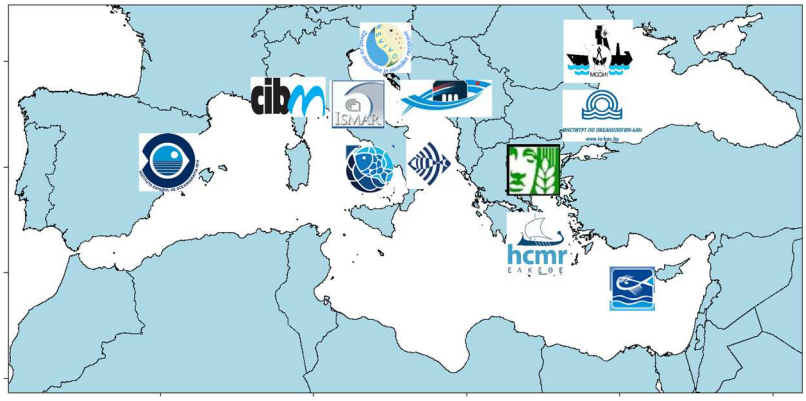

Call for Proposals MARE/2016/22 "Strengthening regional cooperation in the area of fisheries data collection", Annex 1 "Biological data collection in EU waters" – Agreement Number – MARE/2016/22 – SI2.770115

STrengthening REgional cooperation in the Area of fisheries biological data collection in the Mediterranean and Black Sea (STREAM)

D0.3 FINAL REPORT

Project Coordinator: Alessandro Ligas (CIBM)

Partners involved:

CIBM, COISPA, CNR-ISMAR, NISEA, HCMR, FRI, IEO, DFMR, IOF, IO-BAS, NIMRD, REVIVO

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We would like to thank all the colleagues who contributed to the completion of this project, in particular the work package and task leaders who took on the responsibility of delivering substantial sections of the project, and the core teams, for their significant contribution.

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1. EXECUTIVE SUMMARY

The STREAM project "Strengthening Regional cooperation in the area of fisheries biological data collection in the Mediterranean and Black Sea" aimed at providing support to the Commission and MSs to build up experience in new areas of regional cooperation in the Mediterranean and Black Sea for the realization of Multiannual Regional Work Programme (MRWP).

STREAM has been organised in 9 Work Packages, that were tightly interconnected, and 9 Tasks (3 sub-Tasks), and issued 20 deliverables. Each WP included specific activities to achieve the required objectives, had a person in charge (working in cooperation with a co-chair), a core team who carried out the majority of the work, a clear set of milestones and deliverables, and a work plan. The interactions among all these levels was supervised by the Project Coordinator (WP0 Leader), supported by the Project Steering Committee (SC; WP Leaders). Case studies identified considering GSAs, stocks and fisheries represented the project working basis.

The project **Work Package 0** (WP0) ensured the coordination, the organization of meetings to discuss project implementation, results and running case studies. The setting (in cooperation with WP8) of a sharepoint (https://streampartner.coispa.eu/WebInterface/login.html, with a repository section: https://streamstakeholder.coispa.eu/WebInterface/login.html) streamlined the communication among partners, the Commission, and the main stakeholders and end-users throughout the project implementation. The project initiative and preliminary results were presented and discussed at the RCG Med&BS held in Kavala in September 2018. The project outcomes were presented and discussed with National Correspondents and stakeholders at the STREAM Knowledge Exchange Workshop (Rome, 11-12 April 2019), and the RCG Med&BS held in Madrid Madrid, 11-12 June 2019.

The **Work Package 1** (WP1, Set of prerequisites for the functioning of the Regional Coordination Groups) performed a regional consultation to obtain views, determine the degree of consensus on possible future developments of regional coordination in the collection of biological data, on the implementation of common methodologies, the establishment of regional sampling plans as well as the development of *ad hoc* working groups, and note any outstanding areas of disagreement that need to be addressed. The results of the consultation pointed out the urgent need to progress towards common regional methodological approaches for the collection of biological data on commercial fisheries, recreational fisheries, and the marine ecosystem in general. The necessity to better develop statistical and quality check aspects related to the collection of all biological data at regional level, and strengthen the cooperation between MSs sharing the same marine resources in the region also emerged.
WP1 has also analysed the rules of procedures (RoPs) already developed during the RCG Med&BS (RCG Med&BS Report, 2017), identifying gaps and suggesting further actions. The complete list of suggestions is available in section 4.1 of **Deliverable D1.1** (please see Annex V in this report).
Furthermore, WP1 provided a list of recommendations addressed to the relevant stakeholders, including justification and the recommended follow-up actions. This list is provided as Annex IV in the **D1.1**.

Under **Work Package 2** (WP2, