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 (DRP/RAA)
- Direção Regional do Mar da Região Autónoma da Madeira/ Regional Directorate of the Sea in Madeira (DRM/RAM)

Commission Delegated Decision (EU) 2019/910 of 13 March 2019

establishment the multiannual Union programme for the collection, management and management of biological, environmental, technical and socioeconomic data in the fisheries and aquaculture sectors

Commission Delegated Decision (EU) 2019/909 of 18 February 2019

establishment the list of mandatory research surveys and thresholds for the purpose of the multiannual Union programme for the collection, management and management of data in the fisheries and aquaculture sectors

PORTUGAL

Work Plan

2020-2021

Version [2021] – [October 31, 2020]

Lisbon, 31th October 2020

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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:

As the activity of recreational fishing in Portugal was insufficiently monitored, a pilot study was developed in 2017-2018 by an external entity ordered by the General Directorate of Natural Resources, Safety and Maritime Services (DGRM) and coordinated by the Center for Marine Sciences of the University of Algarve (CCMAR).

The aim was to fill the gaps with regard to the systematic collection of data on the recreational catches of the species included in the DCF. In order to attain the identified objectives, a comprehensive sampling strategy was defined.

In terms of the estimates by DCF species, for sea bass, the total annual catch for shore angling and boat-based angling catches was estimated at 965 ton, and the total annual harvest (i.e., retained fish) at 949 ton.

The comparison between annual estimated recreational harvest and commercial catches indicates that the recreational fisheries (shore based and boat-based angling) of sea bass and spotted sea bass represent 68% of the total annual landings for these two species.

In general, this pilot study demonstrates the importance that sea bass recreational fishing has on the Portuguese fisheries. However, despite the size and nature of the pilot project, it should be noted that there are various constraints that may affect the estimates, namely because this was a study of only one fishing year.

Therefore, before the definition of regular sampling a second phase of the pilot study will be developed.

2. Duration of pilot study:

It is expected that the new phase of the pilot study will be developed in 2020 and 2021.

3. Methodology and expected outcomes of pilot study:

Recreational fishing in Portugal includes three segments, onshore fishing ("pesca apeada"), boat fishing and spearfishing. In mainland the highest number of licenses is from onshore fishing. In 2018, 187.372 licenses were issued for onshore fishing followed followed by boat fishing with 68.296 licenses. The number of licenses may not match with the number of 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.

3.1. Population

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

3.2. Sampling

Sampling is expected to include the following components:

- Surveys by questionnaire on a fixed panel of recreational fishers recruited through DGRM web page;
- Surveys in fishing competitions (sport fishing).

3.3 Data collection

Data collection will be focused on estimation of fishing effort and catches.

Databases will be organized with all the collected information.

Pilot Study 1.2: Relative share of catches of recreational fisheries compared to commercial fisheries in Mainland:Pollack, elasmobranchs, highly migratory species and eel

PS1.2

1. Aim of pilot study:

As the activity of recreational fishing in Portugal was insufficiently monitored, a pilot study was developed in 2017-2018 by an external entity ordered by the General Directorate of Natural Resources, Safety and Maritime Services (DGRM) and coordinated by the Center for Marine Sciences of the University of Algarve (CCMAR) This pilot study aimed to estimate the total catch of the pollack, elasmobranchs, highly migratory species and eel caught by recreational fishing in Portugal-mainland.

Concerning pollack, elasmobranchs, highly migratory species, the sampling area considered the entire Portuguese continental coast, divided into NUTS II and subsequently sub-divided into sections of 5 km of coastline (for shore angling and spearfishing) or access points (for onboard angling and spearfishing). Apart from the official data on recreational fisheries licenses (DGRM), the project developed a data collection strategy using face-to-face questionnaire surveys, historical sport fishing activity data from anglers' federations and associations and monitoring of fishing tournaments.

Concerning eel, recreational fishing is forbidden in areas under maritime jurisdiction (Portaria nº 14/2014, of 23 January). In 2017, legislation was published with a ban of recreational fishing in fresh waters (Portaria 360/2017, of 22 November). Therefore, there will be no sampling plan for eel recreational fishery.

Of all the species under the DCF, no catches of pollack (*Pollachius pollachius*) were registered. Blue shark (*Prionace glauca*) was caught in the spring (one single individual, which was not targeted), and in the summer (eight specimens). Only four white marlins and two skipjack tuna were also caught and in the summer.

In terms of the estimates by DCF species, for blue shark, white marlin and skipjack tunas, and because of the small number of specimens, they did not represent robust estimates.

Therefore, before deciding on the need of regular sampling, a second phase of the pilot study will be developed.

2. Duration of pilot study:

It is expected that the new phase of the pilot study will be developed in 2020 and 2021.

3. Methodology and expected outcomes of pilot study:

- Surveys by questionnaire on a fixed panel of recreational fishers recruited through DGRM web page;
- Surveys in fishing competitions (sport fishing).

3.1. Population

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

3.2. Sampling

Sampling is expected to include the following components:

- Surveys by questionnaire on a fixed panel of recreational fishers recruited through DGRM web page;
- Surveys in fishing competitions (sport fishing).

3.3 Data collection

Data collection will be focused on estimation of fishing effort and catches.

Databases will be organized with all the collected information.

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 elasmobranchs and highly migratory ICCAT species by recreational fishing in Azores.

2. Duration of pilot study

The pilot survey design includes a foreseen activity calendar of 24 months for the off-site components and 14 months for the on-site component (between May of 2020 and June of 2021).

3. Methodology and expected outcomes of pilot study

Recreational fishing in Azores captured a high diversity of species including elasmobranchs, tuna species and some vulnerable marine species. The most important fishing modes are spearfishing and boat fishing, estimated to catch 202 tons and 148 tons, respectively. In particular, for some relevant species as Parrot fish (*Sparisoma cretense*) with 112 tons (40%

of artisanal landings) or Blacktail comber (*Serranus atricauda*) with 77 tons (124% of artisanal landings), there is evidence of management policy needs.

Despite the results obtained during NWP 2017-2019, additional methods will be applied in order to improve the estimates and knowledge of recreational fisheries in the region. (before the decision to implement a sampling plan.) Therefore, an adjustment to the pilot study using complementary methodologies is necessary.

