

Deliverable D4.1.1

Num. 1 report illustrating and comparing the existing biological and socio-economic databases concerning fish-related matters provided at institutional level in Italy and Croatia, outlining main statistical information

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1. Introduction

The activities within WP 4 consist of harmonizing data on fisheries and aquaculture in the Adriatic partner area, establishing a common approach to consistency and data on fish stocks trends, ecological status and marine resources. Also, data related to the impact of climate changes on the environment and the mass presence of alien species will be taken for analysis. Official databases will be collected and standardized and then used to define scenarios for sustainable fisheries and aquaculture management. Also, data collected at the local level will be defined by a common scheme and implemented with agreed protocols proposed and approved by the AAC. PP 12 and PP 13 play a key role in this package.

- O4.1. The most important output is the establishment of a unique, common and coordinated scientific approach as a basis for the definition of a common measure for the management of fish stocks and other biological resources in the partner Adriatic Sea area. Same is necessary for the sustainable use of Adriatic fish resources, which will be based on real, updated, coordinated and systematized data representing the actual state of Adriatic fishing resources (biological data), and on the other hand the actual state of current fishing effort (socio-economic data).
- O4.2 Coordinated scientific approach is the basic of the second basic result, which is a single common framework of all existing Adriatic databases on both biological and socio-economic data, which will be compared, analyzed and standardized as a single basis for sharing access to sustainable fisheries management and aquaculture activities.
- O4.3 As a follow-up to the first two results, a technical-scientific approach integrated and coordinated with the institutional committee envisaged in WP3 will represent a truly comprehensive and innovative way of transnational institutional value for joint management of Adriatic fishery resources as a whole.

Durability is ensured by scientific partners commitment in updating and fine-tuning the developed tools in further studies tackling the Adriatic Sea. The shared approach serves as a future basis for necessary common management measures of other marine resources in the context of climate change and incoming marine ecological dynamics.

The development of a common approach based on scientific evidence and combined social and economic data on the environment is a priority not only for the Adriatic Sea, but for the entire Mediterranean basin. Furthermore, scientific institutions participating in wider MSP projects and international surveys will allow

transferability to the main commission and management organizations (e.g. GFCM) promoting sustainable fisheries development and the achievement of EU Environment and Biological targets.



Budget: € 621.865,00

2. 4.1. Survey and comparison of existing data and databases

Given the actual content where biological and socio-economic data in Italy and Croatia are collected in an uncoordinated manner and are available at a too aggregated level, it is created an exhaustive framework of existing Adriatic databases, which data are compared, analysed and standardised. A complete picture of Adriatic databases is a specific objective and hence a deliverable, given the indefinite number of existing databases resulting from local and national schemes and possibly from Interreg projects. Shared and standardised fish-related data will be the base for a necessary common approach in the management of Adriatic biological resources and economic activities and hence a shared unique base for the evaluation of possible integrative/alternative management measures (Act.3.4, 4.2). The whole activity, data and outputs will be evaluated by WP coordinator and then arranged within the AAC (Act. 3.1). Finally, they will be institutionally approved by the SC.

Start Date: 01/04/2020.

End date: 30/06/2022.

3. 4.1.1 Report illustrating and comparing the existing biological and socio-economic databases concerning fish-related matters provided at institutional level in Italy and Croatia, outlining main statistical information (e.g. sample methods, data surveyed, fishing areas)

For the correct and long-term management of renewable marine resources, it is extremely important to know the recent state of livestock, as well as the changes that have taken place over time. In addition to the state of

livestock, it is important to have accurate information of the catch and fishing effort with which it was made, but also on the social and economic aspects of fishing. In recent time in the Mediterranean, quantitative - analytical assessments of the condition of key stocks that are exploited (within the GFCM and STECF) have begun. A major problem in these estimates is the fact that there are no long series of credible data in the Mediterranean for scientists to use in their estimates. Systematic data collection in the EU was established within the framework of the Common Fisheries Policy, and the basic document which prescribes and describes data collection within the Council Regulation (EC) No 1543/2000 of 29 June 2000 establishing a Community framework for the collection and management of data needed to conduct the common fisheries policy which is briefly called the EU DCF (Data Collection Framework). At the level of the Adriatic Sea, data according to the DCF methodology are collected by Italy (since 2002) And Slovenia and Croatia after joining the EU. Other countries in the Adriatic also have similar data collection organized, but within the DCR (whose methodology is prescribed by the GFCM).

A standardized collection of various fisheries data has been established within the DCF. Part of the data is collected through scientific research (so-called Fisheries independent data) and these are the following scientific research: 1) MEDITS - research that aims to describe the state of demersal resources; 2) MEDIAS - research that describes the state of small pelagic resources throughout the echo survey and 3) SOLEMON - research that describes the state of flatfish in the northern Adriatic. The second part of the data includes catching fisheries dependent data on commercial fishing (catch and discard) and - biological sampling (on board and on the landing ports) in order to estimate catch composition and biological parameters such as growth, sex, maturity and fecundity for the stocks. Furthermore, through DCF it includes monitoring of fishing effort, monitoring of prices at first sale and economic monitoring.

DCF data represent the most accurate and detailed series of standardized data in the Adriatic Sea and as such are used in all official assessments and assessments of the state of resources. However, this data series is very short (Italy GSA17 and GSA18 since 2002 and Croatia since 2013) and cannot fully describe the state of resources. Therefore, there is a need to collect, standardize and use older data to describe the situation in the Adriatic. A number of international projects funded from various sources have dealt with this topic.

The most important of these are the FAO AdriaMed Project (Scientific cooperation to support responsible fisheries in the Adriatic Sea), the EVOMED Project (Fishermen interviews as sources and information to reconstruct the evaluation of Mediterranean fisheries in the 20th) and the RECFISH project (Recovery of fisheries historical time series) for Mediterranean and Black Sea stock assessment).

One of the most important activities of the ARGOS project is collecting information's on historical data that exist in the Adriatic Sea for use in stock assessments. Work package 4 is dedicated to this topic (Activity 4.1. Survey and comparison of existing data and databases), while the collected data will be used within work package 3 for the purposes of stock assessment.

Also, through the ARGOS project, it is planned to investigate the existence of fishery biological data at the local level in the Adriatic Sea through various pilot projects, and to propose a future methodology for collecting data on fisheries at the local level (Activity 4.2. local level).

4. Sources of data

Historical data on fishing and the state of resources in the Adriatic Sea can be found in various places. The longest and most reliable databases are located in scientific institutions along the eastern and western coasts of the Adriatic. On the Croatian side, the key institution for marine and fisheries research is the Institute of Oceanography and Fisheries in Split (IOF), which has numerous data on the state of fisheries since the period before the Second World War. Today, the Institute is responsible for collecting data within the DCF under the Marine Fisheries Act. In addition to this institute, research related to fisheries has recently begun at the universities of Split, Zadar and Dubrovnik. On the Italian side, the most important scientific institutions in the Adriatic are the Italian National Research Council (CNR) – Institute of Biological Resources and Marine Biotechnology (IRBIM) in Ancona, the University of Bologna – Laboratorio di Biologia Marina e Pesca (LBMP) in Fano and the National Institute of Oceanography and Applied Geophysics (OGS) in Trieste. CNR-IRBIM is responsible for DCF on commercial fisheries in GSA17 (demersal resources and small pelagics) and GSA18 (only small pelagics). The institution is also responsible for SOLEMON and MEDIAS surveys, respectively in GSA17 and GSA17+18. Catch data and economic statistics related to the fishery sector and DCF have been collect by IREPA and, since 2014, by NISEA. Indeed, regarding old catch data, the longest database for the Italian side of the area was developed through collaboration between institutions. In fact, a thorough— although not exhaustive—search was conducted in local archives, libraries and museums in Venice, Padua, Rome, Trieste, Chioggia (Italy) and Split (Croatia) to collect information on Adriatic marine species from the beginning of the 19th century onwards. All the data were retrieved from scientific literature, bulletins, theses, record books and publications. The development of datasets included digitisation (from paper copies), quality control of the digitisation process, taxonomic and geographic standardisation, data integration and graphical analysis. Data were published in Fortibuoni et al., 2017.

