where the distribution of fishermen is dispersed and unknown (Malvestuto 1996). In general, it is a direct contact method, in which a team of researchers travels to a given area and randomly intercepts the fishermen (Malvestuto, 1996).

For boat and spear fishing, the method of "access point survey" will be used. Surveys will be conducted at known points of access such as ports, marinas and landing ramps, in order to obtain quantitative information regarding the fishing effort and catches.

The pilot study will be based on a stratified random sampling method with unequal probabilities of selection. This approach intends to divide the population into non-overlapping sampling units or strata, after each unit was individually sampled. The stratified sampling is particularly useful in cases where populations and different habitats have to be covered, allowing the reduction of the variances coming from the estimations (Malvestuto *et al.*, 1978, Pollock *et al.*, 1994).

The stratification process will be carried out at spatial and temporal scales. Concerning the spatial scale, the study area will be divided into five zones, corresponding to the coastal areas of the divisions NUTS II: North, Centre, Lisbon area, Alentejo and Algarve. Each of these zones will be further divided into sections of 5 km long. Then, 10 to 20 sections per zone, depending on its size, will be sampled.

Concerning temporal scale, the sample will be stratified by season, namely: spring, summer, autumn and winter. The sampling period will be between 9:00h and 18:00h. Previous studies on recreational fishing in coastal areas showed that the struggle between the sunrise and 9:00h and between 18:00h and the sunset is residual when compared with the remained daytime (Erzini *et al.* 2008).

### 3.3 Data collection

Data collection will be focused on three key aspects, namely: socio-economic characterization, fishing method, estimation of fishing effort and catches.

Sampling carried out on onshore fishing and fishing competitions will also collect information on the size and weight of the captured individuals.

Questionnaires will be used for data collection and databases will be organized with all the collected information.

### References

Erzini, K, Veiga, P, Ribeiro, J., Almeida, C., Oliveira, F., Bentes, L., Monteiro, P. and Gonçalves, J. 2008. Caracterização da pesca recreativa de costa do sul e sudoeste de Portugal. University of Algarve. Project Final Report. 127 pp.

Lockwood, R. N. 2000. Sportfishing Angler Surveys on Michigan Inland Waters, 1993-99. Michigan Department of Natural Resources. Ann Arbor, USA. Fisheries Technical Report 2000-3. 16 pp.

Malvestuto, S. P., Davies, W. D. and Shelton, W. L. 1978. An Evaluation of the Roving Creel Survey with Nonuniform Probability Sampling. Transactions of the American Fisheries Society, 107: 255-262.

Malvestuto, S. P. 1996. Sampling the recreational creel. In: Fisheries Techniques (Murphy, B. R. W., D.W.,

ed.), pp. 591-620. Bethesda, Maryland: American Fisheries Society.

Pollock, K. H., Jones, C. M. and Brown, T. L. 1994. Angler survey methods and their applications in fisheries management. American Fisheries Society Special Publication 25. Bethesda, USA: 371 pp.

Rangel, M. O. and Erzini, K. 2007. An assessment of catches and harvest of recreational shore angling in the north of Portugal. *Fisheries Management and Ecology*, 14: 343-352.

Veiga, P., Ribeiro, J., Gonçalves, J. M. S. and Erzini, K. 2010. Quantifying recreational shore angling catch and harvest in the south of Portugal (Northeast Atlantic): implications for conservation and integrated fisheries management. *Journal of Fish Biology*, 76: 2216-2237.

## **Pilot Study 1.2: Relative share of catches of recreational fisheries compared to commercial fisheries**

### **PS1.2 – Recreational fisheries in Mainland**

#### **Pollack, elasmobranchs, highly migratory species and eel**

##### 1. Aim of pilot study

This pilot study aims to estimate the total catch of the pollack, elasmobranches, highly migratory species and eel caught by recreational fishing in Portugal-mainland.

##### 2. Duration of pilot study

Taking into account the duration of administrative procedures, it is expected that the pilot study will start in the second semester of 2017. The duration is estimated to be until the end of 2018.

##### 3. Methodology and expected outcomes of pilot study

The national law applicable to recreational fishing was changed in 2014 by Portaria 14/2014, 23 January. Since then, the catches of several species, mainly tuna and tuna like species and sharks (*Carcharodon carcharias*, *Cetorhinus maximus*, *Lamna nasus*, *Hexanchus griseus*, *Carcharhinus falciformis*, *Carcharhinus longimanus*, *Alopis superciliosus*), if caught, must be released outright. The number of specimens per vessel and day, for tuna and tuna like species is also limited, namely to 3 bigeye tuna specimens, an annual quota of 500 kg for bluefin tuna, and a limit of 1 specimen for swordfish, blue marlin, white marlin and mako shark. National legislation also makes it mandatory to answer a survey promoted by DGRM, when required, and those who catch tuna-like species are obliged to fill a form on the DGRM website Art 16º (Erzini *et al.*, 2008).

Concerning pollack there are no reports of catches by recreational fishing. However, a preliminary evaluation will be carried out to confirm this.

With regard to fishing for highly migratory species by recreational fishermen, no significant impact of fishery carried onboard maritime tourist boats is expected. On the other hand, sport fishing catches, which take place mainly in the south of Portugal, are expected to be the best option to evaluate the long term trends in abundance, weight, mean size, and diversity of the catches taken. For countries such as Portugal, where historical information regarding the recreational fishing catches is scarce, fishing records from sport fishing competitions can be a cost-effective method to analyze long term trends in catch rates and effort and mean size of fish and to assess the status of a fishery (Coll *et al.*, 2004; Gartside *et al.*, 1999; Pradervand *et al.*, 2007). Additionally, anglers that participate in sport fishing competitions are generally more specialized and have different motivations for fishing than the recreational fishers in general.

Logbooks survey will be distributed among members of the sport fishing companies and associations to

estimate fishing effort, catch rates and composition, catch and released and economic expenses. The universe of the population corresponds to the total number of allowances given by area. Additional surveys will be conducted at known points of access such as ports, marinas and landing ramps, in order to obtain the total number and demographic profile of sport fishermen.

The data will be compiled, and used to estimate the catches of the recreational fishery based on the total reported effort. These estimates will be compared with the catches from the commercial fisheries, already available and regularly reported to DGRM. This will provide an estimate of the relative share of the catches from the recreational fishery compared to the total catches, for each of those species. With this information, it will then be possible to assess the relative impact of the recreational fisheries activities, and determine the need to establish regular monitoring and data collection programs for this activity. This information will also be useful to prioritize activities within the various components of the recreational fisheries.

Concerning eel, recreational fishing is forbidden in areas under maritime jurisdiction (Portaria nº 14/2014, of 23 January). In 2017, legislation is expected to be published with the ban of recreational fishing in fresh waters. However, a sampling plan will be decided if legislation with the ban for freshwater is delayed.

#### References

Coll, J., Linde, M., Garcia-Rubies, A., Riera, F. and Grau, A. M. 2004. Spear fishing in the Balearic Islands (west central Mediterranean): species affected and catch evolution during the period 1975-2001. *Fisheries Research*, 70: 97-111.

Gartside, D. F., Harrison, B. and Ryan, B. L. 1999. An evaluation of the use of fishing club records in the management of marine recreational fisheries. *Fisheries Research*, 41: 47-61.

Pradervand, P., Mann, B. Q. and Bellis, M. F. 2007. Long-term trends in the competitive shore fishery along the KwaZulu-Natal coast, South Africa. *African Zoology*, 42: 216-236.

### **Pilot Study 1.3: Relative share of catches of elasmobranchs and highly migratory species recreational fisheries compared to commercial fisheries in Azores (ICES area X)**

#### **PS1.3**

##### 1. Aim of pilot study

This pilot survey aims to estimate the total catch of elasmobranches and tuna species by recreational fishing in Azores.

##### 2. Duration of pilot study

The pilot survey is designed to have the duration of 16 months, between June of 2017 and September of 2018.

##### 3. Methodology and expected outcomes of pilot study

The recreational fishing pilot survey for Azorean region is focused on the modality of recreational boat fishing. The methodology is based on an off-site survey design comprising three main elements which will be executed by phone: i) screening survey to estimate the characteristics of the population of recreational boat fishers (number of fishers, their demographic profile and stated fishing avidity); ii) 12 month logbooks survey selected during the screening survey to estimate fishing effort, catch rates and economic expenses; iii) one season (June-September) logbooks survey for charter boats to estimate fishing effort, catch rates and economic expenses.

The screening survey aims to estimate the total number and demographic profile of recreational boat fishers in

Azores. The survey objective is to contact 3000 households in a period of four months with a stratified random design (accounting the island population weight) using the Portuguese telephone database (PT – Portugal Telecom company) from Azores region. The survey is embedded in an omnibus questionnaire that will cover the thematic “use of sea”. One member of the household will respond to the questionnaire on behalf of each member of the family of 6 years old or older. Respondents will be asked whether each member of their household had fished recreationally in the Azores during 2017, which gear(s) they had used, whether they were planning to do any recreational fishing in the Azores in 2018 and whether they would be interested in participating in a 12-month logbook survey in the period of 2017-18. In addition, participants who had fished during 2017 will be asked to indicate the number of fishing trips (1–10, 11–20, 21–30, 31–50, or > 50 trips) that were undertaken in the previous 12 months in an attempt to profile activity into broad avidity classes.

The logbook survey aims to monitor fishing activity in detail over 12 months. The minimum age of participation is 6 years old and participants will be selected from two different sources: i) those respondents who, during the screening survey, had indicated an interest in participating in the logbook survey; and ii) the use of boat fishing licenses data to obtain the contact of the boat fishers. Logbook survey participants will be sent a survey kit comprising a logbook per each trip and a logbook manual. Participants are asked to record detailed information in the logbooks for each fishing trip undertaken and they will then be contacted by phone once a month and requested to transfer the data recorded in their paper logbooks to the survey logbook filled by the survey member.

In relation to the recreational boat charters for big game fishing and bottom fishing, it is expected that logbooks will be provided to the enterprises in order to obtain their retained and catch and released per trip. They will be contacted by phone once a month and requested to transfer the data recorded in their paper logbooks to the survey logbook filled by the survey member.

#### **Pilot Study 1.4: Relative share of catches of highly migratory species recreational fisheries compared to commercial fisheries in Madeira (CECAF 34.1.2)**

##### **PS1.4**

###### 1. Aim of pilot study

Conduct a study to analyze catches of species obtained in recreational fishing, and to assess the impact compared to commercial fishing. In order to determine the social and economic importance of this activity and define the rules that help maintaining a sustainable fishery.

###### 2. Duration of pilot study

From 1<sup>st</sup> January 2017 until 31th December 2017.

###### 3. Methodology and expected outcomes of pilot study

Madeira is a important attraction for marine tourism, with many activities directed to that sector. One of them, is offshore recreational fishery, directed mainly to the capture of large migratory species, is generally practiced along the south coast of the island, and their economic relevance is suspected to be very high, probably higher than the commercial fishery (Graça, 2009).

The most common type of fishing, which affects the populations of highly migratory species, is known as "Big Game Fishing". Trolling is the most used method of fishing from the vessel, where one or more fishing lines are thrown into the sea, and when the animal bites the hook, consists of running a large area at low speed (3 to 4 nodes), constant for a variable period of time, to tire him. The captured fish, depending on the species and its

state after the fight, can be or not released (“Catch and Release”). Normally, marlins are free, but sometimes, due to the effort made by the animal, could be dead or nearly, then it would take to the port, and they are measured, weighed, and normally donated to charity institutions. Instead, other species like tuna or wahoo, which has more gastronomic interest, sometimes are retained for consumption by the crew (Graça, 2009).

One of the problems is that this style of fishery, is also used by non professional fishermen involved somehow in a small scale into the artesanal fisheries, and since they do not have to declare fishing obtained, part of the catch of these species cannot be estimated.

Recreational fishing has a lower impact per vessel, but significant for its total volume. Definitely, this is a fishery with a social and economical relevance, but it still needs a lot of adjustments and some basic rules.

First, the companies of the R.A.M. will be contacted, which are responsible for providing this activity to the tourists, and will be asked for their cooperation to make an analysis of this fishery in the area. For that we need to perform a preliminary analysis of catches in recent years, hoping that they give us the historical catch data, with the species that have fished, their sizes and weights, the area and time of capture and the season. A request will be conducted that includes an explanation of the project and its objectives, along with a survey sheet that will be distributed to fishermen, to be filled every time the vessels goes out to the sea.

Also a permission will be asked for a scientific observer to be taken on board and participate in the fishery, to examine the protocol and do some sampling. The data will continue to be collected for the duration of the pilot study and will be analyzed to assess the catches and interaction with the commercial fishery.

The information obtained from surveys and samples obtained at the outings, will serve to create a database as a basis for statistical analysis, for the preparation of the final report of the pilot project.