The extension of the pilot survey for 2020-2021 will focus on the recreational boat fishing and spearfishing. The methodology will be based on a complemented survey design by applying an off-site survey composed by three main elements: i) a survey embedded in the recreational fishing license system; ii) a web based logbook; and iii) logbooks survey for recreational charter boats and an on-site survey (access point survey).

The first off-site survey component is embedded in the recreational fishing license system. This 12-month recall survey will take place at the time the recreational boat angler or spearfisher is applying for a recreational fishing license in an informatics platform that allows the data collection on fishing effort, mean catch per trip and main captured species. This survey implemented during the work plan 20117-2019 will continue during the WP 2020-2021, but with adjustments to improve the engagement rate and the data quality.

The second off-site survey component is a 12-month logbook. This survey implemented during the WP 2017-2019, presented a weak engagement from the recreational fishers. To increase this rate, the recreational fishing license system platform will be used as a get way to recruit a panel for filling up the logbook. It consists of a web logbook that allows collecting data on fishing effort, catch, discards and economic expenditures.

The third off-site survey component it's headed for recreational boat charters for big game fishing and bottom fishing. During 2017–2019, the catch and effort data have been collected by phone surveys revealing that this fleet is mainly based on catch and release handling practice (i.e., 16.7 tons of highly migratory pelagic fishes in 2018). For the WP 2020-2021, web based logbooks will be implemented and enterprises will be contacted monthly to confirm that they are reporting the data (retained and catch and released per fishing trip).

The on-site survey component aims to estimate catch composition, catch rate and other issues (e.g., fishing effort, economic expenditures, and unlicensed fishers) on an island- or archipelago-wide scale. Bearing in mind that sampling the nine Azores islands would be very expensive, five islands were selected based on: i) the number of recreational fishing licenses per island, ii) the island dimension (spatial and population), iii) geographic sampling distribution (three islands groups; western, central and eastern), and iv) islands already surveyed, allowing also an analyses of temporal changes. The islands selected are Flores, Pico, Faial, Terceira, and São Miguel Islands. During the first period (2 month), the work will concentrate on field tests, recognition of the coastal areas, and test interviews with possible methodological adjustments. The second period (12 month) aims to apply the methodology designed. The sampling strategy design is the on-site access point-survey (complete trips) (Pollock et al., 1994). The study islands will be sampled quarterly with a two-stage probability sampling (Pollock et al., 1994): eight days of sampling with exception of Flores island (four days of sampling) due to the fewer population and lower licenses boats. The islands sampling scheme will be randomly schedule in week and weekend days. Two access point combinations per each day will be selected (one in the morning and other in afternoon). The sampling units will be chosen with non-uniform probability for islands where some access points have higher importance for boat fishing (e.g., due to the presence of an important marina). While in islands with multiple site ramps and without an access point weighting more importance, a uniform probability is applied. The sampling scheme will have some adjustments accordingly to weather prevision (i.e., avoiding storms with few or none fishing effort; Diogo and Pereira, 2013).

Diogo, H.M.C. and Pereira, J.G. 2013. Impact evaluation of spear fishing on fish communities in an urban area of São Miguel Island (Azores Archipelago). *Fisheries Management and Ecology*, *20*(6), pp.473-483.

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, Maryland.

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

***Follow-Up study* on the highly migratory species recreational fisheries in Madeira (CECAF 34.1.2)**

1. Aim of pilot study

Following a pilot study - *conducted 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* - further studies are now ongoing and will be continued, taking in account the analysis of the results already obtained and its validation, and aiming to enhance the overall knowledge about recreational fisheries in Madeira, its catches composition and abundance, improve the monitoring of the fishery and collection of biological data and assess the impact of this fishery in the resources.

In Madeira, the big game fishing fleet has increased during the last decade, possibly due to the increase in tourism. In this study 31 vessels were registered, an increase of 101% compared with the number of vessels known to exist in 2003.

Blue marlin, *Makaira nigricans* (Lacepède, 1802) is the target species and the most frequently captured, although other large pelagic fishes, such as the Atlantic white marlin, *Kajikia albida* (Poey, 1860) and occasionally other species of spearfish. By catch species, e.g. wahoos, *Acanthocybium solandri* (Cuvier, 1832), dolphin fishes, *Coryphaena hippurus* (Linnaeus, 1758) and *C. equiselis* (Linnaeus, 1758), and various species of tuna: bigeye tuna, *Thunnus obesus* (Lowe, 1839); albacore, *Thunnus alalunga* (Bonnaterre, 1788) or skipjack, *Katsuwonus pelamis* (Linnaeus, 1758) can be caught but its frequency its most variable yearly.

The average weight of blue marlin in Madeira (295.5 kg) is higher than in other regions of this area of the Eastern Atlantic and of the world, being Madeira considered as one of the best places to capture larger specimens (499 kg was the weight of the biggest blue marlin caught in the period analyzed). Anglers in general, follow catch & release technique. This practice and the limited number of other species captured, suggest that this type of fishery most probably does not significantly affect these resources. However, the economic impact of the big game fishing activity in Madeira is estimated around 2 million euros per year (representing 16% of the total value of the commercial fishing of large migratory pelagic species), an amount of money that should be considered when analyzing the impact of this activity in the regional GDP and its importance to the tourism sector. This study should also be relevant to give

guidance to further monitoring of this fishery activity and the assessment of its environmental and socio-economic impacts.

2. Duration of pilot study

From 1st January 2020 until 31th December 2021.

3. Methodology and expected outcomes of pilot study

The Madeira management of the exercise of recreational fishing on board already requires the licensing by boat, registered in the recreational or Maritime-Tourism activity.

Licensing is carried out at the Regional Fisheries Directorate or via the Government services, "SIMPLIFY". Under current legislation, the holding of any sport fishing competition requires the permission of the Regional Fisheries Directorate.