Much of the more recent data on fisheries, especially catches and fishing efforts, can be found in the national ministries of Italy and Croatia, which are also responsible under the CFP for collecting data within the DCF. The most important part of the data is collected throughout fisheries logbook which include data on catch qualitative and quantitative structure as well as data on fisheries effort. Also, official data are in relevant national and international archives and data bases (FAO FISHSTAT, EUROSTAT, ISTAT, CBS HR, DCF).

Likewise, an important part of the data can be found in the grey literature in which numerous researches and results are presented. This includes various scientific and professional national and international journals, reports, studies, graduate, master's and doctoral theses. Very often they are written in the national language and they are not available to the general public.

Significant and extremely valuable data can be found in fishermen's associations, but also in private fishermen.

These data have so far not been sufficiently recognized or used. Recently, attempts have been made to obtain these data and use them throughout local ecological knowledge (LEK), thus collecting and preserving this valuable data and knowledge. This is especially important today when a large number of fishermen are digitally educated and often have their own digital small databases of fishing activities and associated catches for an extended period of time.

Very useful data are georeferenced data, primarily data on the position of vessels during fishing activities. They include AIS data for commercial vessels (which can be purchased from providers), as well as VMS data for most of the professional fishing fleet (available to the country's fisheries administrations).

In recent times, very interesting data on marine litter and microplastics at sea have begun to be collected. This data started to be collected through the DEFISHGEAR project, then ML-REPAIR, and now this data is regularly collected through the monitoring of the sea and marine ecosystems.

In addition to commercial activities, fishing in the Adriatic is also performed by fishers involved in sport and recreational fishing. As in the whole of the Mediterranean, there are no satisfactory catch or effort statistics for this fishery. Although there are indications that this activity contributes significantly to the total catch and fishing effort, especially in coastal areas. Monitoring of this fishery under EU and GFCM activities is currently under way.

As previously mentioned, most fishing in the Adriatic Sea is based on the catch of shared stocks, which is why it is necessary to have data on the catch and fishing effort of all fishing fleets fishing in the Adriatic.

Bearing in mind that 3 EU countries (Italia, Croatia and Slovenia) fish in the Adriatic, which collect data on fishing in a uniform manner (according to DCF protocol), other non-EU countries (Albania, Montenegro and Bosnia and Herzegovina) do not have the same method of data collection. However, in recent time, these countries, as members of the GFCM, have been involved in data collection according to the DCR, which is complementary to data collection within the DCF. Therefore, it can be said that the entire Adriatic Sea is covered by a harmonized data collection methodology. These data are also used today in official stock assessments conducted under the GFCM and STECF.

In addition to these fishery biological data collected through the DCF, EU countries are also obliged to collect data on the state of the sea and marine ecosystems through two other monitoring under the Water Framework Directive and monitoring under the Marine Strategy Framework Directive.

5. List of the most important fisheries related datasets in the Adriatic Sea

For purposes of stocks evaluations and stock assessments different data sets should be used: scientific survey data, official annual landing data, capacity fleets data, fishing effort data, LPUE data from commercial and scientific fisheries, discard data, biological data (length-frequency data, length age data, growth parameters, length weight data, sex and maturity data, ...), selectivity parameters, technical characteristic of the vessels and fishing gears, VMS data, socio – economic data, environmental data ... Very important are also private datasets provided by fishermen and fishermen associations. All those data sets are usually collected on the different levels, by different institutions, using different methodology, stored in different data bases, standardized on the different ways ... All those issues should be raised before stock evaluation and assessments procedure.

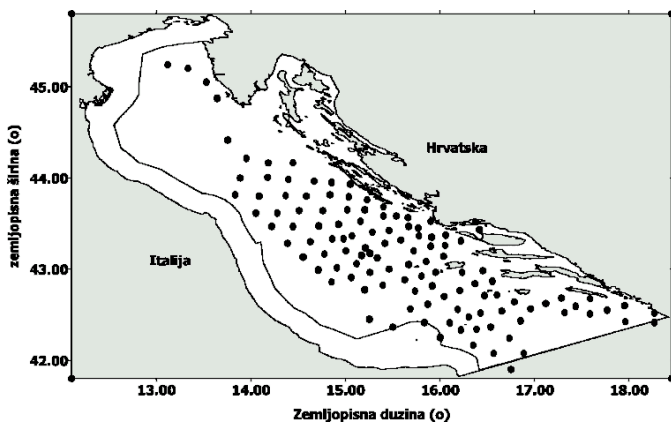
One of the important tasks in the ARGOS project is to collect information on fisheries related data and data sets in the Adriatic Sea and make a critical review of existing data with the aim to make it usable for stocks evaluations and stock assessments (needed for WP 3).

In the following text a list of existing fisheries related data sets exists in Adriatic Sea are collected and presented on the uniform way together with the short description of each dataset.

6. Croatian Scientific Surveys

6.1. Expedition HVAR

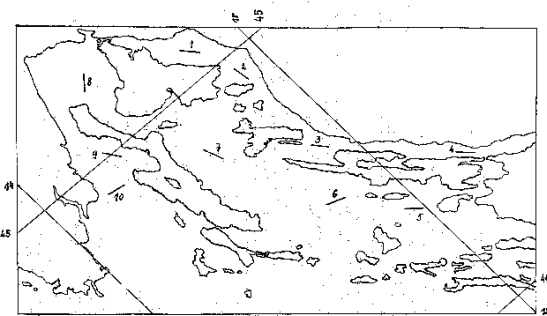
- Short description
 - “Hvar” expedition 1948. /1949. was first demersal trawl survey in the Open Adriatic performed by IOF. Importance of this survey is that it describes virgin state of demersal resources, without impact of fisheries
- Methodology
 - Survey was performed using bottom trawl net and scientific vessel HVAR. Totally 167 fixed stations in open Adriatic (territorial water of Croatia, Montenegro and Albania) and extraterritorial waters in the central and south Adriatic. Two surveys performed during 1948 and 1949. Haul duration one hour



- Collected data
 - Environmental data (depth, temperature, sediment, plankton), qualitative and quantitative catch composition, biological data for commercial species (length, sex, maturity, otoliths), macrobenthos data
- Data storage
 - Publication, original expedition logbook, part of data in data base excel
- Contact
 - IOF

6.2. North Adriatic Channel survey

- Short description
 - Bottom trawl survey organized 1956. and 1957. by IOF to describe demersal assemblages in the channel area of Northern Adriatic
- Methodology
 - Survey was perform using bottom trawl net and scientific vessel on the 10 fixed station Northern Adriatic channel area