Moreover, data on catches obtained by vessels engaged in fishing large pelagic of comercial fisheries will be analyzed. Also it will be interesting to try to relate the information obtained from the different catches with the migratory nature of these species, because they are highly related to their patterns of distribution and abundance. These could have been altered in recent years due to climate change that could modify the course of some oceanic currents.

The result of this study will allow us to know the abundance of species caught and to evaluate the status of their populations. Also the catch of the species subject to recreational fisheries will be analized, and be compared with those reported for commercial fishing, in order to develop a policy that includes both fisheries to characterize the stock defined for this type of species.

#### References

Graça, M.J.D. (2009) Caracterização da pesca grossa na ilha da Madeira. Dissertação apresentada para obtenção do grau de mestre em Biologia Marinha. Universidade do Algarve, Faculdade de Ciências do Mar e Ambiente (Faro). 60pp.

#### **Text Box 1E: Anadromous and catadromous species data collection in fresh water**

##### 1. Justification of data collection programme for the PT EMU

Stock assessment requires collection of stock indicators to accomplish the goals set by the Eel Regulation (mortality and biomass indicators). A combination of methods including the commercial fishery and independent surveys will be used as a proxy to estimate those indicators. The river basin chosen to represent the PT EMU is River Mondego (estuary and freshwater) to compare with data from the 1990's but because this

EMU is the whole country and the production of eels is affected by the type of aquatic system, a coastal lagoon (Santo André Lagoon) is also included in the data collection to represent the variety of aquatic systems (river + estuary + coastal lagoon). The fishery will be monitored (mortality) and a sample of eels will be collected (length, weight, sex, age).

It is prohibited to fish glass eels and silver eels in the PT EMU, which implies that commercial fisheries can only provide data for yellow eels between January and September, when the fishery is allowed. Data on recruitment, stock abundance and silver eel migration/production, have to be obtained from independent surveys. The methods used to collect that information will be electrofishing for freshwater and fyke nets for the estuary and coastal lagoon. To obtain data related to the fishery, questionnaires will be done to all fishermen licensed to fish in freshwater, and to all fishermen licensed to fish in brackish water. Besides, and to assess the pressure of the fishery, logbooks will be distributed monthly to some fishermen who volunteer to cooperate, and samples will be obtained from commercial fishery.

## 2. Justification of data collection programme for the Minho EMU

Glass eel: Glass eel fishing allowed for professional fishermen between November and February (4 new moons). Concerning recruitment analysis, it is intended to perform experimental fishing using one stow net in estuary, in new moon, between November and May. Position, depth, water temperature, salinity, water velocity as well as biological parameters such as length, weight and pigmentation stage will be recorded from a glass eel sample. Logbooks will be analyzed to estimate CPUE and compare with experimental fishing.

Yellow/silver eels: Commercial and recreational fishing is not allowed in the River Minho. Concerning the analysis of stock abundance and sex ratio of emigrating eel, it is intended to perform electric fishing in tributaries covering the maximum area during three years and sampling in different stream order classification. Fishing area ( $m^2$ ), stream average width, average depth, position, temperature, oxygen, visual sediment characteristics, as well as biological parameters such as length, weight and ocular index (Pankhurst and/or Durif indices), will be recorded. A sample of 30 eels per year in migrant stage (silvering) with length less than 50 cm, will be used for sex ratio and age analysis. In River Minho, in different points of the estuary, 10 fyke-nets will be used during two nights with a monthly periodicity. For biological data acquisition the same procedures apply as described above.

## **Pilot Study 2: Level of fishing and impact of fisheries on biological resources and marine ecosystem**

### **PS2**

#### 1. Aim of pilot study

Exploited marine communities are impacted by fisheries and environmental drivers that may lead to changes across the food web. Detecting how marine biodiversity responds to fishing or other factors such as environmental changes require the analysis of long-term data on fish communities and fisheries. A first step is to characterize marine communities (group of interacting species populations occurring together in space and time) and assess how it varies in space and time as well as potential drivers that may affect their structure and abundance. For example, fisheries removals (landings and discards) may lead to changes in marine communities and food webs, by affecting species and size composition. This pilot study aims to identify changes in biodiversity and community changes since 1990 and relate with pressure indicators (e.g. fishing effort). The identification of areas with high levels of biodiversity, highly impacted and/or significant changes in marine communities structure will allow to define data needs in terms of spatial coverage, that may require

changes in sampling effort either from fisheries (onboard and market sampling) or research surveys.

**2. Duration of pilot study**

From October 2017 to December 2019.

**3. Methodology and expected outcomes of pilot study**

The following data sources will be used:

- Groundfish surveys data conducted by IPMA (and former institutes) since 1979 along the Portuguese continental coast.
- Sampling data onboard bottom trawl commercial vessels (landings and discards) since 2004.
- Landings, logbooks and vessel monitoring systems (VMS) data from trawl commercial vessels available from DGRM since 2004.

Groundfish survey data will be used to determine and map biodiversity indexes and infer marine communities' structure. Spatio-temporal changes in species composition and spatial distribution of communities will be assessed through multivariate and multi-metric analyses. These changes will be contrasted with information from onboard sampling (landings and discards) to assess the match between the two types of data (fisheries dependent and independent). Pressure indicators (e.g. fishing effort) will be computed using fishing dependent data, particularly landings, logbooks and VMS, and mapped to explore relationships with community results.

Results will highlight communities' changes in space and time that may correlate with fishing pressure indicators and thus, identify sampling and data needs for monitoring the impact of fisheries on biological resources and marine ecosystem.

**Text Box 1G: List of research surveys at sea**

**TB 1G.1 – Sardine, Anchovy, Horse Mackerel Acoustic Survey – PELAGO**

Survey included in Table 10.

**1.1 Objectives of the survey**

- To estimate the abundance, biomass and spatial distribution of sardine, anchovy and other small pelagic fishes, by length classes and age groups, presented in the Ibero-Atlantic waters.
- To estimate the spatial distribution of sardine (and other pelagic fish) eggs.
- To map sea surface temperature, salinity and fluorescence.

**1.2 Methodology used on the Portuguese acoustic surveys**

**Equipment:**

Simrad EK 500 - 38 KHz, split beam transducer  $8^\circ \times 7^\circ$  (equivalent beam angle:  $10\log\psi = -20.2$  dB; pulse duration = 1 ms), calibrated prior to the survey. Data storage and pos-processing software: Movies+

Pelagic trawl (10 m vertical opening) and bottom trawl (NTC) to identify echoes, split acoustic energy and gather biological data. Opportunistic fishing hauls.

CUFES, continuous underway fish egg sampler, plus coupled temperature, salinity and fluorescence sensors.

Sample design:

Parallel systematic grid, 8 nmi apart (west coast), 6 nmi in Algarve; in Cadiz, not parallel, around 8 nm in the middle of the radials. The acoustic survey is made only during day. During night, opportunistic hydrology/plankton/ecology sampling is carried out, when possible. CUFES sampling continuously acquired along the transects.

Abundance estimates:

Survey area is divided into 4 zones: OCN (Caminha to Nazaré), OCS (Nazaré to Cape S. Vicente), ALG (S. Vicente to V. Real Sto. António) and CAD (V. Real to Cape Trafalgar).

The acoustic energy is split by trawl proportion (in number) taking into account the species TS's, if direct energy extraction is not possible.

There are post-stratifications in coherent (length composition, density) areas for each species. Abundance estimation is calculated in number of individuals, by length class, in each coherent area. The hauls are combined in this area, usually without weighting. Biomass estimation is calculated using weight/length relationship. Estimated abundance by age groups is calculated using age/length key, extracted from the otoliths reading.

Manual:

PELAGO survey is coordinated by ICES WGACEGG  
(<http://www.ices.dk/community/groups/Pages/WGACEGG.aspx>). ICES manual for Acoustic surveys (Series of ICES Survey Protocols) being finalized.

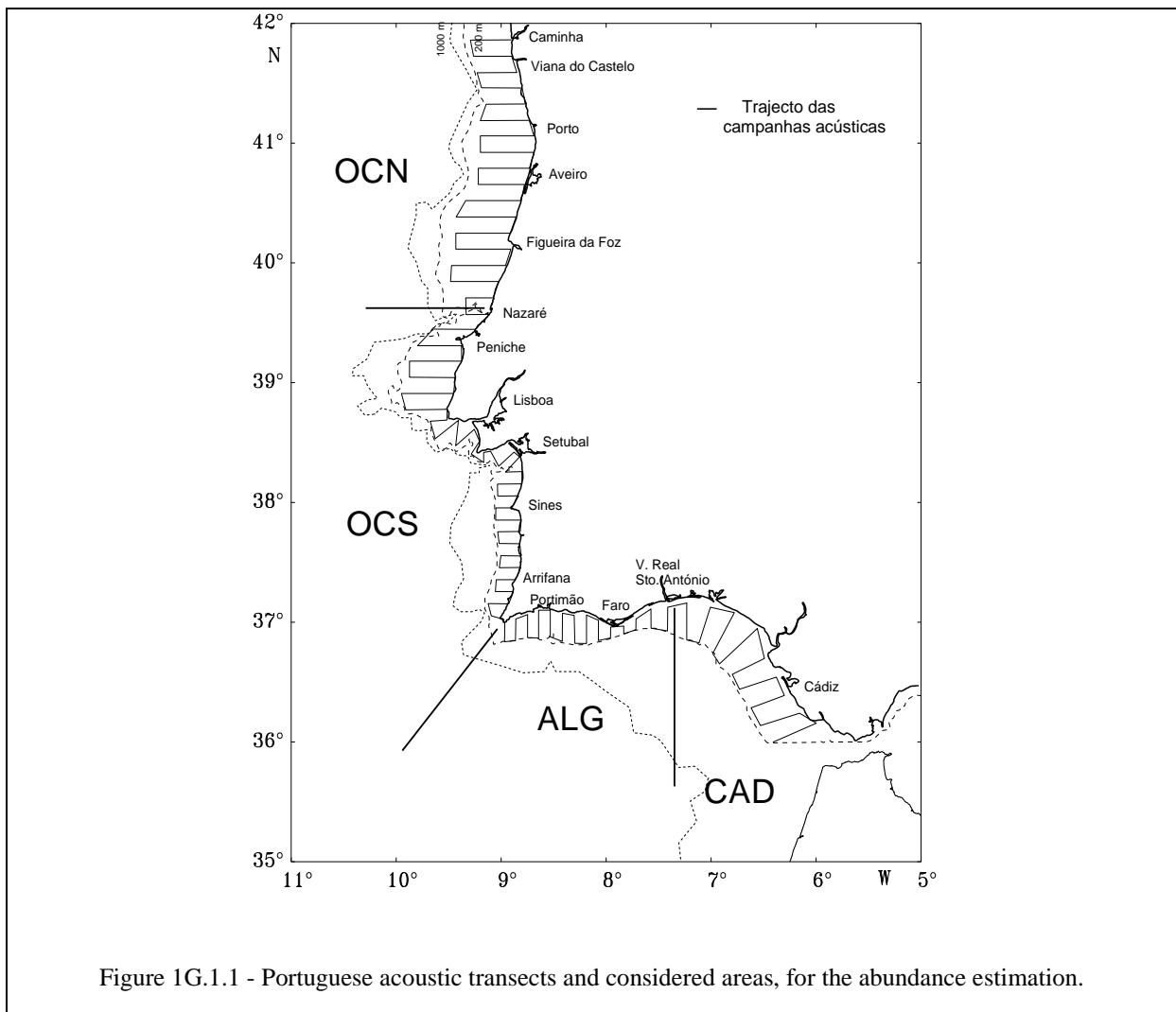


Figure 1G.1.1 - Portuguese acoustic transects and considered areas, for the abundance estimation.

## TB 1G.2 – Western IBTS 4th quarter

Survey included in Table 10.

### 2.1 Objectives of the survey

The Portuguese groundfish surveys have been conducted since 1979, continuously in autumn, with R/V "Noruega". The main objectives are to estimate the abundance and distribution of the most important commercial species in the Portuguese trawl fishery: hake, horse mackerel and blue whiting. The recruitment indices of abundance and distribution for hake and horse mackerel are also evaluated. Data for other species are collected, for biodiversity purposes.

### 2.2 Description of the methods used in the survey

The present sampling scheme was implemented in 2005, based on a systematic and stratified random sampling, to facilitate the use of geostatistical models and to overcome the difficulties in the estimation of the variance. It includes depths from 20 to 500 m with a mixed sampling scheme composed by 66 trawl positions distributed over a fixed grid with 5' per 5' miles, corresponding to trawl positions already done, and 30 random trawl positions, with tow duration of 30 minutes. At the end of each haul, a CTD station is performed to collect data on physical parameters.

The Portuguese surveys cover Division IXa in Portuguese waters. The surveyed area extends from latitude 41°20' N to 36°30' N, and from 20 to 500 m depth. The surveys are carried out with the R/V Noruega, which is a stern trawler of 47.5 m length, 1500 horse power and 495 G.T.R. The used fishing gear is a bottom trawl (type Norwegian Campell Trawl 1800/96 NCT) with a 20 mm codend mesh size. The main characteristic of this gear is the groundrope with bobbins. The mean vertical opening is 4.6 m and the mean horizontal opening between wings and doors is 15.1 m and 45.7 m, respectively. The polyvalent trawl doors are rectangular (2.7 m x 1.58 m) with an area of 3.75 m<sup>2</sup> and weighting 650 Kg.