The effective implementation for monitoring Madeira recreational fisheries is preceded by a preparatory phase comprising the enforcement of the Autonomous Region of Madeira legislation relative to the subject of the ludic fisheries. It commits to the Regional Directorate of Fisheries the implementation of the monitoring activity, ensuring the registration of recreational fishing activities and determining a mandatory response, of all licensed or authorized to exercise recreational fishing, to the surveys that will be carried out to monitor the activity and determine the catches. The renewal of their license is dependent on the accurate and complete response to these inquiries. The enforcement of existent legal tools comprises a deadline of ten days for the delivery of the inquires after each recreational fishing activity (number 3, of the article 14, of the Ordinance n. º 484/2016, of 14th November).

As of now, inquiries are already being furnished to all licensed practitioners and mandatory responses will allow a comprehensive knowledge about each fishing trip or activity, including the big game fishing segment. Several actions were made, and will continue, regarding the conduction of sessions of clarification of stakeholders about the objectives, context and correct way to answer the distributed surveys.

In a second phase, that starts 1ts January 2020 and cover the complete duration of this "*Follow-up study*", the above-mentioned measures should be completed and information gathered in a database should lead to the accurate determination of fishing effort, composition of catches, catches per unit of effort end destination of catches. Information of length and weight of specimens caught will also be gathered. This information will be done by estimative, in the case of catch and release and by effective measurement in the case of specimens caught and landed in the fishing ports for commercial purpose in auctions or discard.

Measures to comply with RECOMMENDATION 18-05 (BIL) by ICCAT will be implemented, namely the objective of a 5% scientific observer coverage of blue marlin and white marlin/spearfish tournament landings.

A revision of the existent Madeira legislation pertaining to the regulation of recreational fishery, namely the adaptation of existent minimum size limits of catches of blue and with marlins and other relevant species to comply with the recommendations issued by ICCAT.

An online portal will be prepared to facilitate license, information, and reports of fishery and catches issues by licensed practitioners. This portal should be available by the end of 2020.

A detailed report of this study will be prepared in the last trimester of 2021, analyzed and made available by the end of the first quarter of 2022.

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 is 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 2.1: Level of fishing and impact of fisheries on biological resources and marine ecosystem - ICES IXa

PS2.1

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 they vary 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.

In the first phase of the pilot study we identified communities and assessed how they changed in space and time (along the Portuguese coast, i.e. ICES IXa; from 1990-2016). Additionally, we performed a preliminary mapping of fish biodiversity indices (for the period 2005-2016).

In the second phase of the pilot study, and based on the findings from the first phase, we will fully explore changes of fish biodiversity indices in space and time, and identify potentially existing fish biodiversity hotspots. Moreover, considering the possible interest of monitoring the identified hotspots, we will present an alternative revised sampling effort of research surveys. Additionally, we will evaluate the relationship between fish biodiversity indices and fishing pressure indicators (e.g. fishing effort).

2. Duration of pilot study

From January 2020 to December 2021.

3. Methodology and expected outcomes of pilot study

The following data sources will be used:

- Groundfish surveys data conducted by IPMA (and former institutes) from 2005 to 2016 along the Portuguese continental coast.
- 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 fish biodiversity indices. Spatio-temporal changes in fish biodiversity indices will be assessed through statistical modelling, and hotspots of fish biodiversity will be identified. Results will possibly highlight an interest in monitoring such hotspots, and an alternative revised sampling effort of research surveys will be developed aiming at this interest.

Pressure indicators (e.g. fishing effort) will be computed using fisheries dependent data, particularly landings, logbooks and VMS, and mapped to explore relationships with fish biodiversity indices. Results will indicate relevant pressure indicators, and relevant areas of high concern (e.g. high pressure) which is valuable information to take into account in the definition of sampling effort of research surveys.

Pilot Study 2.2: Level of fishing and impact of fisheries on biological resources and marine ecosystem - ICES X (waters around Azores)

PS2.2

1. Aim of pilot study

The collection of data to estimate the level and impact of fishing on biological resources and marine ecosystems can meet the needs of several EU legislative instruments related to the protection of marine biodiversity and their habitats. The collection and use of biological, ecological, and socioeconomic data are maximized if added value to existing sampling programmes and multiple data products for different end-users and policy needs are developed.

Commission Decision (EU) 2017/848[1] identifies that the data collection framework shall be used for monitoring under Descriptor 3, it may be used for the collection of relevant fisheries-related data under Descriptors 1, 4, and 6. However, articulation is needed between these two regulations.

This Pilot study enters into the picture because it is stated in EU-MAP that the "collection of data for estimating the level of fishing and the impact of fishing activities on marine biological resources and on marine ecosystems (such as effects on non-commercial species, predator-prey relationships and natural mortality of fish species), shall be first assessed within pilot studies".

This pilot study's main objectives are 1. to identify the gaps, improve the availability of data and tools on the existing sampling plans; 2. and determine future data collection specific for the Azores, based on end-user needs. Specifically, this pilot study aims to ensure the articulation and integration of (some of) the MSFD monitoring programmes with the ongoing sampling programmes, what is expected to happen at the next multi-annual WP submission (2022-2027). The data collection framework should contribute towards reaching the objectives of the common fisheries policy – which include (1) the protection of the marine environment, (2) the sustainable management of all commercially exploited species; (3) and in particular, the achievement of good environmental status in the marine environment.

2. Duration of pilot study

2021 (1 January until 31 December)

A preliminary progress report will be available in June 2021 to include some pilot study outcomes in the next multi-annual WP submission.

3. Methodology and expected outcomes of pilot study

A desk study will evaluate if the known criteria and methodological standards, specifications, and standardised methods for monitoring waters around the Azores, under MSFD, could be complemented (or implemented) under the DCF sampling protocols. A joint analysis with all stakeholders will be promoted to identify, within the work carried out under MSFD and DCF, which variables need to be added to the DCF sampling programmes, as well as stratification, and spatial and temporal aggregation of data to meet the requirements of the MSFD.

[1] COMMISSION DECISION (EU) 2017/848 of 17 May 2017 laying down criteria and methodological standards on good environmental status of marine waters and specifications and standardised methods for monitoring and assessment, and repealing Decision 2010/477/EU.