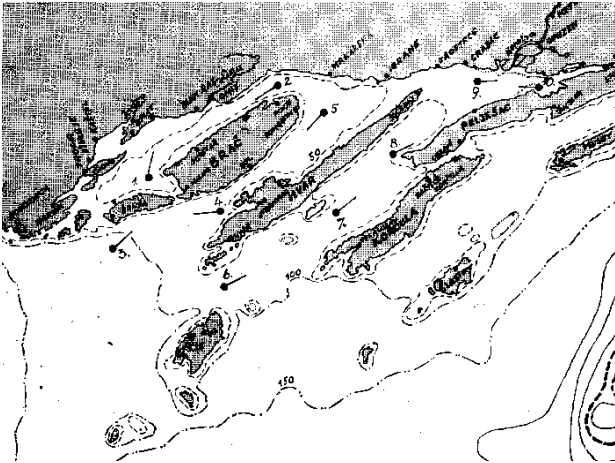


- Collected data
 - Qualitative and quantitative catch composition with length frequency data for the most important species
- Data storage
 - There is no longer original data, data exists in publication
- Contact
 - IOF

6.3. Central Adriatic Chanel survey

- Short description
 - Bottom trawl survey organized 1957. and 1958. by IOF to describe demersal assemblages in the channel area of Central Adriatic
- Methodology

- Survey was performed using bottom trawl net and scientific vessel on the 9 fixed station Northern Adriatic channel area. Sampling was conducted by monthly sampling

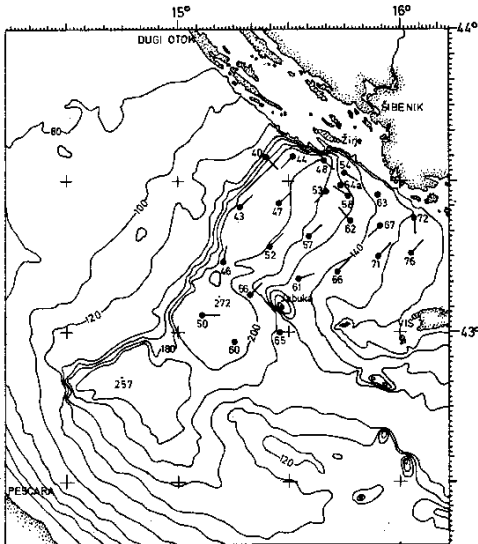


- Collected data
 - Qualitative and quantitative catch composition with length frequency data for the most important species. Benthos invertebrate were analyzed also. Environmental data (depth, temperature, salinity and sediment)
- Data storage
 - There is no longer original data, data exists in publication
- Contact
 - IOF

6.4. Open central Adriatic/Jabuka Pit survey

- Short description
 - Bottom trawl survey organized 1956. till 1971. by IOF to describe demersal assemblages open Central Adriatic (Jabuka Pit)
- Methodology

- Survey was performed from systematically 1956. till 1971. using typical commercial bottom trawl net and scientific vessels BIOS and Predvodnik in wider area of Jabuka Pit with spatial attention to Blitvenica fishing area



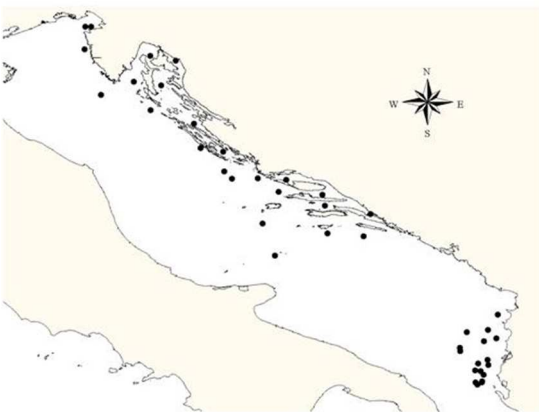
- Collected data
 - Qualitative and quantitative catch composition with length frequency data for the most important species. For the most important species there are also data on sex, maturity and age. Benthos invertebrate were analyzed also. Environmental data (depth, temperature, salinity and sediment) were also collected, as well as sea bottom analysis by echo sounder
- Data storage
 - Publication, original expedition logbook, part of data in data base excel
- Contact
 - IOF

6.5. AdriaMed Trawl Survey

- Short description
 - International regional bottom trawl survey organized by FAO AdriaMed

project started in 2001 and finished 2008. and cover all Mediterranean European countries by uniform methodology in winter period. Complementary survey to the Italian GRUND survey.

- Methodology
 - Survey has been done using methodology according MEDITS protocol and cover eastern Adriatic (territorial waters of Slovenia, Croatia, Montenegro and Albania)

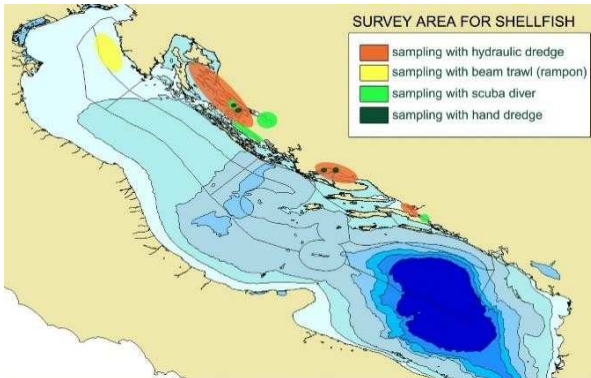


- Collected data
 - Qualitative and quantitative catch composition with biological data (length, weight, sex maturity, otoliths) for the most important (target) species. Benthos invertebrate were analyzed regularly. Environmental data (depth, temperature, salinity) were collected using sonda
- Data storage
 - Database Atris
- Contact
 - IOF

6.6. AiA Shellfish survey

- Short description

- The survey cover channel area of central and northern Adriatic in framework of AiA Interreg project 2008.-2009. with aim to describe distribution and quantity of commercially important shellfish
- Methodology
 - Field sampling was organized using different sampling gear and technique: hydraulic dredge, beam trawl, scuba driver and hand dredges