Manual:

PTGFS IBTSQ4 is coordinated by ICES IBTSWG.

ICES, 2010. Manual for the International Bottom Trawl Surveys in the Western and Southern Areas Revision III Agreed during the meeting of the International Bottom Trawl Survey Working Group 22–26 March 2010, Lisbon. Addendum 2: ICES CM 2010/SSGESST: 06. 58 pp.

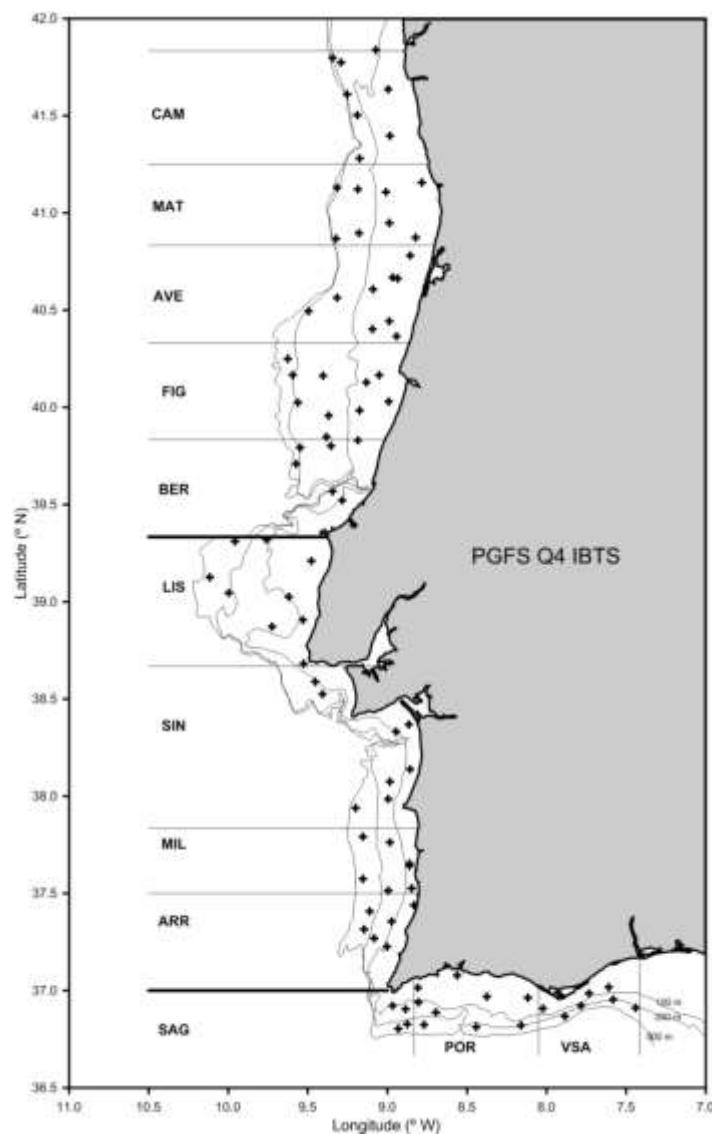


Figure 1G.2.1 - Western IBTS 4th quarter – IBTS Q4. Sampling grid.

## **TB 1G.3 – Nephrops Survey Offshore Portugal NepS (NepS (FU 28-29))**

Survey included in Table 10.

### 3.1 Objectives of the survey

The main objectives of the survey are to estimate the abundance, and to study the distribution and the biological characteristics of the main crustacean species, namely *Nephrops norvegicus* (Norway lobster), *Parapenaeus longirostris* (rose shrimp) and *Aristeus antennatus* (red shrimp).

### 3.2 Description of the methods used in the survey

The crustacean surveys are the only independent mean of assessing the status of the Portuguese crustacean resources. Surveys have been carried out since the early 80's using IPMA (formerly IPIMAR) research vessels. These surveys usually take place during the second quarter, generally late May - early July.

The sampling grid was designed to cover the main crustacean fishing grounds within the range of 200 - 750 m. The substrate in these grounds is characterized by muddy sediments composed by different percentages of silt and clay.

Each rectangle has 6.6 minutes of latitude x 5.5 minutes of longitude for the SW coast and vice-versa for the south coast, corresponding approx. to 33 nm<sup>2</sup>. The abundance observed at a particular point within the rectangle will reflect the relative abundance of the resource at that geographical area and it is assigned to the centre of the rectangle. The stations may be grouped a posteriori in the strata used previously and the results compared with the former surveys.

The grid has been updated to include areas where fishing is known to occur, and to exclude others where the target species do not occur or non trawlable areas, based on the definition of the fishing grounds through VMS fishing records. The new grid is composed by 80 rectangles in total, with 22 in FU 28 and 58 in FU29. Figure 1G.3.1 shows the grid overlaying the fishing grounds, highlighting the changes. The areas deeper than 750 m, where the giant scarlet prawn occurs, are not covered.

- Start time of the haul is defined as the moment when the vertical net-opening and door spread are stable. Stop time is defined as the start of pull back. The haul duration is 30 minutes. Hauls with duration lower than 15 minutes are not considered valid.
- Hauls are carried during daylight at a mean speed of 2.8-3.0 knots.
- Sensors to monitor the trawl net parameters (wings/doors spread, horizontal and vertical openings, depth) are sometimes used and expected to be used on a regular basis from 2015 onwards.

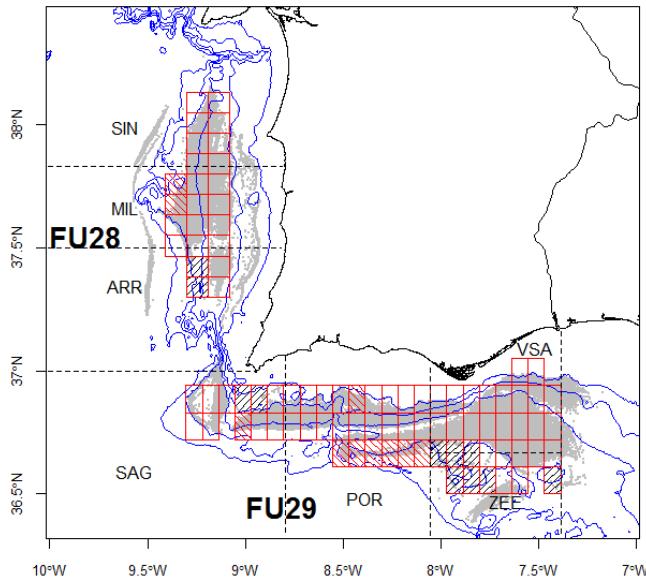


Figure 1G.3.1 - Survey grid in FUs 28 and 29 overlaying the crustacean fishing grounds represented by VMS records (in grey). The red-dashed rectangles were added to the grid survey, the black-dashed rectangles were removed. The sectors used in the previous stratified design are delimited by dashed lines and labelled.

Manual:

NepS (FU 28-29) survey is coordinated by ICES WGNEPS. ICES manual for Nephrops surveys (Series of ICES Survey Protocols) being finalized.

#### **TB 1G.4 – Sardine Daily Egg Production Method (DEPM PIL)**

Survey included in Table 10.

##### 4.1 Objectives of the survey

Estimate de spawning stock biomass (SSB) of the Atlanto-Iberian sardine stock (ICES VIIIC and IXa), using the Daily Egg Production Method (DEPM).

##### 4.2 Description of the methods used in the survey

The DEPM survey involves vertical ichthyoplankton sampling on fixed stations with a CalVET net. Simultaneously, the auxiliary CUFES system operates underway (between the CalVET stations), collecting plankton samples at approximately 3 m from the surface. Both samplers follow a predefined grid of fixed transects perpendicular to the coast and spaced 8 nm, covering the platform at least until the 200 m isobath (Fig. 1G.4.1). Decisions on the offshore limit of surveying are made, adaptively, depending on the samples obtained by the CUFES system. After hauling, ichthyoplankton samples are preserved, subsequently processed and analysed in laboratory. Concurrently to the plankton sampling with the CalVET and the CUFES, environmental data (temperature and salinity and fluorescence) are recorded. These samples are then used in view of:

- Quantifying and identifying per developmental stage sardine eggs observed over the whole surveyed area;
- Delimiting and estimating the spawning area of sardine;
- Estimating daily egg production.

Simultaneously with the ichthyoplankton sampling, fishing hauls are conducted by pelagic or bottom trawling, opportunistically, following the information provided by the RV echo-sounder. Their number and spatial distribution aim at ensuring a good and homogeneous coverage of the survey area and an adequate representation of the population demography and distribution. Samples collected by the RV are often complemented with samples obtained from the commercial purse-seine fleet at the main landing harbours, during the period of the survey. Immediately after trawling, sardine fish samples are processed onboard the RV, individual biological information is recorded, and biological material is collected and preserved for subsequent histological processing in laboratory.

The collected data and material are used to estimate adult parameters (sex ratio, mean female weight, mean batch fecundity and spawning fraction) within the mature component of the population, and subsequently calculate sardine daily fecundity.

Manual:

DEPM PIL survey is coordinated by ICES WGACEGG

(<http://www.ices.dk/community/groups/WGACEGG.aspx>). ICES manual for DEPM survey (Series of ICES Survey Protocols) being finalized.

#### 4.3 Description of the participating Member States/vessels and the relevant international group in charge of planning the survey

Sardine DEPM survey is coordinated internationally under the auspices of the ICES WGACEGG; Portuguese survey carried out jointly with the Spanish survey (from the Instituto Español de Oceanografía, IEO) in order to cover the Atlanto-Iberian sardine stock area (IXa, VIIc).

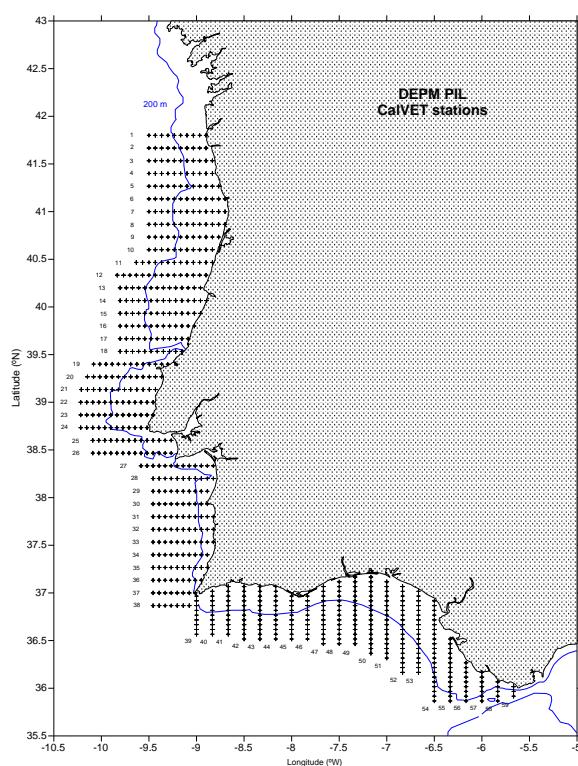


Figure 1G.4.1 – Sardine DEPM (Triennial) - Sampling grid.

## **TB 1G.5 – International Mackerel and Horse Mackerel Egg Survey (Triennial) (MEGS)**

Survey included in Table 10.

### 5.1 Objectives of the survey

Estimate de spawning stock biomass (SSB) of the southern stock horse-mackerel (ICES IXa), using the Daily Egg Production Method (DEPM).

### 5.2 Description of the methods used in the survey

The DEPM survey involves vertical ichthyoplankton sampling on fixed stations with a (adapted) CalVET net. Simultaneously, the auxiliary CUFES system operates underway (between the CalVET stations), collecting plankton samples at approximately 3 m from the surface. Both samplers follow a predefined grid of fixed transects perpendicular to the coast and spaced 10 nm, covering the entire platform and shelf break (Fig.1G.5.1). After hauling, ichthyoplankton samples are preserved, subsequently processed and analysed in laboratory. Concurrently to the plankton sampling with the CalVET and the CUFES, environmental data (temperature and salinity and fluorescence) are recorded. These samples are then used in view of:

- Quantifying and identifying per developmental stage horse-mackerel eggs observed over the whole surveyed area;
- Delimiting and estimating the spawning area of horse-mackerel;
- Estimating daily egg production per unit area.

Simultaneously with the ichthyoplankton sampling, fishing hauls are conducted by pelagic or bottom trawling, opportunistically, following the information provided by the RV echo-sounder. Their number and spatial distribution aim at ensuring a good and homogeneous coverage of the survey area and an adequate representation of the population demography and distribution. Samples collected by the RV are often complemented with samples obtained from the commercial bottom trawler and purse-seiners fleets at the main landing harbours, during the period of the survey. Immediately after trawling, horse-mackerel fish samples are processed onboard the RV, individual biological information is recorded, and biological material is collected and preserved for subsequent histological processing in laboratory.