One of the outcomes will be identify projects for (possible) submission as future pilot studies that are directly relevant to the DCF and MSFD requirements to inform on the level of fishing and impact of fisheries on biological resources and marine ecosystem and to inform on future data collection programmes:

(1) Improve data collection protocols for non-commercial fish species;

(2) Evaluate the possible extension of the Continuous Plankton Recorder (CPR-SAHFOS) Survey, to the commercial fishing fleet of the Azores;

(3) To assess food spectra at the species level and to understand the prey-predator relationships doing stomach sampling (at least) from commercial samples;

(4) Use drift cameras in deep-water habitats and seamounts for image acquisition of a topographically complex environment, inaccessible for sampling;

(5) Analysis to measure the marine environment quality and health through pollutants in the water column and seafood and nutrients and phosphorus compounds in the water;

(6) Data-collection actions to monitor species at risk bycatch, namely deep-water sharks;

(7) Reproductive biology sampling (baseline) for the most exploited coastal species to evaluate the impacts of fishing on life-history traits and reproductive output of the populations.

Several other outcomes are expected during this pilot study:

- Complete the list of fish and cephalopod species at risk from incidental bycatch, taking into account EU-MAP Table 1D, to reflect métiers causing the most significant bycatch problems and PETS bycatch;
- Include in the work plan the (already) identified data to be collected regarding the impact of fisheries:
    - Biological data of other important species on a national (Azorean) scale for small-scale/local coastal fisheries;
    - Biological data, bycatch fraction, on stocks caught by Azorean commercial fisheries;
    - Water samples collected by onboard scientific observers for contaminants and nutrient analysis;
    - Collect muscle samples from species subject to biological sampling;
    - Record information on post-release vitality to determine bycatch mortality rate for the coastal species of released individuals;
    - Record information on losing and finding of fishing gears and marine litter, in general.
- Regarding detailed data on the activity of fishing vessels in waters around the Azores, it is expected (i) to know how to improve access to detailed data on the activity of fishing vessels (sales notes, fishing effort inquiries, logbooks, VMS data, AIS data, etc.); (ii) facilitate the cross-check of information from different sources; (iii) and also automate the process to achieve high quality and faster throughput of data products.

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 Portuguese coast and Gulf of Cadiz.

- To estimate the spatial distribution and abundance of zooplankton, fish eggs and larvae distribution;

- To characterize the physical environment:sea surface temperature, salinity and fluorescence (3 m depth) and CTDF profiles;

- To perform a census of sea birds and marine mammals.

1.2 Methodology used on the Portuguese acoustic surveys

Equipment:

Simrad EK 60 - 38 KHz, split beam transducer 8º x 7º (equivalent beam angle: $10\log$ = -20.2 dB; pulse duration = 1 ms), calibrated prior to the survey. Data storage and pos-processing software: ER60 and 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) submitted for publication to ICES TIMES (Techniques in Marine Environmental Sciences) Survey Protocols Series.

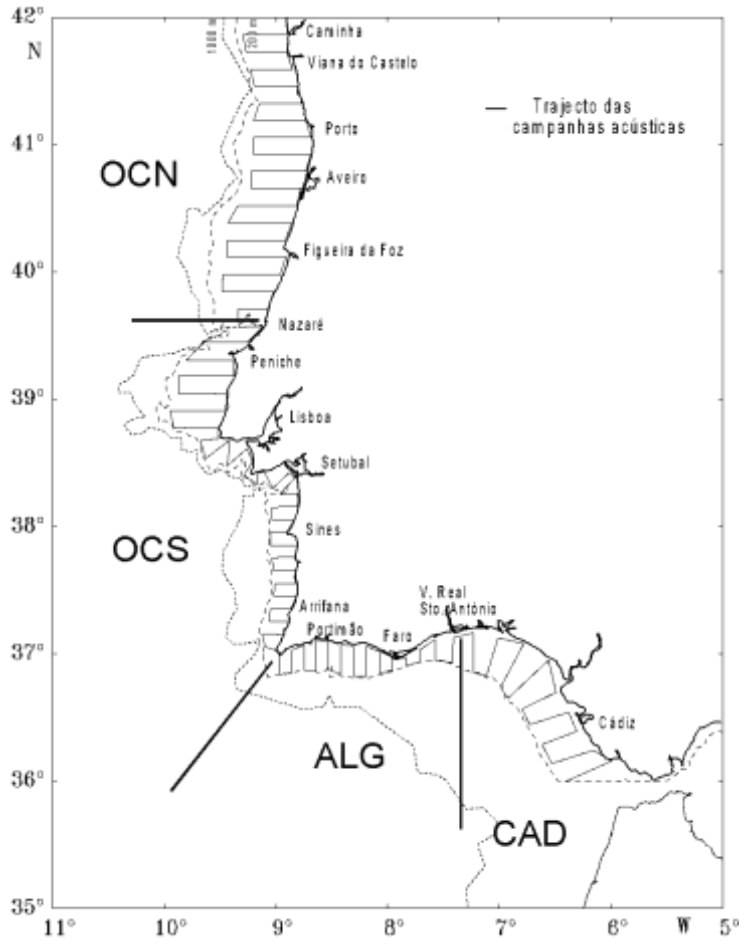

Figure 1G.1.1 - Portuguese acoustic transects and considered areas, for the abundance estimation.

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^2 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.