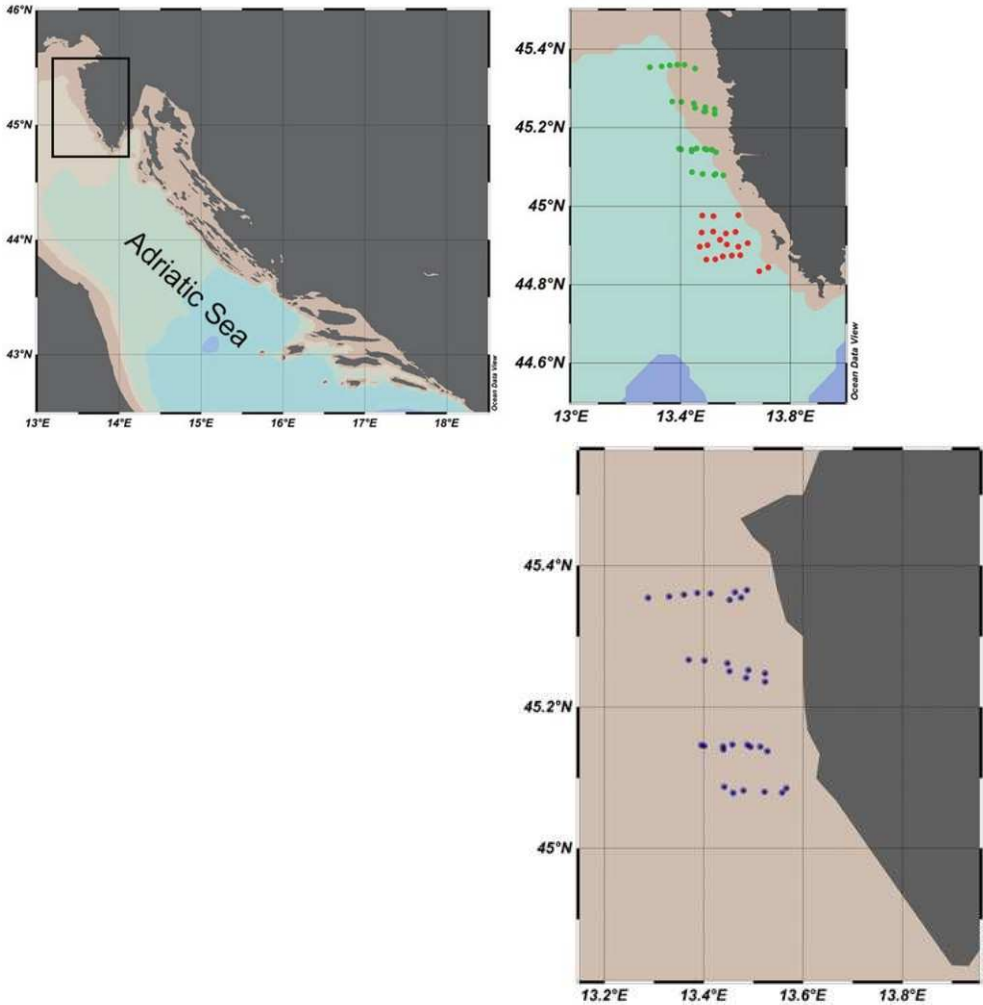


- Collected data
 - Qualitative and quantitative catch composition with biological data (shell size, weight, maturity, age) for the most important (target) species.
- Data storage
 - Database in excel, scientific publications, report
- Contact
 - IOF

6.7. Beam-trawl surveys along Istrian coast

- Short description
 - Those surveys were performed in 2017 and 2018. to describe status of resources in the area exploited by beam trawl and in the area that is not under beam trawl exploitation along western Istrian coast
- Methodology

- Survey has been performed using commercial fishing vessel and the beam-trawl usually used in Istria. In total, 50 tows were performed, 29 in the beam trawl fishing area and 21 in the beam trawl non-fishing area. Structure of landing and discard were analyzed on board



- Collected data
 - Qualitative and quantitative catch composition with biological data (length, weight) for the most important (target) species. Benthos invertebrate were analyzed regularly
- Data storage
 - Database Excel, scientific paper, reports
- Contact
 - IOF

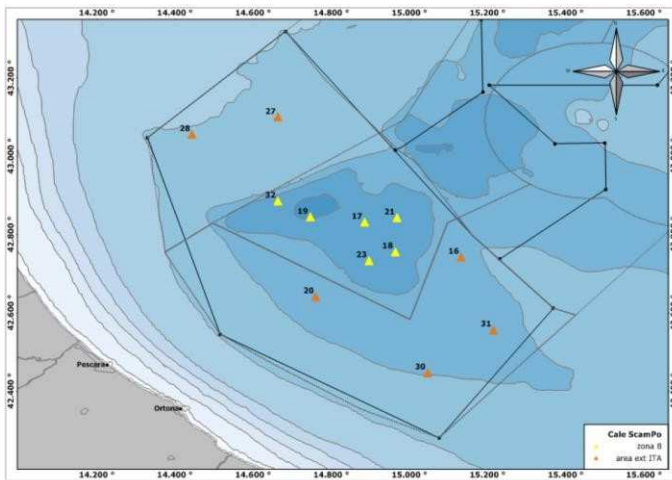
7. Italian surveys

7.1. ECHOADRI

- Short description
 - In the western part of the Adriatic Sea, acoustic surveys “ECHOADRI” have been carried out since 1976 in the Northern Adriatic (2/3 of the area: western GSA 17), and since 1987 also in the Mid Adriatic (1/3 of the area: western GSA 17) and South Adriatic (GSA 18). It was performed until 2008, when it was transformed into MEDIAS project (see chapter XXX)
- Methodology
 - This survey included both investigations using Echosounders and sampling with pelagic trawl
- Collected data
 - Distribution of small pelagic fish, qualitative and quantitative structure of pelagic trawl catch, biological characteristic of target species (length, weight, sex maturity, age). Hydrographic parameter was collected boxy CTD probes, and sea bottom structure used echosounder
- Data storage
 - ECHOADRI database
- Contact
 - CNR-IRBIM

7.2. ScamPo

- Short description
 - Performed in winter, this survey aims to monitor the stock of *N. norvegicus* living in the Italian side of the Jabuka/Pomo pits and evaluate the efficacy of the Fishery Restricted Area (FRA)
- Methodology
 - The survey consists of a minimum of 10 hauls (at sunset and sunrise), performed with an experimental bottom trawling net



- Collected data
 - Qualitative and quantitative catch composition with biological data (length, weight, sex maturity) for the most important (target) species.
- Data storage
 - ScamPo database
- Contact
 - CNR-IRBIM

7.3 Impacts of hydraulic dredging

- Short description
 - The aim of the study was: quantify and evaluate the impacts of hydraulic dredging on the structure of the macrobenthic community present in the study area; to identify groups of taxa or trophic guilds particularly sensitive to this fishing activity; and identify species whose negative (or positive) response to the fishing activity could be used as an indicator of fishing disturbance
- Methodology
 - The impact of hydraulic dredging for *C. gallina* on the macrozoobenthic assemblages inhabiting sandy substrata within the study area was assessed using a balanced beyond BACI experimental design

- Collected data
 - Species composition of the Macrozoobenthic assemblage
- Data storage
 - CNR-IRBIM
 - Contact: CNR-IRBIM

7.4 Fishery & Oceanography Observing System” (FOOS)

- Short description
 - The project started in 2012. It produces important information on catches and fishing effort distribution patterns to be used for the improvement of the management of marine fishing resources. The acquisition of geo-referenced catch data allows for the estimation of catch per unit effort (CPUE) and, at the same time, the great amount of environmental information collected by the system is of interest from oceanographic and meteorological standpoints
- Methodology
 - A dual (satellite/terrestrial) communication system for bottom trawlers and a single GPRS/UMTS terrestrial communication system for small pelagic fisheries were installed on vessels of the Ancona fleet
- Collected data
 - GPS position and environmental parameters along the water column, catch data, meteorological and navigation data
- Data storage
 - CNR-IRBIM
- Contact
 - CNR-IRBIM

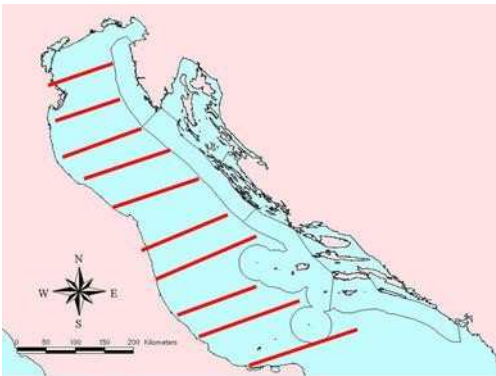
8. Shared surveys

8.1. PIPETA PROGRAMME/GRUND SURVEY

- Short description
 - Bottom trawl survey organized from 1956 to 1971 by LBM Fano and IOF to describe demersal assemblages open Northern and Central Adriatic