The collected data and material are used to estimate adult parameters (sex ratio, mean female weight, mean batch fecundity and spawning fraction) within the mature component of the population, and subsequently calculate horse-mackerel daily fecundity.

During the Portuguese survey, both ichthyoplankton and fish sampling also provide information on eggs and adults for mackerel, as a commitment to the WGMEGS (countries/institutes) partners, with the objective of obtaining an index of the SSB for the stocks of Atlantic mackerel (western and southern areas).

#### Manual:

SISP 6. MEGS V2.0 Sampling at Sea and SISP 5 - WGMEGS V11 Manual for AEPM and DEPM fecundity.

### 5.3 Description of the participating Member States/vessels and the relevant international group in charge of planning the survey

International Mackerel and Horse Mackerel Egg Survey coordinated internationally under the auspices of the ICES WGMEGS, but Portuguese survey alone covers the whole area of the horse-mackerel southern stock (ICES IXa).

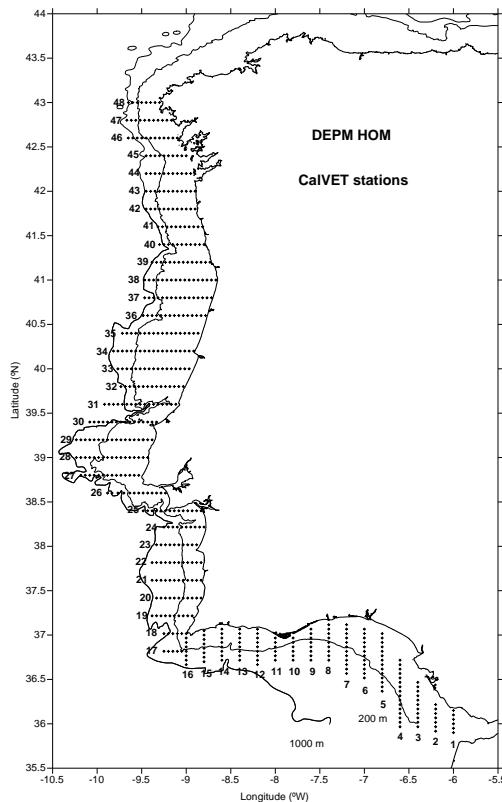


Figure 1G.5.1 - International Mackerel and Horse Mackerel Egg Survey (Triennial) – Sampling grid.

## TB 1G.6 – Flemish Cap Groundfish survey (FCGS)

Survey included in Table 10.

### 6.1 Objectives of the survey

The main objectives of the survey are the estimation of abundance and biomass index of the target species, as well as the knowledge of their population demographic structure and the oceanographic conditions on the Flemish Cap Bank (NAFO Division 3M). For this purpose, the following tasks were implemented:

- Detailed length distribution and biological sampling of the catch for each target species, recording length, weight, sex, and the collection of otoliths and gonads. For other species only length and length-weight sampling were performed.
- Observation of the oceanographic conditions on the Bank. The collection of oceanographic data (temperature and salinity) was carried out mainly through the CTD profiling; with a grid-pattern design, placing CTD stations separated 15 nautical miles, both in latitude and longitude, with the aim of covering the whole Bank.
- Feeding analysis of most abundant species, to be done every two years.
- Sampling of invertebrates, with special attention to corals and sponges, to allow identification of

potentially vulnerable marine ecosystems.

Target species:

- Cod, roughhead grenadier, redfish, american plaice, greenland halibut and northern shrimp.

6.2 Description of the methods used in the survey

Bottom trawl fishing hauls that last for 30 minutes and are distributed using a stratified random sampling scheme. The used trawling gear is the Lofoten (Vázquez *et al*, 2013).

Temperature and salinity profiles are taken with a CTD according to a predefined square grid.

The survey starts in the second half of June, and needs 35 days at sea.

Manual: <http://archive.nafo.int/open/studies/s46/S46.pdf>

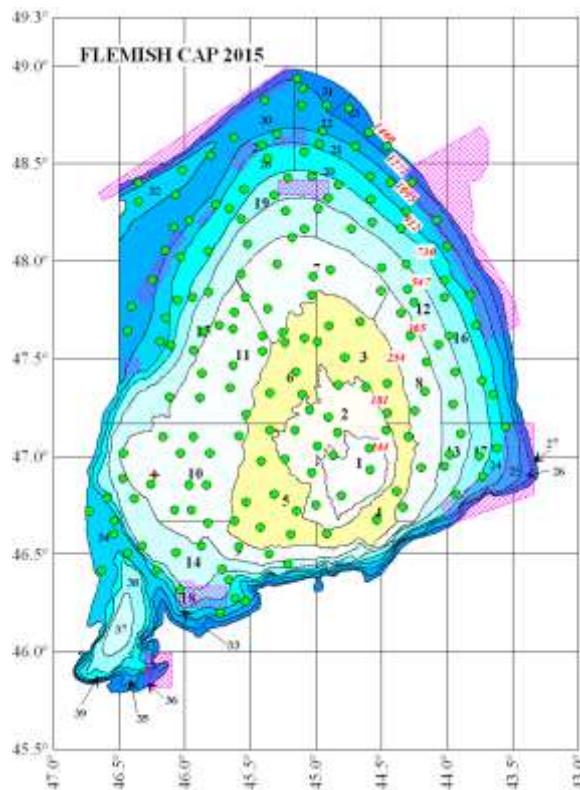


Figure 1G.6.1 - Flemish Cap Groundfish Survey, FCGS (RV Vizconde d'Eza). Sampling grid. Coral and sponge protection areas (red squares); valid hauls (green circles); invalid hauls (red crosses).

6.3 Description of the participating Member States/vessels and the relevant international group in charge of planning the survey

- Spain + Portugal; RV Vizconde de Eza;
- Portuguese-Spanish surveys in Flemish Cap - coordination meeting for the survey.

#### 6.4 Description of the international task sharing (physical and/or financial) and the cost sharing agreement used

Spain contributes with vessel, staff and samples analysis in laboratory and Portugal contributes with staff and samples analysis in laboratory.

There is not signed agreement about task sharing.

#### References

Vázquez, A; Casas, J. M. and Alpoim, R. (2013). Protocols of the EU bottom trawl survey of Flemish Cap. NAFO SCR Doc. 13/021. Serial No. N6174. 51p

### **TB 1G.7 – ARQDAÇO Survey**

#### 7.1 Objectives of the survey

The annual spring bottom longline survey - ARQDAÇO - was established since 1995, targeting demersal and deep water species up to 1200 m depth in the areas near all the nine islands of the archipelago, and various seamounts in the Azores Exclusive Economic Zone. The main aim of the monitoring surveys is to monitor the abundances of the main demersal fishes in Azores, but several campaigns have also explored areas still poorly known in the region, mostly for prospecting purposes, adding to the knowledge on regional environment and species. The applicability of the collected data is related to the support and advice to fishery policy makers, to contribute to the compilation of assessment reports by several working groups, such as the ICES (International Council for the Exploration of the Sea), or regional and national assessments under the framework of the Marine Strategy Framework Directive.

#### 7.2 Description of the methods used in the survey

The ARQDAÇO surveys follow a standardized methodology, using a bottom longline gear similar to that mostly used by the local demersal fishing fleet. Each year, around 34 fishing sets are deployed (Fig 1G.7.1). Data, collected during the surveys, include data on fishing effort and catches by species. On a subsample of fish, biological variables (length, weight, sex, gonadal maturation stage) and samples (otoliths, for age estimation; portions of muscle, for genetic analyses; other tissue for different studies) are collected. During the surveys, a large amount of fishes (mainly *Pagellus bogaraveo* and *Helicolenus dactylopterus*) are tagged with traditional spaghetti tags and released. Tagging activity is expected to contribute to the knowledge of the species movements and connectivity among fishing grounds, abundance estimates, mortality and growth rates. Organisms collected as by-catch (such as corals, and other invertebrates) are preserved for further identification and studies. Additionally, oceanographic data are collected using CTDs in half of the fishing sets deployed (i.e. 17 stations; Fig 1G.7.2).

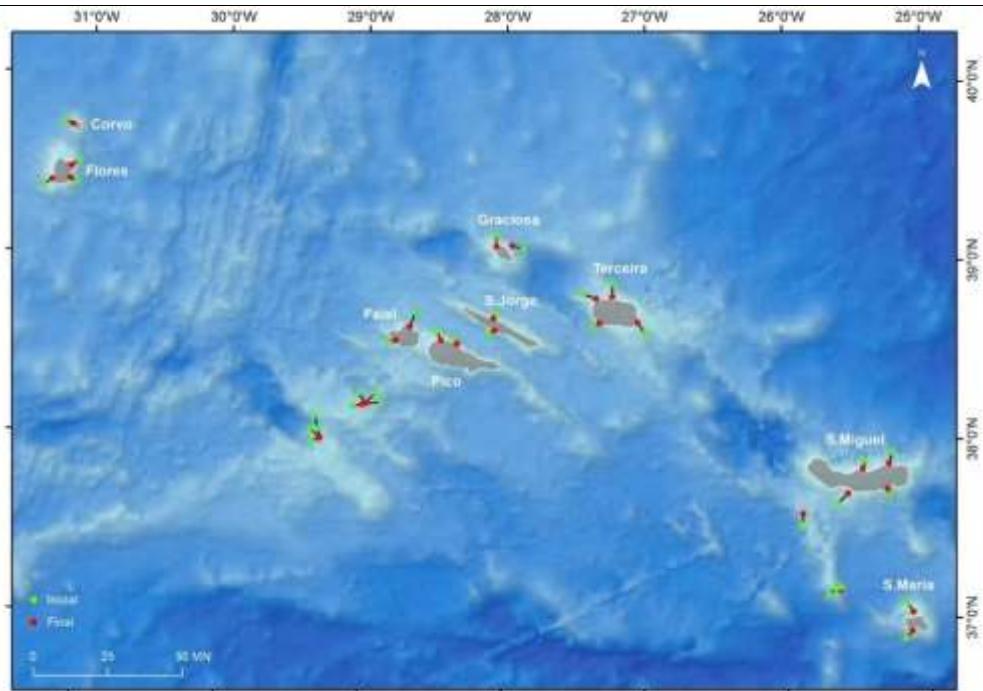


Figure 1G.7.1 – Annual spring bottom longline survey - ARQDAÇO - fishing sets location.

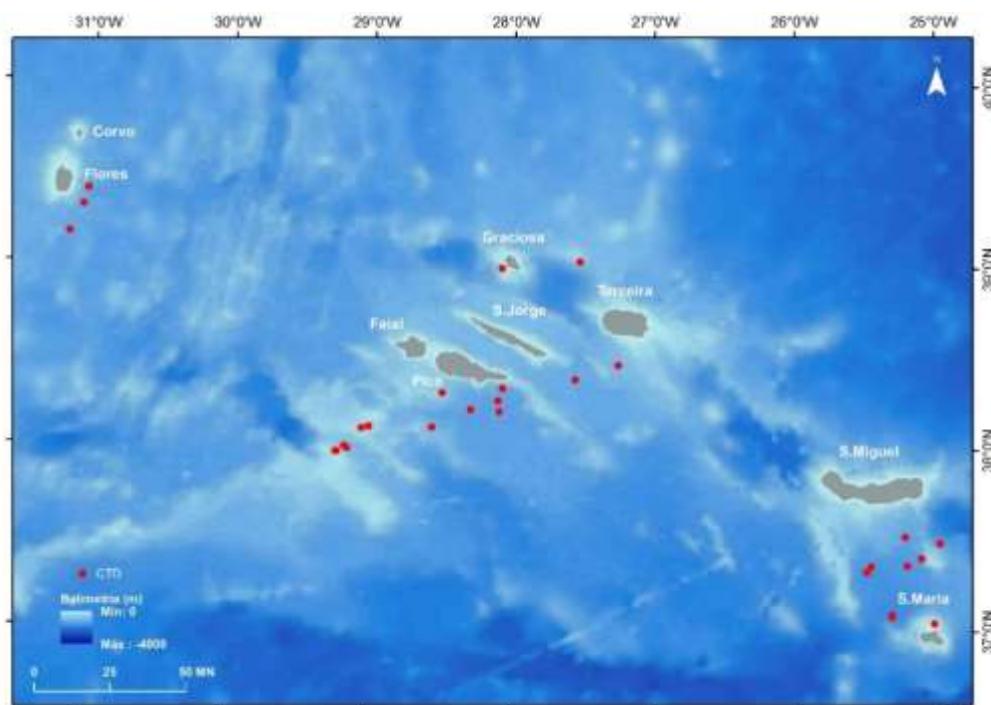


Figure 1G.7.2 – Annual spring bottom longline survey - ARQDAÇO - CTD stations.