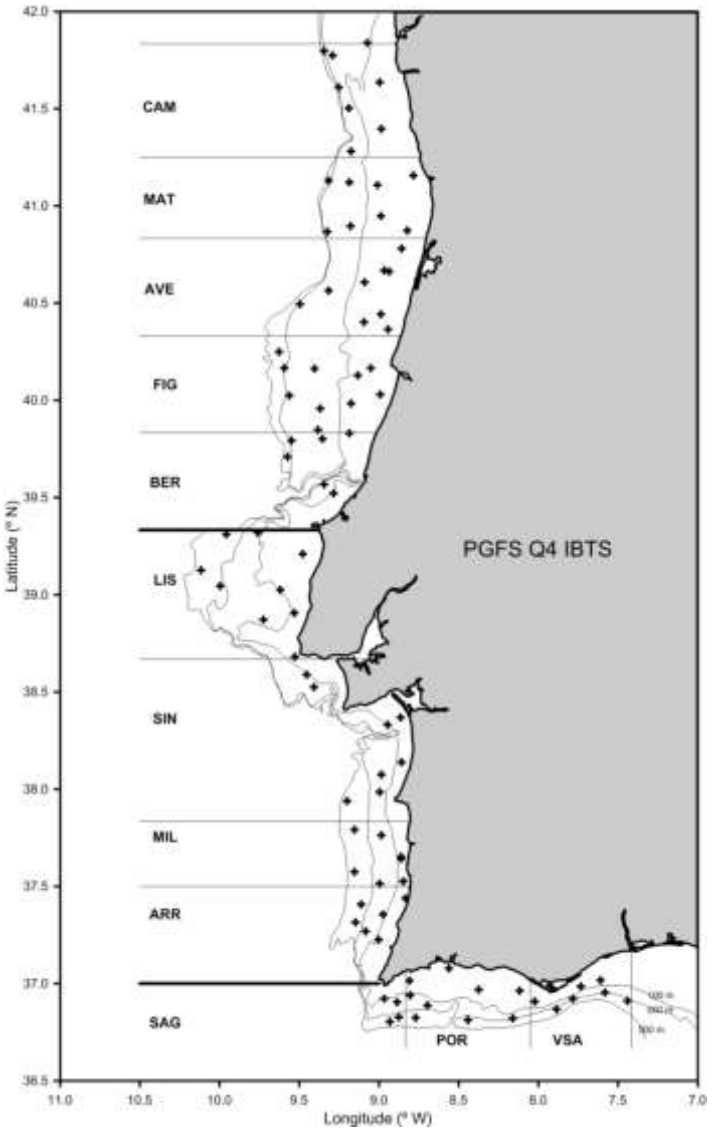

Figure 1G.2.1 - Western IBTS 4th quarter – IBTS Q4. Sampling grid.

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 antenn*atus (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^2. 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 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.

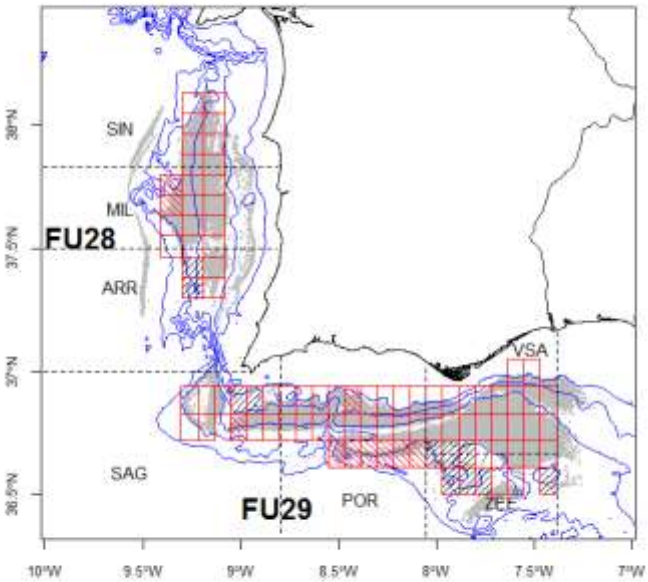

Figure 1G.3.1 - Survey grid in FUs 28 and 29 overlaying the crustacean fishing grounds represented by VMS records (in grey). The red-dashed rectangles were added to the grid survey, the black-dashed rectangles were removed. The sectors used in the previous stratified design are delimited by dashed lines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

Manual:

NepS (FU 28-29) survey is coordinated by ICES WGNEPS. ICES manual for the survey (Series of ICES Survey Protocols) was published as Annex 8.3 of the WGNEPS 2018 report.

References

ICES. 2018. Report of the Working Group on Nephrops Surveys (WGNEPS). 6-8 November. Lorient, France. ICES CM 2018/EOSG:18. 226 pp.

http://www.ices.dk/sites/pub/Publication%20Reports/Expert%20Group%20Report/EOSG/2018/WGNEPS/WGNEPS%20report%202018.pdf

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

Survey included in Table 10.

4.1 Objectives of the survey

Estimate the 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 (=PairoVET) net. Simultaneously, the auxiliary CUFES system operates underway (between the CalVET (=PairoVET) stations), pumping water from approximately 3 m from the surface and plankton samples are collected every 3nmiles. 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 egg presence observed onboard in the samples obtained by the CUFES system. All ichthyoplankton samples (CalVET (=PairoVET) and CUFES) are preserved, and subsequently analysed in laboratory. Concurrently to the plankton sampling with the CalVET (=PairoVET) and the CUFES, environmental data (temperature and salinity and fluorescence) are recorded by the sensors measuring surface water variables and the CTDF coupled to the CalVET (=PairoVET) system for temperature, salinity and fluorescence profiling. These samples are then used in view of:

- Quantifying and classifying by 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/Pages/WGACEGG.aspx). ICES manual for DEPM survey (Series of ICES Survey Protocols) submitted for publication to ICES TIMES (Techniques in Marine Environmental Sciences) Survey Protocols Series.

1. 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 (VIIIc, IXa).

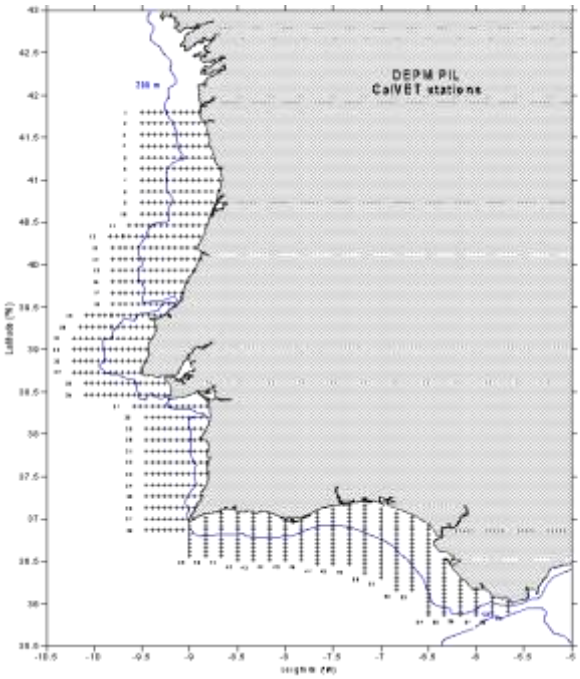

Figure 1G.4.1 – Sardine DEPM (Triennial) - Sampling grid.