- Methodology

- Survey was performed in 1973 and 1974, and then systematically from 1982. The survey was successively called GRUND and ended in 2007. It was performed using typical Italian commercial bottom trawl net and commercial vessels Pipeta in Northern and Central Adriatic (except Croatian territorial water), during winter season. Sampling scheme was systematic in five stations by ten transect



- Collected data

- Qualitative and quantitative catch composition with length frequency data for the most important species. For that species there are also data on sex, maturity and age. Benthos invertebrate were analyzed also. Environmental data (depth, temperature, salinity and sediment) were also collected

- Data storage

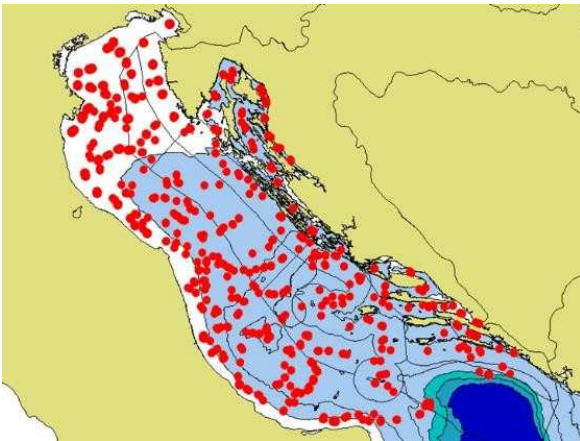
- Data base in excel format.

- Contact

- LBMP and IOF

8.2. MEDITS SURVEY GSA17

- Short description
 - It is an international bottom trawl survey that started in 1994 and covers all Mediterranean European countries by uniform methodology. This survey is actually part of DCF
- Methodology
 - Croatia is involved in the survey from 1996. In Croatian waters there are 60 stations. Italy is involved in the survey from 1994, with a number of hauls around 250. It has a random sampling scheme, one survey per year in spring-summer period. Methodology according DCF protocol

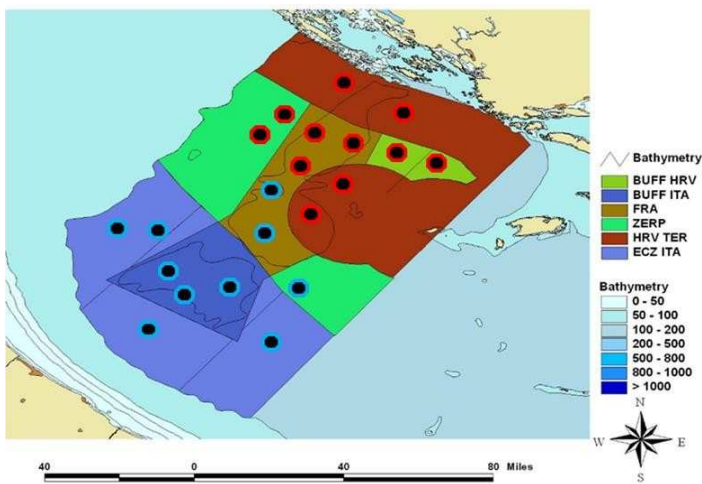


- Collected data
 - Qualitative and quantitative catch composition with biological data (length, weight, sex maturity, otoliths) for the most important (target) species. Benthos invertebrate were analyzed regularly, as well as marine litter. Environmental data (depth, temperature, salinity and sediment) were collected using sonda

- Data storage
 - MEDITS data base
- Contact
 - IOF and LBMP

8.3. FRA Jabuka/Pomo Pit survey

- Short description
 - This bottom trawl survey is organized by AdriaMed to monitor effect of establishment of Fisheries restricted area in the Jabuka/Pomo Pit
- Methodology
 - Survey was organized from 2019-2021. and performed by LBMP Fano and IOS IOF using methodology according MEDITS protocol. Survey was done in winter period in wider area of in respect to the pit

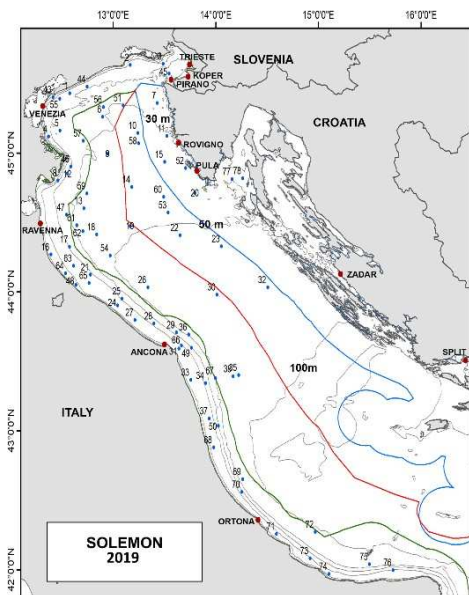


- Collected data
 - Qualitative and quantitative catch composition with biological data (length, weight, sex maturity, otoliths) for the most important (target) species. Benthos invertebrate were analyzed regularly. Environmental data (depth, temperature, salinity) were collected using sonda

- Data storage
 - Database Atris
- Contact
 - IOF and LBMP

8.4. SOLEMON SURVEY

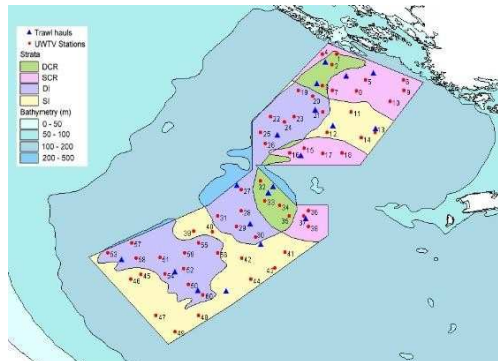
- Short description
 - This rapido trawl fishing survey is carried out in GSA17 from 2005, and organized by CNR-IRBIM of Ancona. It was developed specifically for the monitoring of *S. solea*; however, it is an important source of information for many benthic species
- Methodology
 - The survey is performed in fall-winter season in Italian, Slovenian and Croatian waters, and the number of stations is stratified on the basis of depth (0-30 m, 30-50 m, 50-100m). Each haul is performed with 2 rapido trawls simultaneously (stretched codend mesh size = 40.2 ± 0.83) and lasts for 30 minutes



- Collected data
 - Qualitative and quantitative catch composition with biological data (length, weight, sex maturity, otoliths) for the most important (target) species. Benthic assemblages are also regularly analyzed. Environmental data (depth, temperature, salinity) are collected using minilogs and CTD. In more recent years, data on litter are also collected
- Data storage
 - SOLEMON database
- Contact
 - CNR-IRBIM, IOF and FRIS

8.5. UWTV SURVEY

- Short description
 - In order to carry out an evaluation of *N. norvegicus* stock in the Jabuka/Pomo pit, in May 2009 was established the Underwater Television survey. The recording of underwater footage using a system set up for the quantification of anything included within the field of view of the camera, lends itself nicely to the collection of corollary ecological data, potentially producing datasets that could be used in the context of an ecosystem approach to fisheries management.
- Methodology
 - The UWTV stations were assigned to the study area following a stratified random sampling design with strata defined according to (i) depth: shallow (< 200 m) and deep (> 200 m), and (ii) fishing intensity. The number of stations per stratum was determined proportionally to the surface area of the stratum for a total of 60 stations. The UWTV camera (Kongsberg Simrad OE 1364 color camera) was mounted on a sledge towed on the sea bed at a speed of 1 knot