### 7.3 Description of the international task sharing (physical and/or financial) and the cost sharing agreement used

The surveys have been mainly funded by the Azores Regional Government, but also by national and European entities (i.e. EU-DGXIV, INTERREG).

## SECTION 2: FISHING ACTIVITY DATA

### Text Box 2A: Fishing activity variables data collection strategy

#### 1. Description of methodologies used to cross-validate the different sources of data.

For effort, the primary data source is logbooks data and the sales notes are the secondary data source. Frame population comprises all vessels with annual permit to operate.

- In order to improve the data harmonization between partners (Mainland, Azores and Madeira), a refined algorithm for fleet segmentation and metier definition was implemented, being each fishing trip assigned to a metier. The registered fishing trips were collected from different sources, and some issues have been identified (e.g.: trip duplication) that point to the need for further developing the algorithm. This task is foreseen to be accomplished in the short term, aiming for transmission on transversal, economic and biological variables at fleet segment or metier based. The algorithm and methodology will be made available to RCMs, following Recommendation 20 of LM: “Review current algorithms and processes for allocating a trip to a métier based on catch data, provide standard guidelines for it and define a strategy for storing and maintaining national fishery descriptions relative to the defined metiers.”
- Regarding landings in national ports, Portuguese administration cross-checks all the information from VMS, logbooks and sales notes in order to filter wrong data (e.g.: trip duration, location of fishing operation), complying with the cross-checks foreseen under the control legislation. The cross-check between landed species (name and weight) and the ones declared in the logbooks is performed on a daily base.
- As far as landings in other MS harbours are concerned, Portugal cross-checks landings data recorded in the logbooks' landing declaration with the landings reported to the Commission by each of those MS, via catch reports. In case of landings or transhipments in third country ports, where sales notes are not available, the cross-checking is made between logbooks' landings, and using VMS data to identify the area of fishing operation. When transhipment takes place, the catch volume by species is computed from T2M documentation.

#### 2. Description of methodologies used to estimate the value of landings.

In Portugal, all vessels landing fresh fish are obliged to sell in first sale. Therefore, data regarding all vessels landing in national ports, including small scale fisheries, are census-like.

The sources of information on landings of fresh or refrigerated fish in national ports are the national designated authorities for that purpose, DOCAPESCA SA and LOTAÇOR E.P., for mainland ports and Azores ports, respectively, and the Regional Directorate DRPM, for Madeira ports.

These entities electronically register all the data from 1<sup>st</sup> sale, and then send the information to the national administration, accordingly to the rules laid out in the Control regulation.

Regarding fish processed on board, the sources for landing data are logbooks and landing declarations. Landings' live weight by species is computed using processed-live weight conversion factors.

#### 3. Description of methodologies used to estimate the average price (it is recommended to use weighted averages, trip by trip)

Like it was already referred above, all vessels are obliged to sell the landed fish in the auction places, then data regarding prices are census-like.

#### 4. Description of methodologies used to plan collection of the complementary data (sample plan methodology,

type of data collected, frequency of collection etc)

For Azores Region a complementary data collection is run with the aim of completing the information for effort variables with a sampling coverage of 5% of the fishing trips.

IMAR/DOP is in charge of information collection concerning the fishing effort, from all harbours where technicians/samplers are located. The information to be collected on effort refers to: days at sea, fishing days, number of fishing trips, number of fishing gears, number of fishing operations, number and size of nets, number of hooks and lines and number of traps.

The main sources of information for gathering these transversal variables are logbooks and inquiries to boat owners present in the harbours at unloading time. These inquiries include all fleet segments, but with increased effort on those that are not obliged to fill a logbook (< 10 meters). For the small scale fleet (boats under 10 meters), questionnaires are distributed by fishermen based on a panel survey methodology, with the purpose of collecting more information of this fleet segment.

### SECTION 3: ECONOMIC AND SOCIAL DATA

#### **Text Box 3A: Population segments for collection of economic and social data for fisheries**

##### 1. Description of methodologies used to choose the different sources of data

Data sources used for the estimation of economic variables are administrative data, logbooks, sales notes and surveys carried out following a stratified random sampling strategy. For social variables, the data will be collected together with the economic survey adapting the questionnaire form. Each of those sources has as basic unit for the data collection: the vessel. Though the first two sources are census like and the last one is a sample, both relate to the same universe, i.e. the fleet registered on the 1<sup>st</sup> January of the reference year, therefore the matching of sources is assured. The sources and methods for each variable are listed in Table 3A.

##### 2. Description of methodologies used to choose the different types of data collection

Different type of data collection was applied per variable and fleet segment. Variables related with fleet operations and fleet characteristics are collected from the national administration database, from sales notes or even logbooks with a census methodology. Concerning economic variables, data were collected by questionnaires.

##### 3. Description of methodologies used to choose sampling frame and allocation scheme

For Madeira region, economic and social data collection is done by census, while for Azores and mainland a stratified random sampling is applied.

In order to comply with new demands and to obtain more accurate estimates, Portugal established an uniform fishing fleet segmentation between economic and biological data, based on metier level 6. Allocation of vessels that performed fishing operations in more than one supra region was made according to the criteria of days of activity. In this situation we can find the longline vessels, operating at North Atlantic but also within Other Regions.

Besides the criteria for assigning a particular vessel to a supra region, it was also required to define criteria to merge some of the fleet segment. All the fleet segments without enough representativity to be run independently, are in these circumstances.

For sample selection the criteria are the sample size by segment (minimum of 30 vessels per segment); number

of vessels by segment (census for segments with less than 15 vessels).

#### 4. Description of methodologies used for estimation procedures

The methodology used for the estimation of most of the variables is based on the imputation of averages per fleet segments. With the raising in importance of the economic results, improvements on the methodology are previewed in order to use more of the available administrative data. The objective is to combine administrative data with surveys answers to modelling, in order to achieve better quality with the available data. This approach has been tested with variable “Energy costs”.

Other specific methodologies are used for the calculation of variables: capital values, capital costs and FTE.

The value of fixed assets and the capital costs are estimated processing data of the vessel register, and according to the methodology suggested by the study on “evaluation of the capital value, investments and capital costs in the fisheries sector” (No FISH/2005/03).

According to the capital study, the estimation of the capital value (GCS) consisted of three steps:

1. Specification of the composition of the active fleet by age (fleet register).

The specification of the composition of the active fleet by age has been done by processing the fleet register.

2. Estimation of price per unit of capacity (GT).

In order to apply the PIM (perpetual inventory method) and in absence of other possibilities, the price per unit of capacity is estimated having in mind the price for building new vessels (replacement values). Those prices for 2011 were:

- Small scale fleet segment = 21 050,00 euros/GT;
- Polyvalents segment > 12 meters = 47 250,00 euros/GT0,7;
- Trawl segment = 25 820,00 euros/GT0,8;
- Seiner segment = 15 170,00 euros/GT.

3. Calculation of the values of each vintage of the fleet at current prices.

After (1) and (2) we are able to estimate the Gross capital stock, the depreciated replacement value, and all the others variables. Inactive vessels are considered in the evaluation of the capital value and capital costs.

For calculation of FTE, survey information is collected about:

- Number of months of activity;
- Number of days of activity;
- Average number of working hours per day;
- Number of workers per month/gender/type of employment (partial/full time);
- Number of unpaid workers.

The number of days of activity is gathered from logbooks and auctions.

#### 5. Description of methodologies used on data quality

The sample size for each fleet segment is determined by statistical procedures, targeting the precision level required by DCF for the variable income of the previous year ( $CV < 5\%$ ). To mitigate the non-responses, the CV is increased to 20%.

Before the estimation methodology some quality checks are run. The collected values for each variable are plotted by fleet segment, and for extreme values, a direct contact with the respondent is established.

On the other hand, the same vessels can have, from year to year, huge variations for some of the variables that were expected to remain relatively stable, e.g.: fixed costs, due to the change of respondents and different interpretations for the same questions. Extreme values are compared with previous available answers for the same vessel, to provide more information during the contact with the respondent.

In both cases, if the extreme value is noticed as failure on the fulfilment, correction is made on the data. Otherwise, the value is considered an outlier.

### **Pilot Study 3: Data on employment by education level and nationality**

No pilot study will be applied for data collection on employment by education level and by nationality in 2017. This data will be collected under the aquaculture census operation conducted annually by DGRM.

### **Text Box 3B: Population segments for collection of economic and social data for aquaculture**

#### 1. Description of methodologies used to choose the different sources of data

As much as the aquaculture sector is concerned, Portuguese Fisheries Administration acts as the national authority for the production of statistical data. Ever since, all work undertaken within the aquaculture sector is related to the production of data under the European Statistical System.

#### 2. Description of methodologies used to choose the different types of data collection

Following the publication of Regulation (EC) no. 788/1996, DGRM developed a statistical operation, together with the National Institute for Statistics, performed annually. The sample unit is the establishment and the population comprehends all those establishments that, at the reference year, had legal conditions to undertake any aquaculture activity.

The two operations that supports Aquaculture programme have different target population. The first one,

administrative inquiry, has a population comprises by all the aquaculture establishments, regardless of being the first or second activity of the enterprise. The unit of observations is the establishment identified with aquaculture annual licence register.

For the second operation, the one supported by National Institute for Statistics, the unit of observation is the enterprise, and will be considered the enterprises with primary activity under NACE Code 03.02, as orientations laid down on Commission Decision.

Relation between both operations is assured by the National Registry of Aquaculture Units and Enterprises, where all the population of enterprises and units are stored, despite of nature of the aquaculture activity (primary or secondary).

As result of different levels of activity and also target population (hatchery and fish units, shellfish units), two kinds of questionnaires were developed, both as census-like operations. The first one, more complete, is set to the universe of hatcheries and all fish farming units and the second questionnaire is developed to collect data on shellfish farming units.

### 3. Description of methodologies used to choose sampling frame and allocation scheme

Both supporting operations are census like operations, therefore not applicable.

### 4. Description of methodologies used for estimation procedures

Estimation process for primary variables is supported by estimators of total for census-like information.

To deal with non-responses, a problem mainly concerned with artisanal units for production of bivalve molluscs (clams), the developed methodology is based on the application of raising factors. Each year, based on the collected answers, the average yield (Y) of production, tonnes per hectare, is estimated. For all non respondents units, based on their farming area, and applying the annual yield, the total clam production for the reference year is estimated. For non-responses on other variables an imputation of the segment average value is made. This imputation is made only for variables where values are expected, for other variables a direct contact to the respondent is established in order to confirm the zero value instead of a non-response.

Employment variables, such as FTE will be estimated in accordance with Study Fish/2005/14.

### 5. Description of methodologies used on data quality

Data collected under the present methodology are subject to a series of validation procedures, in accordance with the rules already evaluated under the Methodological document produced to INE. Both sources are census operations and evaluation of the coverage rate is foreseen. Values by segment are plotted to identify extreme values. For some extreme values, corrections on the dimensions are made (kilos to tonnes and kilos to grammes), for other extreme values a direct contact to the respondent is established in order to confirm them.

#### Pilot Study 4: Environmental data on aquaculture

No pilot study is needed for environmental data on portuguese aquaculture considering chapter V (6.). Actually, Portugal's production represents 0,65% of the total Union aquaculture production in volume and 1,23% in value.

The threshold to be applied is 2,5% of the total Union aquaculture.

Total Aquaculture Production	EU-28	PT	%
Volume (tonnes)	1.211.259	7.874	0,65
Value (1000 euro)	4.014.626	49.266	1,23

(source: Facts and Figures - 2016 EUROSTAT).

#### Text Box 3C: Population segments for collection of economic and social data for the processing industry

Considering that under Chapter III, 1.1 (d) of Commission Implementing Decision (EU) 2016/1251 of 12 July, social and economic data on the processing industry may be collected on a voluntary basis, Portugal did not include those sets in the Work Plan.

### SECTION 4: SAMPLING STRATEGY FOR BIOLOGICAL DATA FROM COMMERCIAL FISHERIES

#### Text Box 4A.1: ICES Division IXa

##### TB 4A.1 At-market and at-sea sampling

**At-market sampling (ICES Division IXa) – PTM1-FPO\_MOL; PTM5-GNS\_GTR\_DEF; PTM7-LLS\_DEF; PTM11-LLS\_DWS; PTM14-OTB\_DEF; PTM17-OTB\_CRU; PTM20-PS\_SPF; PTM22-TBB\_MCD (in Table 4A)**

##### 1.Specification of purposes

The objective of at-market sampling is to obtain length distributions of fish landed at auctions by Portuguese vessels operating in ICES Division IXa.

##### 2.Design

Population: Lengths of fish landed by Portuguese vessels operating in ICES Division IXa.

Target population: Lengths of fish landed at auction (= port) by Portuguese vessels licensed to operate in ICES

Division IXa.

Study population: Lengths of fish at port from a subset of vessels from a fleet segment, based on a combination of gear licences and the main species landed in previous year.

Sampling frame: List of ports\*day for each fleet segment<sup>(\*)</sup>.