TB 1G.5 – 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 ntification 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*, 2014).

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: https://www.nafo.int/Library/Documents-chronological/nafo-sc-studies-no-46-2014

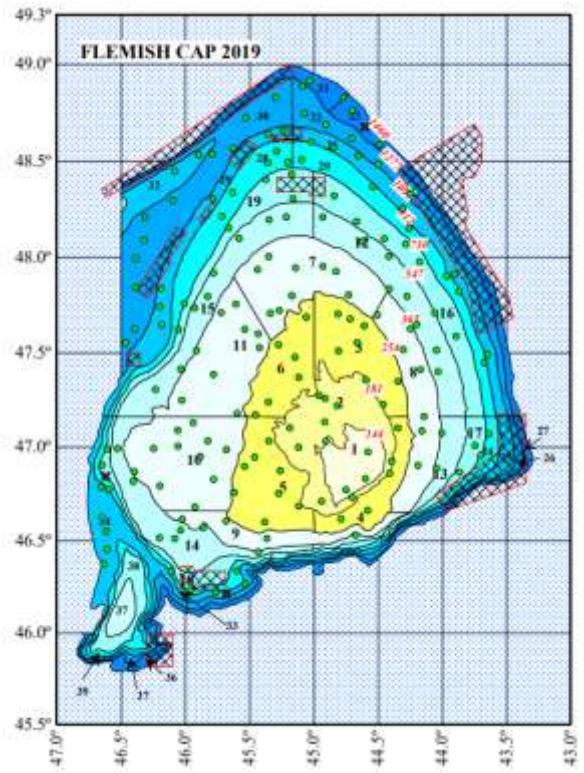

Figure 1G.6.1 - Flemish Cap Groundfish Survey, FCGS (RV Vizconde d'Eza). Sampling grid. Coral and sponge protection areas (red squares); valid hauls (green circles); invalid hauls (red crosses).

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 no signed agreement about task sharing, but long-term bilateral collaboration.

References

Vázquez, A., J. Miguel Casas, R. Alpoim. 2014. Protocols of the EU bottom trawl survey of Flemish Cap. NAFO Scientific Council Studies, 46: 1–42. doi:10.2960/S.v46.m1

TB 1G.6 – 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).

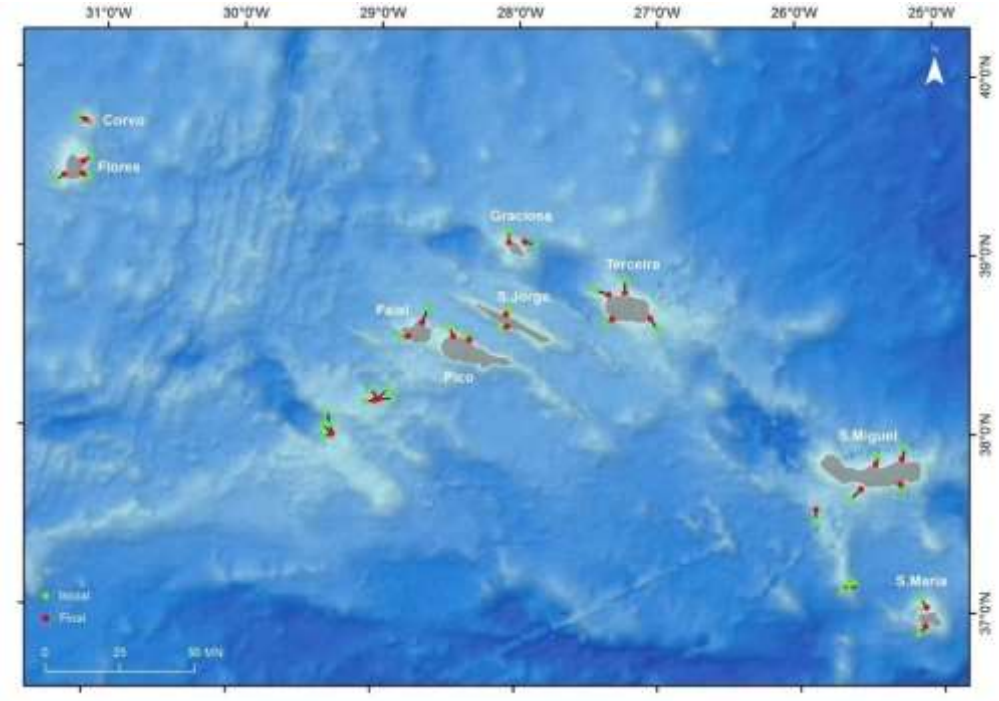

Figure 1G.7.1 – Annual spring bottom longline survey - ARQDAÇO - fishing sets location.