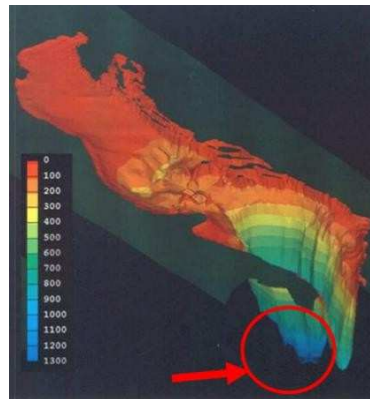


- Collected data
 - Analysis of VHS footage and *N. norvegicus* burrow identification and quantification were carried out following ICES protocols.
- Data storage
 - UWTV database
- Contact
 - CNR-IRBIM and IOF

8.6. DeepSea Survey

- Short description
 - This bottom trawl survey is organized by LBM Fano, IOF Split, FRI Ljubljana and IBM Kotor to describe demersal communities in the deep South Adriatic (bathyal zone)
- Methodology

- Trawl survey according MEDITS protocol and sampling with longlines and different traps for fish and crustaceans. Survey were performed in summer 2008. and 2009



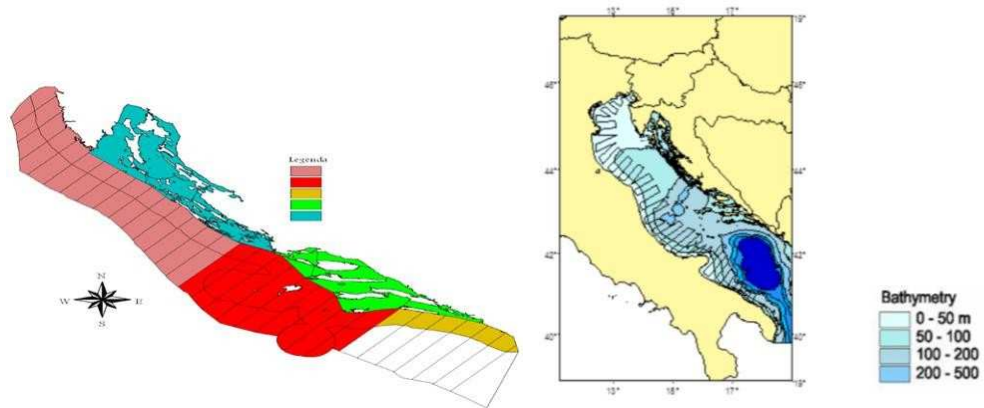
- Collected data
 - Qualitative and quantitative catch composition with biological data (length, weight, sex maturity, otoliths) for the most important (target) species. Benthos invertebrate were analyzed regularly. Environmental data (depth, temperature, salinity) were collected using sonda
- Data storage
 - Data base in excel
- Contact
 - LBMP and IOF

8.7. MEDIAS survey

- Short description
 - Echo survey with the aim to describe status of small pelagic fish. Under the name ECHOADRI (see previous chapter), it started in Italy in 1976, while in Croatia it started in 2002 through national monitoring project PELMON. In 2008 in Italy, and after 2013 in Croatia, it was incorporated in the EU program

MEDIAS. It is actually part of DCF program. Starting from 2008 and with exception of 2009, 2017 (only for Albania) and 2018, Eastern GSA 18 (Montenegro and Albania waters) were monitored by Italian acoustic survey group in collaboration with local Institutes as extension of the MEDIAS survey

- Methodology
 - The survey is organized according uniform methodology in the all Mediterranean EU countries. Croatian survey has been organized each year in the September and cover Croatian territorial water and Exclusive economic zone. Italian survey is performed during summer and covers Italian territorial waters of GSA17 and both sides of GSA18. This survey includes both investigations using Echosounders and sampling with pelagic trawl



- Collected data
 - Distribution of small pelagic fish, qualitative and quantitative structure of pelagic trawl catch, biological characteristic of target species (length, weight, sex maturity, age). Hydrographic parameter was collected boxy CTD probes, and sea bottom structure used echosounder
- Data storage
 - MEDIAS database
- Contact
 - IOF and CNR-IRBIM

9. BIOLOGICAL MONITORING OF COMMERCIAL FISHERIES

9.1. DEMMON – Monitoring of demersal fisheries (2002-2013)

- Short description
 - IOF started this monitoring in 2002. with support of Norway. After two year it continued as national monitoring project. Recently, it is part of DCF (from 2013). Sampling covered bottom trawlers, beam trawl, traps for Norway lobster and bottom long – lines
- Methodology
 - IOF performed sampling on board on the commercial vessels and on the landing places. Sampling was organized on the bimonthly basis in each fishing zone
- Collected data
 - Qualitative and quantitative structure of catches (separately landing and discard). Analysis of the macrozoobenthic bycatch. Biological analysis of target species (length, weight, sex, maturity, age)
- Data storage
 - Data base in Excel
- Contact
 - IOF

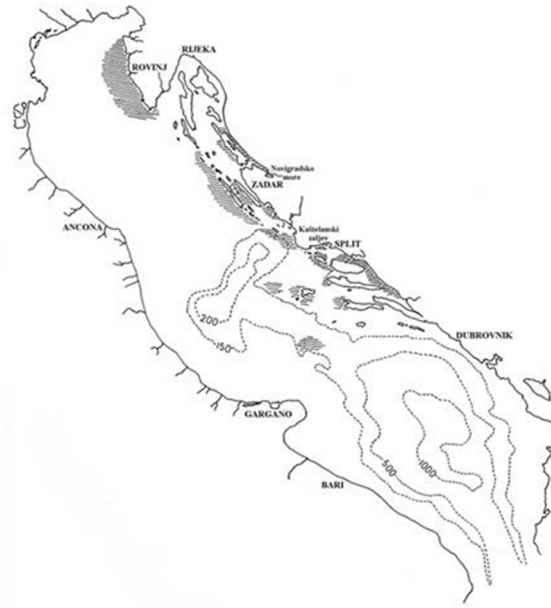
9.2. PRIMO

- Short description
 - IOF started this monitoring in 2008 as national monitoring project of small-scale fisheries and coastal marine resources. Recently, it is part of DCF (from 2013). Sampling covered gill-nets, trammel nets, shore seines, fishing techniques of using gill-nets with ropes for sparids and longlines
- Methodology
 - IOF performed sampling on board on the commercial vessels and on the landing places. Sampling was organized on the monthly basis in each fishing zone (based on fishing season of each fishing gear)

- o Collected data
 - Qualitative and quantitative structure of catches (separately landing and discard). Biological analysis of target species (length, weight, sex, maturity, age)
- o Data storage
 - Data base in Excel
- o Contact
 - IOF

9.3 Project JADRAN

- o Short description
 - From 1998 till 2009 IOF monitoring project for purse seine fishing nets was established in order to obtain the informations regarding the qualitative and quantitative catch data
- o Methodology
 - IOF performed sampling on board of the commercial purse seine vessels and on the landing places or fish markets. Sampling was organized on the monthly basis in the six most important fishing areas – Istra, channel area, coastal area, open sea area, nursery and spawning grounds - Kaštela Bay and Novigrad Sea



- o Collected data
 - Quantitative and qualitative description of the catches, bycatch and discards, as well as biology of the most important target species (length, weight, sex, maturity, age...) have been obtained. Annual landing data were collected from the fisherman or fish industry dating from 1947
- o Data storage
 - excel data base (IOF)
- o Contact
 - IOF