Stratification type: Spatial – ports; Temporal – quarters. Stratification is used to improve sampling coverage through the year and in the Portuguese coast.

Sampling effort: Fixed by previous allocation where a weight/value criteria is used. Spatio-temporal allocation is proportional to landings (from previous year) in each port\*quarter combination.

Primary Sampling Unit (PSU): Auction\*day.

Description:

- a) The Portuguese fleet is stratified by fleet, auction and quarter. Following the DCF requirements [EU Commission Decision (2016/1251)], less significant fleets are not sampled (e.g. dredges, beach-seines) and sampling effort is established as number of trips. Annual sampling effort is fixed by the DCF National Sampling Plan that sets number of trips to be sampled in each fleet ( $\approx$  métier). Sampling effort is allocated to auctions and quarters proportionally to last year's landings.
- b) For each fleet, the visit dates in each auction\*quarter are spread somewhat systematically throughout the quarter in a way that covers all week-days where the fleet is active.
- c) In every auction\*visit\_date, observers attempt to sample a predefined number of vessel\_sale\_events, that are haphazardly selected from a list of all landings awaiting auction. This list includes the name of each vessel and the commercial species, commercial category and weight of each of its boxes. Each vessel\_sale\_event generally corresponds to the landings of one fishing trip. A minor proportion of vessel\_sale\_events may not be present in the selection list at selection time when sampling starts.
- d) In each vessel\_sale\_event, the observers aim to sample boxes from every commercial species and commercial category.
- e) Within each commercial category, the observers select 1 box haphazardly. When there are very few fish from a scientific species inside the box, observers take more boxes until the length composition of the size category is well defined.
- f) When different species are present within a box, observers sample them all.

During 2017, fish length measurements will be also recorded in some auctions, using on an experimental basis an electronic system composed by a local unit for automatic image acquisition of fish boxes and a remote database to record the processed images (Fishmetrics), which allows to conclude fish length measurements at a later stage.

### **3.Expected execution difficulties**

- a) Vessels arriving to port after the auction has started, with large amounts of landings/species/categories meaning no time to sample the complete trip. (e.g.: OTB\_DEF).
- b) Shipmasters not giving permission for observers to sample fish from their vessels.
- c) Some commercial species may not be available for sampling if they have been subjected to previously fixed sale contract. Sometimes observers do not have time to sample all commercial species, so they select the more important species.

### **4.Data archiving and Quality assurance procedure**

Database is programmed in Oracle and contains internal routines for the detection of basic errors (e.g.: errors in

dates). Also, quarterly checks are performed using R and SQL routines.

## 5. Analysis methods

Most of the stocks are assessed within ICES Assessment Working Groups. Data preparation and stock assessment methods are defined in benchmarking processes and described in the species “stock annex”.

## References

ICES. 2015. Report of the workshop on developing the RDB data format for design based sampling and estimation (WKRDB 2014-1), 27-31 October 2014, Aberdeen, Scotland, United-Kingdom. ICES CM 2014|ACOM:68. 98 pp

(\*) There are 9 mutually exclusive vessel lists (based on fishing licenses and previous catch) that approximate the métiers selected for sampling at DCF level.

## **At-sea sampling (ICES Division IXa)- PTS3-GNS\_GTR\_DEF; PTS9-LLS\_DWS; PTS12-OTB\_DEF; PTS15-OTB\_CRU; PTS18-PS\_SPF; TBB\_MCD (in Table 4A)**

### 1. Specification of purposes

The objective of at-sea sampling is to obtain catch (discards + landings) composition, volume, lengths and age of fish captured by Portuguese vessels operating in ICES Division IXa.

### 2. Design

Population: Lengths of fish captured by the Portuguese vessels operating in ICES Division IXa (within species).

Target population: Lengths of fish captured by the Portuguese vessels > 12m that operate in ICES Division IXa (within species).

Study population: Lengths of fish captured by a subset of Portuguese vessels > 18m that operate in ICES Division IXa (within species). The subset is composed of several fleet segments selected based on species landings. The subset does not encompass the full target population (i.e., some fleet segments are not sampled).

Sampling frame: List of cooperative vessels for each fleet segment/métier.

Stratification type: Spatial – ports (Northwest, Southwest and South); Temporal – quarters.

Sampling effort: Sampling effort defined at a trip basis, where the number of trips to sample OTB\_CRU and OTB\_DEF was obtained from a Neyman allocation which is considered valid for the entire DCF period (OTB\_CRU: 12 trips and OTB\_DEF: 27 trips). For the other metiers, the sampling effort established was at least one per month (LLS\_DWS, TBB\_MCD: 12 trips each) and 2 per month (GNS\_GTR, PS\_SPF: 24 trips). Within each métier, sampling effort distribution in space and time is proportional to effort or landings.

Primary Sampling Unit (PSU): Trip.

### Description:

Vessels selection for trip sampling is quasi-random from within a set of cooperative vessels.

Haul selection is systematic (odd or even hauls) after a random choice of the starting haul (first or second). Catch volume is estimated independently from skipper’s opinion. It is obtained from the relative proportion between discards: retained weight in a sample from catch and raised by total landings. The number of specimens per species and the length composition are collected in fixed gears instead of weights, In what

concerns to onboard sampling strategy, observers follow crew's criteria to sort landings and discards when they are in deck. The onboard sampling procedure differs between active (OTB, TBB and PS) and fixed gears (GNS, GTR, LLS\_DWS) (Prista *et al.*, 2012; Jardim *et al.* 2012, Feijó *et al.*, 2012).

### **3.Expected execution difficulties**

- a) For some fleets (GNS\_GTR) there are a large number of smaller vessels that cannot take observers onboard.
- b) Increased refusal rate for on-board observers from TBB\_MCD vessels.
- c) Trips from vessels licensed for multiple gears other than GNS and GTR (e.g. FPO, LLS), result in a multiplicity of species that can be targeted per fishing trip, making it particularly difficult to provide robust estimates for species at a metier basis.
- d) Logistic difficulties in transportation of observers to certain ports.

### **4.Data archiving & Quality assurance procedure**

Database is programmed in Oracle and contains internal routines for the detection of basic errors (e.g., errors in dates). Data recorded refers to general trip information (location, haul number, retained weight by species), sample information by fraction (retained, discarded) and species, namely weight, number of specimens and length composition. Quality checks are carried out for all sampled fleet segments but, in what concerns to trawl fleet segment, a semi-automated R quality assurance procedure was designed and the entire trawl database is checked for additional undetected errors.

### **5.Analysis methods**

Estimates at fleet level have only been provided for OTB\_CRU and OTB\_DEF, where vessel lists and fishing behaviour have proven fairly consistent through time, and where sampling dates back to 2004. In other métiers, sampling and estimation have proven more difficult and have not yet been reported. This is particularly the case of GNS\_GTR (sampling dating back to 2009), and reasons for that are referred in "Expected execution difficulties".

### References

- Prista, N.; Jardim, E.; Fernandes, A.C.; Silva, D.; Ferreira, A. L.; Abreu, P.; Fernandes, P., 2012. Manual de procedimentos a bordo: artes fundeadas.*Relat. Cient. Téc. Inst. Invest. Pescas Mar*, nº 56, 23 p. + Anexos.
- Jardim, E.; Prista, N.; Fernandes, A.C.; Silva, D.; Ferreira, A. L.; Abreu, P.; Fernandes, P., 2012. Manual de procedimentos a bordo: arrasto de fundo com portas.*Relat. Cient. Téc. Inst. Invest. Pescas Mar*, nº 55, 20 p. + Anexos
- Feijó, D.; Marçalo, A.; Wise, L.; Silva, A., 2012. Protocolo de Amostragem a Bordo da Pescado Cerco. *Relat. Cient. Téc. IPIMAR, Série digital* (<http://inrb.pt/ipimar>) nº 57, 11 p + X Anexos.

### **Text Box 4A.2: IOTC**

#### **TB 4A.2 At-sea sampling (IOTC longline)**

#### **At-sea sampling (IOTC longline) - PTS26 - LLD\_LPF (in Table 4A)**

##### **1.Specification of purposes**

The objective of at-sea sampling is to obtain the species composition and length distribution of total catches (discards + landings) from the Portuguese longline vessels operating in the IOTC area.

## **2.Design**

Population: Fish captured by the Portuguese longline vessels operating in the IOTC area.

Target population: Fish captured by the Portuguese longline vessels operating mainly in the SW Indian Ocean (IOTC area).

Study population: Fish captured by the Portuguese longline vessels operating in the IOTC area.

Sampling frame: List of cooperative vessels.

Stratification type: No stratification. Most of the effort of the Portuguese pelagic longline fleet in the IOTC area is in the South and Southwest Indian Ocean.

Sampling effort: Sampling effort distribution in space and time is proportional to effort or landings. The goal is to cover a minimum of 5% of fishing effort, as recommended by IOTC.

Primary Sampling Unit (PSU): Trip.

### Description:

Vessel selection is quasi-random from within a set of cooperative vessels. The observer identifies, measures and determines the sex of every specimen from every haul. The observer also registers whether the specimen is alive or dead when captured and discarded (in case discard happens). All interactions with vulnerable fauna (e.g. sea-birds, sea-turtles and marine mammals) are recorded, as well as the conditions when they are released.

## **3.Expected execution difficulties**

Decreasing number of vessels with capacity and willing to carry observers on board. Some vessels of the fleet moving to Pacific Ocean in recent years.

## **4.Data archiving and Quality assurance procedure**

Data are stored locally at IPMA. Quality control to meet IOTC requirements is carried out before data are submitted to IOTC. All data are public at the IOTC Secretariat and website.

## **5.Analysis methods**

Stocks of the main IOTC species are assessed regularly by the Scientific Committee (SC) of IOTC. The methods are defined and applied according to the SC work. The frequency of the stock assessments is predefined according to the SC schedule of assessments and requests from the IOTC Commission.

## **Text Box 4A.3: NAFO**

### **TB 4A.3 At-sea sampling (NAFO; NEAFC; Norwegian and Svalbard waters)**

**At-sea sampling (NAFO; NEAFC; Norwegian and Svalbard waters): PTS30 - OTB\_DEF; PTS28 - OTB\_DEF; PTS29 - OTM\_SPF (in Table 4A)**

#### **1.Specification of purposes**

The objective of the at-sea sampling is to obtain catch (unsorted catches) composition, volume, positions, effort, lengths and biological parameters of Portuguese vessels operating in NAFO Subarea 3 and ICES Divisions I; II.

#### **2.Design**

Population: Portuguese vessels operating in NAFO Subarea 3 and ICES Divisions I; II.

Target population: Active vessels fishing in the area with logistical conditions (crew space/slot) for carrying out scientific sampling on board.

Sampling frame: Cooperative vessels.

Stratification type: Spatial (by Division).

Sampling effort: Sampling effort is dependent both on companies/skippers cooperation and availability of a nurseman within the crew.

Primary Sampling Unit (PSU): Trip.

Description:

Vessels selection is quasi-random from within a set of cooperative vessels. The Portuguese vessels are factory vessels that are obliged in NAFO to carry out a Compliance Observer Programme. This implies not only the accommodation facilities for this observer extra crew, but prevents the income of another observer (scientific) from outside. In practice, this obligation constrain the performance of scientific sampling to the more adequate skills within the crew, who is, by the nature of his professional background and the all round tasks he performs, the nurseman of the vessel.

Haul selection is random. For each sampled haul, representative samples of target or priority species (as those under moratorium), along with another from the most abundant by-catch, are sorted. This task is performed by one person (the nurseman) under a tight fishing haul schedule, leaving no room to collect samples of less abundant and/or non commercial fish. The fisheries in Eastern Arctic fishing grounds are composed by almost clean target catches with few by-catches, difficult to collect within usual large volumes of total catch.

Sampling for each species is random; each sample is taken from the haul catch before any rejections. The sample length is made by sex (exception for cod) consisting in recording the sample weight and collecting all individual lengths. A subsample from length sampling is taken to collect biological data.

### **3.Expected execution difficulties**

Fishing strategy of cooperative companies is highly variable and dependent of unpredicted market opportunities. This may partly jeopardize the yearly sampling design in one or both regulatory areas.

### **4.Data archiving and Quality assurance procedure**

The NEAFC, Norwegian and Svalbard waters data are stored in a local data base and upload in the international data bases FishFrame and Intercatch. NAFO data are stored in a local data base and submitted to quality check to meet NAFO requirements, and are further validated by NAFO.

### **5.Analysis methods**

Estimates at fleet level have been provided to NAFO and the relevant ICES working groups.

### References

Vargas, J.; Alpoim, R.; Santos, E. e Ávila de Melo, A. M. (2016) – NAFO Portuguese Research Report for 2015. NAFO SCS Doc. 16/09, Serial N6555, 45 pp.