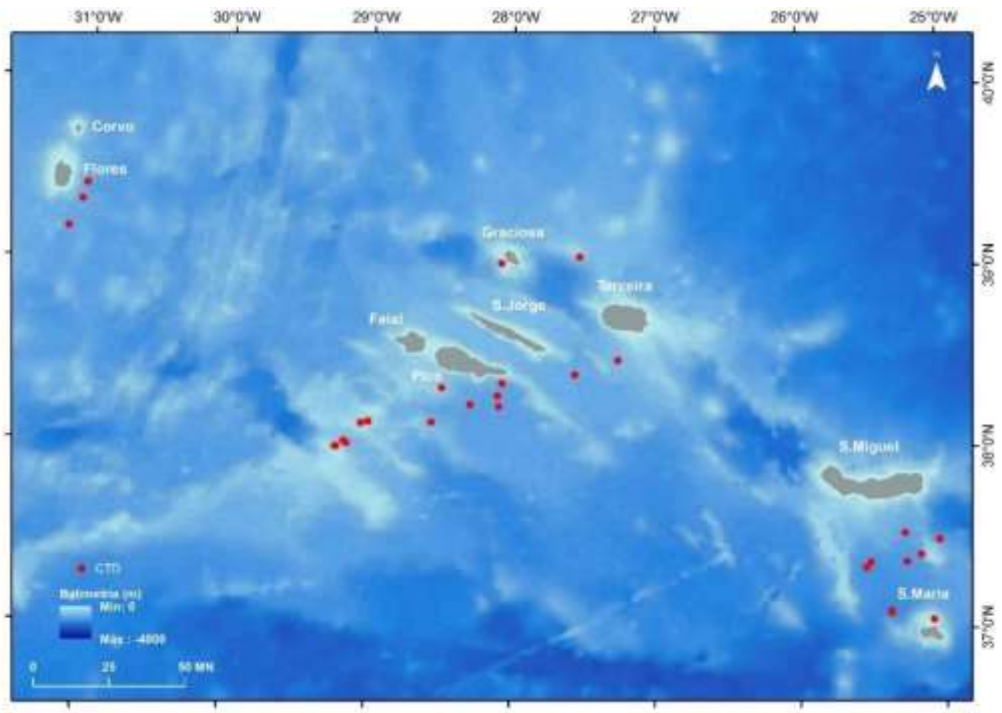

Figure 1G.7.2 – Annual spring bottom longline survey - ARQDAÇO - CTD stations.

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 basis.

- 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 transshipments 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 1st 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.

Regional Directorate for Fisheries in Azores (DRP/RAA) 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.

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 available for all vessel owners. 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, although it is census it is not possible to get answers from the whole universe. All of them are related to the same universe, i.e. the fleet registered on the 31th December 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

Economic and social data collection is done by census.

In order to comply with new demands and to obtain more accurate estimates, Portugal established a 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.

4. Description of methodologies used for estimation procedures

To deal with non-responses, 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 2011were:

- Small scale fleet segment = 21 050,00euros/GT;

- Polyvalents segment > 12 meters = 47 250,00euros/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 year 2019 is the first year of census economic data collection. MS will evaluate the best methodology to be used to ensure the data quality level required by DCF.

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 inputation 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 coverance 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 gramms), 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.

(source: Facts and Figures - 2016 EUROSTAT).

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

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.

Text Box 4A.1: Region NAFO (FAO area 21) - RFMO/RFO/IO NAFO - Sub-area / Fishing ground NAFO 3LMNO; Region Eastern Artic (ICES areas I and II) - RFMO/RFO/IO ICES - Sub-area / Fishing ground ICES areas I and II

TB 4A.1 At-sea sampling

At-sea sampling:
NAFO 3LMNO (PTS30 - OTB_DEF in Table 4A);
ICES I, II (PTS28 - OTB_DEF and 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 Eastern Artic - ICES - ICES I, II data are stored in a local data base and upload in the international data bases FishFrame and Intercatch. NAFO (FAO area 21) - NAFO Sub-area 3LMNO 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.2: Region Southern Western waters (ICES zones VIII, IX) - RFMO/RFO/IO ICES - Sub-area / Fishing ground IXa and IXa (Functional Units 28, 29)

TB 4A.2 At-market (Concurrent sampling), At-market (Species focus - Size category) and at-sea sampling

At-market sampling (Concurrent sampling) (Mainland - IXa): PTM1-FPO_MOL; PTM5-GNS_GTR_DEF; PTM7-LLS_DEF; PTM11-LLS_DWS; PTM14-OTB_DEF; PTM17-OTB_CRU (IXa (Functional Units 28, 29))**; 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(*).

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 auction*days to be sampled in each fleet (≈ 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. Eachvessel_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 2020, 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-market sampling (Species focus – Size category) (Mainland - IXa): PTM9 – SF_SC (in Table 4A)

1.Specification of purposes

The objective of at-market sampling (Species focus – Size category)is to obtain length distributions of fish landed at auctions by Portuguese vessels operating in ICES Division IXa. This sampling strategy is currently applied to horse mackerel, *Trachurus trachurus*, following a pilot-study run in 2017 in parallel to the concurrent sampling. This sampling strategy may be extended to other species with high landings and economically important in Portugal. Since the implementation of this sampling scheme, this species is no longer sampled under concurrent sampling at-market.

2.Design

Population: Lengths of fish (*Trachurus trachurus*) landed by Portuguese vessels operating in ICES Division IXa.

Target population: Lengths of fish (*Trachurus trachurus*) landed at auction (= port) by Portuguese vessels licensed to operate in ICES Division IXa.

Study population: Lengths of fish at port.

Sampling frame: List of ports*day.

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 criteria is used. Spatio-temporal allocation is proportional to landings in each port*quarter combination.

Primary Sampling Unit (PSU): Auction*day.

Secondary Sampling Unit (SSU): Commercial size category

Description:

a) Annual sampling effort is fixed by the DCF National Sampling Plan that sets number of auction*days to be sampled. Sampling effort is allocated to auctions and quarters proportionally to landings in previous reference years.

b) For each auction, 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 every commercial size category of *Trachurus trachurus*, by haphazardly selecting 1 box from each commercial size category, 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.

d) Within each box, the observers haphazardly select a predefined number of individuals which are sampled for all biological variables (length, weight, age, sex ratio, sexual maturity).

3.Expected execution difficulties

a) Shipmasters not giving permission for observers to sample fish from their vessels.

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

Trachurus trachurus is assessed within the ICES Assessment Working Group WGHANSA. Data preparation and stock assessment methods are defined in benchmarking processes and described in the species "stock annex".

References

Azevedo M, Silva C, Volstad JH. 2016. Modelling length distribution by commercial size category to estimate species catch length composition for stock assessment. ICES CM 2016/O

At-sea sampling (Mainland - 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.3: Region Southern Western waters (waters around Azores - RFMO/RFO/IO ICES - Sub-area / Fishing ground ICES X (waters around Azores)

TB 4A.3 At market and at sea sampling

At market sampling (Azores - ICES X (waters around Azores)): AZM1 - LHP_FIF; AZM14 – LHP_CEP; AZM18 – PS_SPF; AZM22 – GNS_FIF; AZM27 – FPO; AZM43 - LLS_DWS _<12m; AZM45 - LLS_DWS_>18m; AZM51 - GRAPP (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: spatially (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 (≈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.

f) Refusal rates are recorded.