9.4. VPA/PERIMON

- o Short description
 - From 2009 till 2013 IOF monitoring project for purse seine fishing nets was established in order to obtain, the information regarding the qualitative and quantitative catch data. From 2013 it has become a part of the DCF
- o Methodology
 - IOF performed sampling on board on the commercial purse seine vessels and on the landing places. Sampling was organized on the monthly basis in the most important fishing zones (6 on board, 12 landing places)
- o Collected data
 - Quantitative and qualitative description of the catches, bycatch and discards, as well as biology of the most important target species (length, weight, sex, maturity, age...) have been obtained
- o Data storage
 - Excel data base (IOF)
- o Contact
 - IOF

9.5. Scientific project: Definition of spatial and temporal spawning grounds of sardine and anchovy

- o Short description
 - In 2012 IOF performed via two surveys collection of ichthyoplankton samples in order to define spawning areas of sardine and anchovy
- o Methodology
 - Ichthyoplankton sampling during the surveys (one in winter and another in summer time) were done with standard plankton net WP2 (net opening 0.255 m²; mesh size 0.200 mm) on 60 stations along the eastern side of Adriatic Sea (Croatian fishing ground). All collected samples were analyzed under the binocular. Sardine and anchovy eggs and larva were isolated and counted
- o Collected data
 - Abundances of sardine and anchovy early life stages (eggs and larva) were obtained
- o Data storage
 - excel data base (IOF)
- o Contact
 - IOF

9.6. PRUT - Monitoring of fishing and farming of bluefin tuna (Thunnus thynnus)

o Short description

- The IOF monitoring of fishing and farming of bluefin tuna (*Thunnus thynnus*) was established 2005. The overall objective of this project is data collection from fishing of bluefin tuna according to the ICCAT specific conditions and recommendation and with requirements established in the laws and regulations of the Republic of Croatia: ICCAT Recommendation 06-07; ICCAT Recommendation 19-04; Regulation (EU) 2016/1627 of the European Parliament and of the Council of 14 September 2016) on a multiannual recovery plan for Bluefin in the Eastern Atlantic and Mediterranean, and repealing Council Regulation (EC) No 302/2009, Regulation of fishing of bluefin tuna (*Thunnus thynnus*) purse seiner, the farming of bluefin tuna, specific conditions and objective criteria for the purpose of allocating access to the individual transferable quotas rights (NN, br. 46/19 i 41/20). Having regard to the reporting obligations arising from the provisions of Regulation, scientifically justified fisheries and farming monitoring of BFT has been conducted over the past years. Analyzed collected data from the fisheries and farming monitoring of BFT are updated and submitted to the national authority, EC (DG MARE) and ICCAT

o Methodology

- For the purpose of monitoring the collection of data implements following sampling method:

Collection of size data of Bluefin tuna stock in the cages referred to the number of died fish on the purse seiner and /or on towing vessel used for towing cages

o Collected data

- Sampling is carried out at the beginning of the farming cycle in which the standard curve length, mass and gender is determined. Sampling of each cage from which bluefin tuna is harvested and on all farms in such a way that at least 100 Bluefin tunas are sampled per 100 tons of harvested fish

o Data storage

- In accordance to the conducted sampling all data should be updated in Excel file. This base is source for the computational analysis of data and it is submitting in the report form TASK IV, Farming size sampling (BFT) ST06-T2 FM to the ICCAT

o Contact

- IOF

9.7. OPR – DCF

o Short description

- Starting from 2013 in Croatia and from 2002 in Italy, it was established the monitoring of marine fisheries according to the Common Fisheries Policy throughout national Data Collection Framework

o Methodology

- Sampling, analysis and storing data methodology is common for all EU countries and it is

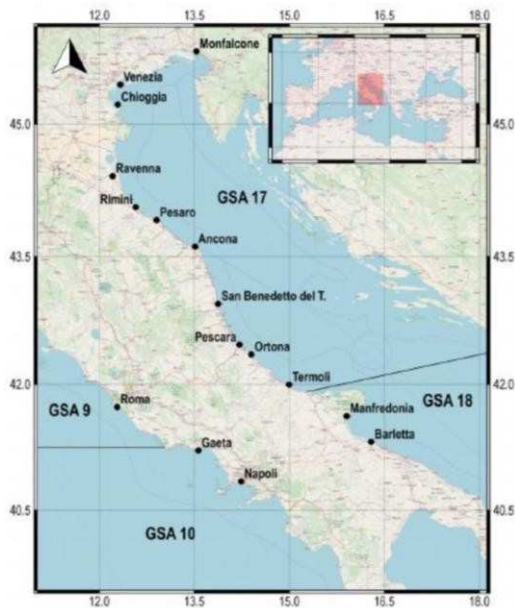
- prescribed by EU regulation
- Collected data
 - LPUE data, catch/discard data, effort data, biological data, socio economic data
- Data storage
 - DCF data base
- Contact
 - IOF and CNR

9.8. Monitoring of small pelagic species in the channel water

- Short description
 - This sampling survey is organized to collect additional data on status of small pelagic resources in the channel waters
- Methodology
 - Monthly sampling on board of fishing vessels (purse seiners) and landing ports in the territorial waters of Croatia
- Collected data
 - Monthly samples of quantitative and qualitative structure of catches (landing/discard data) together with collection of the biological data (length, sex, maturity, age, stomach contents) for sardine and anchovy
- Data storage
 - Data base in Excel format
- Contact
 - IOF

9.9. Monitoring of Clams fishery along the Italian coast

- Short description
 - Dredgers Molluscs Surveys (DRES), starting in in 2017, aims to assess the health status of the two species *Chamelea gallina* (clam) and *Ensis minor* (razor clam) along the Italian coasts. The type of survey proposed serves as a basis for assessing stock density and biomass



- Methodology
 - During the spawning months of the two species, the sampling takes place along transects perpendicular to the coast and about 2 nautical miles (nm) apart from each other. For each transect, hauls are made at regular intervals of 0.25 mn from each other (0.25, 0.5, 0.75, 1 mn) continuing by further 0.25 mn towards the open sea if in the 1 mn samples they are still present clams. Each set is carried out parallel to the coastline and at a constant depth
- Collected data
 - Qualitative and quantitative catch composition with biological data (length, weight, sex)
- Data storage
 - PLNRDA database
- Contact
 - CNR-IRBIM

9. LPUE DATA

Recently LPUE data (landing and discard) per fishing area and per months, are collected mainly through DCF sampling for demersal, pelagic and coastal fisheries. Sampling include all relevant fishing gears (fishing fleets) and commercially important species. Following gears are sampled: bottom trawl, beam trawl, purse seines, gill-net, trammel net, shore-seine, longlines (pelagic and bottom), and traps. Sampling is organized according standardized methodology for all EU Countries prescribed throughout Data Collection Framework (EC 2017/1004 and EC 2016/1251). Sampling is organized on the monthly basis on each fishing zone. All data are stored in the DCF data base.

In Fisheries Department data on landing and fishing effort are collected through e-logbook system. Those data

are basis for national fisheries statistic data which are provided throughout DCF and FDI data call.

Historical landing data by fishing area on national level exist for period from 2002. collected through fisheries monitoring projects DEMMON, PERIMON, PRIMO and PRUT. Sampling, data analyzing and data storing methodology are similar to the DCF protocol.

Historical data for older period exists in the IOF data bases and cover spatially and temporally limited data series. Data are mainly collected onboard commercial vessels during fishing activities. Data are stored in the IOF data bases.

10. ANNUAL LANDING DATA

Official annual landing data are recently provided throughout DCF and FDI data call and include all relevant information regarding fishing fleet.