#### Text Box 4A.4: ICES Division X

##### **TB 4A.4 At market and at sea sampling**

**At market sampling (ICES Division X): AZM1 - LHP\_FIF\_<10m; AZM2 - LHP\_FIF\_>10m; AZM6 - LLS\_DEF\_<12m; AZM7 - LLS\_DEF\_1218; AZM8 - LLS\_DEF\_>18m; AZM14 - LHP\_CEP; AZM18 - PS\_SPF; AZM22 - GNS\_FIF; AZM27 - FPO; AZM37 - LHP\_DWS\_<10m ; AZM38 - LHP\_DWS\_>10m ; AZM43 - LLS\_DWS\_<12m ; AZM44 - LLS\_DWS\_1218 ; AZM45 - LLS\_DWS\_>18m (in Table 4A)**

###### **1.Specification of purposes**

The objective of at market sampling is to obtain length frequency distributions of fish landed at auctions by Azorean vessels operating in ICES Division X.

###### **2.Design**

Population: lengths of fish landed by Azorean vessels operating in ICES Division X;

Target population: lengths of fish landed at auction (=port) by the Azorean vessels licensed to operate in ICES Division X;

Study population: lengths of fish at port from a subset of vessels from a fleet segment/métier based on the result from the analysis through the algorithm developed and runned for previous year landings;

Sampling frame: vessels (using the different fishing techniques) operating from the main Azorean ports;

Stratification type: spacially (ports) and temporally (quarters) in order to improve sampling coverage through the year and in the main Azorean ports;

Sampling effort: in each fleet segment/métier sampling effort is fixed by previous allocation where a weight criteria is used. Spatio-temporal allocation is proportional to landings (from previous year) in each port\*quarter combination;

Primary Sampling Unit (PSU): port x day.

###### Description

The sampling design is stratified multistage:

- a) The Azorean fleet is stratified by fleet segment, métier and time. Sampling effort is established as number of trips expected to be sampled in each fleet ( $\approx$ métier) and allocated to auctions and quarters proportionally to last year's landings;
- b) In every auction\*visit\_date, samplers attempt to sample a predefined number of vessel\_sale\_events. Each vessel\_sale\_event corresponds to the landings of one fishing trip. Samplers randomly select the vessel\_sale\_events from vessels present at the harbor;
- c) In each vessel\_sale\_event, the samplers aim to sample boxes from every commercial species and commercial category. This way, concurrent sampling scheme is applied, although sometimes the coverage of all species is not possible.
- d) Within each commercial category samplers randomly select boxes to be sampled aiming for a minimum

number of 50 fishes;

e) A fishing effort related questionnaire is also performed to the shipmaster of the vessel selected for sampling.

In an experimental basis during 2017, length measurements will also be recorded in some auctions using an electronic system composed by a local unit for automatic image acquisition of fish boxes and a remote database to record the processed images using Fishmetrics system.

### **3.Expected execution difficulties**

- a) Vessels arriving to port after the auction has started. If there is a large amount of landings/species/categories, there is no time to sample the complete trip;
- b) Shipmasters don't give permission for samplers to measure fish from their vessels;
- c) Previously fixed sale contracts for some species, prevents samplers access to fish.

### **4.Data archiving and Quality assurance procedure**

At market sampling database (PRAI) is programmed in MySQL and contains internal routines for the detection of basic errors (e.g., errors in dates, species codes). Routines for checking of errors are also implemented.

Quality checks and validation procedures are implemented: (1) All samples are checked by a coordinator before the input of data; (2) All data introduced in database is checked for syntax errors; (3) A random check of 10% of the data is executed by inspecting the registered data for logical errors; (4) Length distribution and effort samples are then connected with the market landings for future cross examinations.

### **5.Analysis methods**

Is dependent on stock coordinators needs, the purposes of the analysis or specific recommendations from RFMO's.

**At sea sampling (ICES Division X): AZS4 - LHP\_FIF\_>10m; AZS10 - LLS\_DEF \_<12m; AZ11 - LLS\_DEF \_1218; AZS12 - LLS\_DEF \_>18m; AZS16 - LHP\_CEP; AZS20 - PS\_SPF; AZS23 - GNS\_FIF; AZS28 - FPO; AZS40 - LHP\_DWS \_>10m ; AZS47 - LLS\_DWS \_<12m ; AZS48 - LLS\_DWS \_1218 ; AZS49 - LLS\_DWS \_>18m (in Table 4A)**

#### **1.Specification of purposes**

The objective of the at sea sampling is to obtain all catch fractions specific composition (including discards), both in number and volume, lengths and age of Azorean vessels operating in ICES Division X.

#### **2.Design**

Population: lengths of fish captured by the Azorean vessels operating in ICES Division X (within species);

Target population: lengths of fish captured by the Azorean vessels of all length class that operate in ICES Division X (within species), except for Handliners targeting tuna (pole and line);

Study population: lengths of fish captured by a subset of Azorean vessels within each length class/métier that operate in ICES Division X (within species). The subset is composed of several fleet segments selected based on species landings. The list of vessels for each fleet segment/métier is updated annually based on a combination of the result from the analysis through the algorithm developed and runned for previous year landings and a list of cooperative vessels;

Sampling frame: list of cooperative vessels >10m for each fleet segment/métier that are willing and have logistics conditions (space and safety equipment) to take observers onboard operating from the main Azorean

ports;

Stratification type: métier, vessel length class, spatial (ports) and temporal (quarters);

Sampling effort: within each fleet segment/métier, sampling effort distribution in space and time is proportional to effort or landings;

Primary Sampling Unit (PSU): trip.

Description:

Vessels selection is quasi-random from a set of cooperative vessels within each fleet length class/métier. For 2017, the following metiers and sampling effort (number of trips) objectives are set: LHP\_FIF (n=6 trips), LLS\_DEF (n=48 trips), LHP\_CEP (n=9 trips), PS\_SPF (n=9 trips), GNS\_FIF (n=12 trips), FPO (n=6 trips) and LLD\_LPF (n=6 trips).

At sea sampling for discards purposes (length distribution and volume) is conducted by scientific observers accommodated voluntarily on board selected vessels (by métier and length class).

The Azores at sea observer scheme collects comprehensive data on species composition and length composition of all retained and discarded components of the catch on a haul-by-haul basis. All interactions with vulnerable fauna (e.g. sea-birds, sea-turtles and marine mammals) are recorded, as well as the conditions when they are released. Landings from vessels with an observer on board will be sampled by the samplers present at the landing port. Non-responses and refusal rates are recorded.

### **3.Expected execution difficulties**

Problems will occur regarding the access of the scientific observers on board fishing vessels that, either do not present the necessary conditions to take one extra person or refuse to accept them. Sampling targets depends critically on the goodwill of the fishing industry to at sea sampling. Main difficulties will occur at the level of smaller vessels that cannot take observers on board.

### **4.Data archiving & Quality assurance procedure**

Discards database is programmed in MySQL and contains general trip information (vessel information, date, location, haul number, landed weight by species), along with sample information by catch fraction (retained, discarded) and species, namely weight, number of specimens and length composition.

Quality checks and validation procedures are implemented: (1) All samples are checked by a coordinator before the input of data; (2) All data introduced in database is checked for syntax errors; (3) A random check of 10% of the data is executed by inspecting the registered data for logical errors; (4) Length distribution and effort samples are then connected with the market landings for future cross examinations.

### **5.Analysis methods**

Estimates at fleetlevel have only been provided for LLS\_DEF where sampling dates back to 2004.

### **Text Box 4A.5: CECAF 34.1.2.**

#### **TB 4A. 5. At-market and at-sea sampling**

#### **At-market sampling (CECAF 34.1.2.)- DWF1\_M1; SPF1\_M2; MOL1\_M4 (in Table 4A)**

##### **1.Specification of purposes**

The objective of at-market sampling is to obtain length distributions of fish landed at auctions by Madeiran

vessels operating in CECAF 34.1.2. and CECAF 34.2.0.

## **2. Sampling Design**

Population: Lengths of fish landed by the Madeiran vessels operating in CECAF 34.1.2. and CECAF 34.2.0.(Within species).

Target population: Lengths of fish landed at auction (= port) by the Madeiran vessels operating in CECAF 34.1.2. and CECAF 34.2.0.(Within species).

Study population: Lengths of fish landed by a subset of the Madeiran active vessels which operate in CECAF 34.1.2. and CECAF 34.2.0. (Within species). The subset is composed of several fleet segments selected based on species landings. The list of vessels for each fleet segment is updated annually based on a combination of gear licenses and the main species landed in the previous year.

Sampling frame: list of ports\*day for each fleet segment.

Stratification type: Spatial – ports; Temporal – months. Stratification is used to improve sampling coverage through the year and in Madeira island.

Sampling effort: Within each métier, sampling effort distribution in space and time is proportional to effort or landings in each port\*month combination.

Primary Sampling Unit (PSU): trip.

### Description:

The sampling design is stratified multistage, with trip as the Primary Sampling Unit (PSU).

a) The Madeiran fleet is stratified by fleet segment/métier, trip and month. Following the DCF requirements [EU Commission Decision (2010/93/EU) and sampling effort is established as number of trips. Annual sampling effort is fixed by the DCF National Sampling Plan that sets the number of trips expected to be sampled in each fleet ( $\approx$  métier).

b) For each fleet segment/métier, the visit dates in each auction\*month are spread somewhat systematically throughout the month in a way that covers all week-days where the fleet is active.

c) In every auction\*visit\_date, observers attempt to sample a predefined number of vessel\_sale\_events. Each vessel\_sale\_event generally corresponds to the landings of one fishing trip. To select the vessel\_sale\_events that are to be sampled, observers obtain a list of all landings awaiting auction. The list generally includes the name of each vessel and the commercial species, commercial category and weight of each of its boxes. A vessel\_sale\_event is selected haphazardly from the list.

d) In each vessel\_sale\_event, the observers aim to sample boxes from every commercial species and commercial category.

e) Within each commercial category, the observers select 1 box haphazardly. However, sometimes there are <100 fish from a scientific species inside the box, so observers take several boxes until they reach the required number.

f) Within each box, different species may be present, and observers select all of them to sample.

## **3.Expected execution difficulties**

a) Vessels arriving to the port after the auction has started. If they have a large amount of landings/species/categories, there is no time to sample the complete trips.

b) Shipmasters do not give permission for observers to sample fish from their vessels.

c) Sometimes observers do not have time to sample all commercial species, so they select the more important

species.

#### **4.Data bases & Quality assurance procedure**

The database in EXCEL contains general trip information (vessel information, date, location, landed weight by species), along with sample information by species, namely weight, number of specimens and length composition.

Quality checks and validation procedures are implemented: (1) All samples are checked by a coordinator before the input of data (2) All data introduced in database is checked for errors and outliers; (3) A random check of 10% of the data is executed by inspecting the registered data for logical errors; (4) Length distribution and effort samples are then connected with the logbooks for future cross examinations.

### **At-sea sampling (CECAF 34.1.2.)- DWF2\_ M1; SPF2\_ M2; (in Table 4A)**

#### **1.Objectives**

The main objectives of the "at-sea sampling programme" is to identify and characterize the catches fractions specific composition (including discards), both in number and volume and lengths and age, of Madeira registered vessels operating in CECAF 34.1.2. and CECAF 34.2.0.

#### **2.Sampling Design**

Population: Lengths of fishes captured by the Madeiran vessels operating in CECAF 34.1.2. and CECAF 34.2.0. (Within species).

Target population: Lengths of fish captured by the Madeiran vessels of all length classes that operate in CECAF 34.1.2. and CECAF 34.2.0. (Within species).

Study population: Lengths of fish captured by a subset of the Madeiran active vessels within each length class that operate in CECAF 34.1.2. and CECAF 34.2.0. (Within species). The subset is composed of several fleet segments selected based on species landings. The list of vessels for each fleet segment is updated annually based on a combination of gear licenses and the main species landed in the previous year.

Sampling frame: List of cooperative vessels for each fleet segment/métier that are willing and have logistics (space and conditions) to take observers onboard.

Stratification type: vessel length class, métier and spatial (fishing grounds).

Sampling effort: Within each métier, sampling effort distribution in space and time is proportional to effort or landings.

Primary Sampling Unit (PSU): Trip

#### Description:

Vessels selection is quasi-random within a set of cooperative vessels. Every year, the following métiers and sampling effort objectives are set: LLD\_DWF (n=30 trips), and PS\_SPF (n=60 trips). Within each métier, sampling effort distribution in space and time is proportional to effort or landings.

A pluriannual programme (2017-2019) will be implemented contracting an outsource service to implement the Madeira observers on board programme.

At-sea sampling is conducted by one scientific observer, accommodated voluntarily on board by the captain.

Every haul of a trip is selected for sampling and for each fishing operation data to be recorded includes: (i) type, and technical characteristics of the gear and fishing operations; (ii) geographical location of fishing sets; (iii) species composition of the total catch (retained and discarded), and landings (collected at the fish auction following the trip) in number and biomass; (iv) lengths of retained (subsample), discards (*census*) and landings (subsample); (v) sex for elasmobranchs and crustaceans; (vi) reason for discarding each individual; (vii) the condition when discarded (alive/dead) and (viii) destiny of the retained fraction of the catch that might not be landed. Interactions with vulnerable fauna (e.g. sea-birds, sea-turtles and marine mammals) are also recorded.

The Madeira at-sea observer programme will collect comprehensive data on species composition and length composition of all retained and discarded components on a haul-by-haul basis, and therefore provides Scheme 1 concurrent sampling of Group 1 – 3 species. Landings from vessels with an observer on board, in specific trips will be sampled by the sampling technicians present at the landing harbour.

The target population is the total number of fishing trips, of a given metier, in a given time period, in Madeira fishing grounds.

### **3.Expected execution difficulties**

Problems will occur regarding the access of the scientific observers on board fishing vessels that, either do not present the necessary conditions to take one extra person or refuse to accept them. Sampling targets depends critically on the goodwill of the fishing industry to at-sea sampling. Main difficulties will occur at the level of smaller vessels that cannot take observers on board.

### **4.Data bases & Quality assurance procedure**

The database in EXCEL contains general trip information (vessel information, date, location, haul number, retained weight by species), along with sample information by fraction (retained, discarded) and species, namely weight, number of specimens and length composition.

Quality checks and validation procedures are implemented: (1) All samples are checked by a coordinator before the input of data (2) All data introduced in database is checked for errors and outliers; (3) A random check of 10% of the data is executed by inspecting the registered data for logical errors; (4) Length distribution and effort samples are then connected with the market landings for future cross examinations.

## **Biological variables sampling (CECAF 34.1.2. )**

Biological variables sampling are performed (at the Madeira fisheries laboratory), to obtain stock related variables including biometry, age, sex-ratio and sexual maturity of fish landed and sold in auctions by the Madeiran registered vessels operating in the CECAF 34.1.2. & CECAF 34.2.0. Areas.

Sampling for biological variables is independent of at-market sampling. Commercial sampling for biological variables (length, weight, age, sex ratio and maturity) is performed monthly by purchasing fish samples from selected ports at Madeira. Fish from each sample are randomly selected per length class (5 individuals/2, 5 or 10cm length class, depending on the species).

Biological sampling follows standardized protocols depending on the species. Length-weight relationship, age-length-key and maturity ogive are estimated in time intervals indicated in Table 1B.

### **Text Box 4A.6.: ICCAT**

#### **TB 4A.6 At-market and at-sea sampling in ICCAT**

### **At-market sampling (ICCAT – BFT58, Azores grounds and CECAF Division 34.1.2.)**

At-market sampling in ICCAT is performed at Portugal mainland, Azores and Madeira ports. Sampling strategy used in each zone is described in table below:

At-market sampling	PT_Mainland		Azores	Madeira
Stratum ID Code (Table 4A)	PTM25 - LLD_LPF (longline)	PTM27 - FPN_LPF (tuna traps)	AZM24 - LHP_LPF_<12m; AZM25 - LHP_LPF_>12m (poles and lines); AZM29 – LLD_LPF (longline)	LPF1_M3 (poles and lines)
Zone/Area	ICCAT	ICCAT - BFT58	ICCAT –Azores grounds	ICCAT – CECAF 34.1.2
<b>1-Specification of purposes</b>	Obtain length distributions of fish landed at auctions			
<b>2-Design</b>				
<u>Population</u>	Lengths of fish landed by Portuguese vessels in each zone/area			
<u>Target population</u>	Lengths of fish landed at auction (=port) in each zone/area			
<u>Study population</u>	Lengths of fish captured by Portuguese vessels operating in each zone/area and landed in selected ports for sampling			
<u>Sampling frame</u>	All vessels landing in each selected port for sampling			
<u>Stratification type</u>	None	Temporal (quarters) (*)	Spatial (ports) and temporal (quarters) (*)	None
<u>Sampling effort</u>	All vessels landing in port are sampled	Fixed number of sampling days per quarter are defined proportionally to number of landing days per quarter	Fixed by previous allocation using a weight criteria. Spatio-temporal allocation proportional to landings in previous year in each port*quarter combination	Samplers randomly measure 50 individuals per species present in the harbor, following a predefined scheme
<u>Primary sampling unit</u>	Auction*day (in specific ports)		Trip	
<u>Description</u>	In each vessel_sale_event, the observers aim to individually measure and/or weight each	Visit dates in each auction*quarter are spread somewhat systematically throughout the	Seasonal fishery (May-September), where for every auction*visit_date,samplers aim to randomly sample a	In each vessel_sale_event, the observers aim to individually measure each

	specimen from every commercial species and commercial category. Some commercial species may not be available for sampling if they are frozen and packaged.	quarter in a way that covers all week-days where the tuna trap is active. In every auction*visit_date, observers attempt to sample a predefined number of vessel_sale_events. Each vessel_sale_event generally corresponds to the landings of one fishing event at the tuna trap.	predefined number of vessel_sale_events, from vessels present at the harbor, which generally corresponds to the landings of one fishing trip. Samplers aim to sample boxes from every species and commercial category (at a minimum number of 50 fishes to be measured and/or weighted), applying concurrent sampling scheme A fishing effort related questionnaire is also performed to the shipmaster of the vessel selected for sampling.	specimen from every commercial species and commercial category.
<b>3-Expected execution difficulties</b>	Some commercial species are landed frozen and packaged: only total landed weight is taken.	During the fishing season, after tuna quota is closed, fishing activity suspends until all tunas are sold. In some years it is difficult to carry out all planned sampling days.	Difficulties maybe raised by the fishing industry operators concerning fish access and handling. In these situations only the total landed weight is taken.	-
<b>4-Data archiving and Quality assurance procedure</b>	Data stored locally at IPMA.		Data is archived at IMAR/DOP's local database designed to accommodate this type of information.	Data is archived at DSI/DRP local database designed to accommodate this type of information.
	Quality control to meet ICCAT requirements carried out before data are submitted to ICCAT, including: (1) All samples are checked by a coordinator before the input of data; (2) All data introduced in the database is checked for syntax errors; (3) A random check of 10% of the data is executed by inspecting the registered data for logical errors, like for example, type of data and values range of the variables; (4) Length distributions are then connected with the market landings for future cross examinations. All data is public at ICCAT Secretariat and website.			
<b>5-Analysis procedures</b>	Stocks of the main ICCAT species are assessed regularly by the Scientific Committee for Research and Statistics (SCRS) of ICCAT. The methods are defined and applied according to the SCRS work. The frequency of the stock assessments is predefined according to the SCRS schedule of assessments and requests from the ICCAT Commission.			

<sup>(\*)</sup>Stratification used to improve sampling coverage.

## **At-sea sampling (ICCAT longline) - PTS26 - LLD\_LPF; AZS31 – LLD\_LPF (in Table 4A)**

### **1.Specification of purposes**

The objective of at-sea sampling is to obtain the species composition and length distribution of total catches (targeted and bycatch species, including landed catch and discards) from the Portuguese longline vessels operating in the ICCAT area.

### **2.Design**

Population: Fish captured by the Portuguese longline vessels operating in the ICCAT area.

Target population: Fish captured by the Portuguese longline vessels in the main areas of operation of the Portuguese pelagic longline fleet, specifically in the Equatorial, Tropical Northeast, and Temperate Northeast Atlantic (ICCAT area).

Study population: Fish captured by the Portuguese longline vessels operating in the ICCAT area.

Sampling frame: List of cooperative vessels that are willing and have logistics (space and conditions) to take observers onboard.

Stratification type: Sampling stratified by areas/fleet components, covering the main areas of operation (Equatorial/Tropical and Temperate regions) and fleet components (Fresh and Freezer vessels).

Sampling effort: Sampling effort distribution in space and time is proportional to effort or landings. The goal is to cover a minimum of 5% of the total fishing effort, as currently recommended by ICCAT.

Primary Sampling Unit (PSU): Trip.

#### Description:

Vessels selection is quasi-random from within a set of cooperative vessels. The observer identifies, measures and determines the sex of every specimen from every haul. The observer also registers whether the specimen is alive or dead when captured and discarded (in case discard happens). All interactions with vulnerable fauna (e.g. sea-birds, sea-turtles and marine mammals) are recorded, as well as the conditions when they are released.

### **3.Expected execution difficulties**

Increased number of vessels operating with skippers that do not allow observers on board.

### **4.Data archiving and Quality assurance procedure**

Data are stored locally at IPMA and IMAR/DOP. Quality control to meet ICCAT requirements is carried out before data are submitted to ICCAT. All data are public at the ICCAT Secretariat and website.

### **5.Analysis methods**

Stocks of the main ICCAT species are assessed regularly by the Scientific Committee for Research and Statistics (SCRS) of ICCAT. The methods are defined and applied according to the SCRS work. The frequency of the stock assessments is predefined according to the SCRS schedule of assessments and requests from the ICCAT Commission.

## **At-sea sampling (ICCAT Baitboat\_CECAF 34.1.2.) LPF2\_M3 (in Table 4A)**

### **1.Objectives**

The main objectives of the "at-sea sampling programme" is to identify species composition (including discards), both in number, weight and lengths of specimens of Madeira active vessels catches which operate in CECAF 34.1.2. and CECAF 34.2.0.

## **2.Sampling Design**

Population: Lengths of fishes captured by the Madeiran vessels operating in CECAF 34.1.2. and CECAF 34.2.0. (Within species).

Target population: Lengths of fish captured by the Madeira tuna vessels of all length classes that operate in CECAF 34.1.2. and CECAF 34.2.0. (Within species).

Study population: Lengths of tuna captured by a subset of the Madeiran active vessels within each length class, that operate in CECAF 34.1.2. and CECAF 34.2.0. (Within species). The subset is composed of several fleet segments selected based on species landings. The list of vessels for each fleet segment is updated annually based on a combination of gear licenses and the main species landed in the previous year.

Sampling frame: List of cooperative vessels that are willing and have logistics (space and conditions) to take observers onboard.

Stratification type: vessel length class, métier and spatial (fishing grounds).

Sampling effort: Within each métier, sampling effort distribution in space and time is proportional to effort or landings.

Primary Sampling Unit (PSU): Trip

Description:

Vessels selection is quasi-random within a set of cooperative vessels. Every year, the following métiers and sampling effort objectives are set: LHP\_LPF (n=50 trips) . Within each métier, sampling effort distribution in space and time is proportional to effort or landings.

A pluriannual programme (2017-2019) will be implemented contracting an outsource service to implement the Madeira observers on board programme.

At-sea sampling is conducted by one scientific observer, accommodated voluntarily on board by the captain.

Every haul of a trip is selected for sampling and for each fishing operation data to be recorded includes: (i) type, and technical characteristics of the gear and fishing operations; (ii) geographical location of fishing sets; (iii) species composition of the total catch (retained and discarded), and landings (collected at the fish auction following the trip) in number and biomass; (iv) lengths of retained (subsample), discards (census) and landings (subsample); (v) reason for discarding each individual; (vi) the condition when discarded (alive/dead) and (vii) destiny of the retained fraction of the catch that might not be landed. Interactions with vulnerable fauna (e.g. sea-birds, sea-turtles and marine mammals) are also recorded.

The Madeira at-sea observer programme will collect comprehensive data on species composition and length composition of all retained and discarded components on a haul-by-haul basis, and therefore provides Scheme 1 concurrent sampling of Group 1 – 3 species. Landings from vessels with an observer on board, in specific trips will be sampled by the sampling technicians present at the landing harbour.

The target population is the total number of fishing trips, of a given metier, in a given time period, in Madeira fishing grounds.

## **3.Expected execution difficulties**

Problems will occur regarding the access of the scientific observers on board fishing vessels that, either do not present the necessary conditions to take one extra person or refuse to accept them. Sampling targets depends critically on the goodwill of the fishing industry to at-sea sampling. Main difficulties will occur at the level of smaller vessels that cannot take observers on board.

## **4.Data bases & Quality assurance procedure**

The database in EXCEL contains general trip information (vessel information, date, location, haul number, retained weight by species), along with sample information by fraction (retained, discarded) and species, namely weight, number of specimens and length composition.

Quality checks and validation procedures are implemented: (1) All samples are checked by a coordinator before the input of data (2) All data introduced in database is checked for errors and outliers; (3) A random check of 10% of the data is executed by inspecting the registered data for logical errors; (4) Length distribution and effort samples are then connected with the market landings for future cross examinations.

#### **Biological variables sampling (ICCAT)**

Biological variables sampling are performed (at the laboratory), to obtain stock related variables including , weight, sex-ratio and sexual maturity of fish landed and sold in auctions by the Madeiran vessels operating in the ICCAT area.

Most of the stocks are assessed within ICCAT Assessment Working Groups. Data preparation and stock assessment methods are defined by SCRS and described in the species work plans. Sampling for biological variables is independent of at-market sampling. Commercial sampling for biological variables (weight sex ratio and maturity) is performed annually for selected species by purchasing. Each individual is selected per length class (5 individuals/5 cm length class). Length-weight relationship and maturity ogive are estimated in time intervals indicated in Table 1B.