During the sampling period covered, fish length measurements will also be recorded in three 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.

d) In most situations, sampling is performed before weighing, which results in a constraint that at the time of landing, samplers have no way of classifying the trip as having been targeting deep-sea species. In order to ensure compliance with Article 5 (2) of Regulation (EU) 2016/2336, the trip classification from handliners and bottom longliners targeting deep water species (or finfish/demersal) is performed after sampling.

4.Data archiving and Quality assurance procedure

At market sampling database will be transferred from Excel files into a database to be constructed during the sampling period covered. This is expected to contain internal routines for both basic errors detection (e.g., errors in dates, species codes) as well as implementation of checking of errors.

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.

<u>At sea sampling (Azores - ICES X (waters around Azores))</u>: AZS4 - LHP_FIF; AZS16 - LHP_CEP; AZS20 - PS_SPF; AZS23 - GNS_FIF; AZS28 – FPO; AZS47 - LLS_DWS _<12m ; AZS49 - LLS_DWS _>12m (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

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

<u>Target population:</u> lengths of fish captured by the Azorean vessels of all length classes 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 fleets segments selected based on species landings. The list of vessels for each fleet segment/métier is updated annually based on a combination of the results 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 2020, the following metiers and sampling effort (number of trips) objectives are set: LHP_FIF (n=12 trips), LLS_DWS (n=46 trips), LHP_CEP (n=12 trips), PS_SPF (n=12 trips), GNS_FIF (n=12 trips) and FPO (n=12 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 (including incidental by-catch), 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. Increased refusal rates and last minute boarding issues. At the time of boarding, observers have no way of classifying the trip as targeting deep-sea species. In order to ensure compliance with Article 5 (2) of Regulation (EU) 2016/2336, trip classification from handliners and bottom longliners targeting deep water species (or finfish/demersal) is performed after sampling.

4.Data archiving & Quality assurance procedure

At sea sampling database will be transferred from Excel files into a database to be constructed during the sampling period covered. This is expected to contain internal routines for both basic errors detection (e.g., errors in dates, species codes) as well as implementation of checking of errors.

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 fleet level have only been provided for LLS_DEF where sampling dates back to 2004.

Text Box 4A.4: Region Southern Western waters (waters around Madeira) - RFMO/RFO/IO CECAF- Sub-area / Fishing ground FAO 34.1.2

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

At-market sampling (Madeira - FAO 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 FAO 34.1.2 and 34.2.0.

2. Sampling Design

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

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

Study population: Lengths of fish landed by a subset of the Madeiran active vessels which operate in FAO 34.1.2 and 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 (≈ 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 (Madeira - FAO 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 FAO 34.1.2 and 34.2.0.

2.Sampling Design

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

Target population: Lengths of fish captured by the Madeiran vessels of all length classes that operate in FAO 34.1.2 and 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 FAO 34.1.2. and 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 (Madeira - FAO 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 FAO 34.1.2 and 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.5.: Region Other regions - RFMO/RFO/IO ICCAT - Sub-area / Fishing ground Atlantic Oceans and adjacent seas, BF58, Waters around Azores, Waters around Madeira

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

At-market sampling (RFMO/RFO/IO ICCAT**):**
Mainland (Sub-area / Fishing ground Atlantic Ocean and adjacent seas**, Sub-area / Fishing ground** BF58**);**
Azores (Sub-area / Fishing ground Waters around Azores grounds**);**
Madeira (Sub-area / Fishing ground Waters around Madeira**)**

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)
RFMO/RFO/IO - Sub-area / Fishing ground	ICCAT - Atlantic Ocean and adjacent seas	ICCAT - BF58	ICCAT – Waters around Azores	ICCAT – Waters around Madeira
1-Specification of purposes	Obtain length distributions of fish landed at auctions			
2-Design				
Population	Lengths of fish landed by Portuguese vessels in each zone/area			
Target population	Lengths of fish landed at auction (=port) in each zone/area			
Study population	Lengths of fish captured by Portuguese vessels operating in each zone/area and landed in selected ports for sampling			
Sampling frame	All vessels landing in each selected port for sampling			

Stratification type	None	Temporal (quarters) (*)	Spatial (ports) and temporal (quarters) (*)	None
Sampling effort	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
Primary sampling unit	Auction*day (in specific ports)		Trip	
Description	In each vessel_sale_event, the observers aim to individually measure and/or weight each specimen from every commercial species and commercial category. Some commercial species may not be available for sampling if they are frozen and packaged.	Visit dates in each auction*quarter are spread somewhat systematically throughout the 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.	Seasonal fishery (May-September), where for every auction*visit_date,samplers aim to randomly sample a 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.	In each vessel_sale_event, the observers aim to individually measure each specimen from every commercial species and commercial category.
3-Expected execution difficulties	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.	-
4-Data archiving and	Data stored locally at IPMA.		Data is archived at DRP/RAA local database designed to	Data is archived at DSEIMar/DRM

Quality assurance procedure		accommodate this type of information.	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.		
5-Analysis procedures	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.		

(*) Stratification used to improve sampling coverage.

At-sea sampling (RFMO/RFO/IO ICCAT**):**
Mainland (Atlantic Ocean and adjacent seas**) - PTS26 - LLD_LPF (in Table 4A);**
Azores (Waters around Azores**) - 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 DRP/RAA. 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.

Madeira (Waters around Madeira**) - 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 FAO 34.1.2 and 34.2.0.

2.Sampling Design

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

Target population: Lengths of fish captured by the Madeira tuna vessels of all length classes that operate in FAO 34.1.2 and 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 FAO 34.1.2 and 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

Madeira (Waters around Madeira**)** - 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.

Text Box 4A.6: Region Other regions - RFMO/RFO/IO IOTC - Sub-area / Fishing ground Indian Ocean Western and Eastern

TB 4A.6 At-sea sampling

At-sea sampling (IOTC**): 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.