Historical annual landing data could be found in the FAO Fishstat, and DZS RH databases.

Regarding the Italian side, it is important to cite the Fortibuoni et al., 2017 historical database. However, a research programme called “Feasibility Study of a Sampling System for the Collection of Fishery Statistics in Italy (PESTAT)” was conducted in all Italian seas from 1980 to 1986. This study, financed by the Ministry of the Merchant Navy, was designed and executed by CNR-IRBIM (IRPEM at that time) with technical assistance provided by the FAO Fishery Department. The collection of fishing catch and effort data started in September 1981 and finished in September 1983. The purpose was to estimate the status of exploitation of fishing areas in Italian waters and their yield.

11. FLEET CAPACITY DATA

Official fleet capacity data are recently provided throughout DCF and FDI data call and include all relevant information regarding fishing fleet capacities.

Historical fishing fleet data could be found in the DZS RH databases and in the databases of Croatian Fleet Register.

12. ECONOMIC DATA

Fisheries economic data are collected by Fisheries department using standardized methodology of DCF. Data are stored in the DCF data base.

13. SELECTIVITY DATA

- Bottom trawl selectivity data

- 40/50 mm mesh size
- Square/diamond mesh orientation
- T90 selectivity experiments
- Bottom trawl grid selectivity experiments
- Shore seine selectivity data
 - 24, 40, 50 mm mesh size
- Traps selectivity data
 - 40 mm mesh size
 - 50 mm mesh site

14. BIOLOGICAL DATA

- Biological data are collected throughout national DCF using prescribed methodology, and data are stored in the IOF and CNR-IRBIM data bases respectively. Those data series include length frequency data, sex, maturity, age, diet composition data, L/W relationship, L/A key, VBGF parameters. Those data exist for all key species prescribed by EC 2017/1004 and EC 2016/1251.
- Additionally, IOF has numerous biological data collected throughout different scientific surveys and commercial fisheries surveys before mentioned
- Age length data
 - Age /Length data for demersal species
 - *Merluccius merluccius*, *Mullus barbatus*, *Trichuris trachurus*
 - Age/length data for pelagic species
 - *Sardina pilchardus*, *Engraulis encrasicolus*, *Scomber colias*, *Scomber scombrus*, *Belone belone*
 - Age/length data for coastal species
 - *Spicara smaris*, *Boops boops*, *Solea solea*, *Merluccius merluccius*, *Scorpaena scrofa*, *Mullus surmuletus*, *Diplodus vulgaris*; *Dentex dentex*
 - Age length data for shellfish:
 - *Pecten jacobaeus*, *Venus verucosa*, *Acanthocardia tuberculata*, *Callista chione*, *Venerupis decussata*, *Arca noae*
- VBGF data exist for the following species:
 - Demersal species
 - *Merluccius meruccius*, *Mullus barbatus*, *Pagellus erythrinus*, *Solea solea*, *Eledone moschata*, *Parapenaeus longirostris*
 - Pelagic species
 - *Sardina pilchardus*, *Engraulis encrasicolus*, *Thunus thynnus*, *Scomber scomber*, *Scomber colias*, *Belone belone*
 - Costal species

- *Spicara smaris, Mullus surmeulettus, Solea vulgaris, Merluccius merluccius, Scorpaena scrofa, Mullus surmuletus, Diplodus vulgaris*
- Shellfish species
 - *Pecten jacobaeus, Vennus verucosa, Calista chione, Acanthocardia tuberculata, Callista chione, Venerupis decussata, Arca noae, Modiolus barbatus*

15. MARINE LITTER DATA

IOF and LBMP collected marine litter data through MEDITS survey starting 2018. Also, information on marine litter and microplastic were collected throughout DEFISFGEAR project and MLREPAIR project. The international project of cross-border cooperation DeFishGear, funded under the European program IPA Adriatic, puts together the efforts of Albania, Bosnia-Herzegovina, Croatia, Greece, Italy, Montenegro and Slovenia to address the various aspects related to the presence of marine litter in the Adriatic Sea. IOF was one of the partners in the project. DeFishGear aims to provide a first global assessment on the quantities and types of marine litter in the Adriatic Sea, using the same protocols and monitoring methodologies throughout the basin, raising the awareness of parties involved in the problem (fishing authorities, population, etc.) to prevent the production of marine litter and carry out practical actions to reduce it. IOF addresses the problem of marine litter in the Adriatic Sea through a collaboration with fishermen and local institutions. In addition to a scientific activity of litter monitoring (on the beaches, on the seabed, on the surface and within the biota), useful to provide a first picture of the current situation, one of the main objectives is to import in Croatia the practice known as fishing-for-litter, to involve fishermen in the sea cleaning process.

The ML-REPAIR project, capitalizing the results of the Adriatic IPA CBC DeFishGear project, is aimed at strengthening joint governance on marine litter management and developing of solutions among

different entities for reducing and preventing marine pollution. The main project activities are focused on testing new educational tools for raising awareness of tourists in the coastal areas and for supporting the strategies for monitoring the marine litter in participative approach of the fishermen community. The collaborative activities among different entities, strengthening joint governance on marine litter management, addressing the proper target groups - local communities, fishery sector and tourism sector – are the strength of the ML-REPAIR project. The project contributes to the environmentally sustainable growth of tourism and fishery activities in the Adriatic Sea by providing efficient approaches and actions able to reduce and control marine litter in the Adriatic Sea, consequentially improving the environmental quality of its waters in the mid to long term. Within the ML-REPAIR project, activities are carried out in Croatia and Italy, and the core of the project's activities is to involve the predefined target groups of the project (fishermen and fishing associations/cooperatives, local communities and the younger population, tourism sector, public administration bodies and the FLAGS and LAGs) through the implementation of various activities related to diverse aspects related to marine litter.

From 2009, in the SOLEMON framework it is included the collection of marine litter in each sampling station. During the survey performed in 2014 and 2015, 535 common soles were also used for an in deep analysis of microplastics content (Pellini et al., 2018). On the same issue, in 2013 a survey was performed by CNR-IRBIM,

collecting native mussels, *M. galloprovincialis*, from two artificial reefs (Gomiero et al., 2019).

16. PRIVATE FISHERMEN DATA

- Traps for Norway lobster data
 - Data are collected by IOF and cover Norway lobster trap fisherman operated in Northern Adriatic. Data include qualitative and quantitative structure of daily landing and data on fishing effort.
- Longlines data
 - Data are collected though out VIP longlines project and cover Bottom Longlines. Data cover daily catches 20 vessels operated in Central and South Adriatic. Data include qualitative and quantitative structure of daily landing. Also, there are data on fishing effort and price of fish.
- Bottom trawl fisheries data
 - Data are collected by IOF and cover bottom trawler operated exclusively in Jabuka area. Data include qualitative and quantitative structure of daily landing. Also, there are data on fishing effort and price of fish.

17. VMS DATA

VMS data are regularly collected by Fisheries Departments starting from 2018. It includes all active vessels bigger than 12 meters LoA (bottom trawlers, purse seiners and beam trawlers). Data are stored in the Fisheries Departments data base.

18. AIS DATA

This kind of data is yearly collected by CNR-IRBIM of Ancona from 2015. In 2012, this system became compulsory for all EU fishing vessels longer than 24 m LOA, and in the subsequent two years it has been progressively extended to medium-large size fishing vessels becoming compulsory since May 2014 for all fishing vessels having overall length exceeding 15 m.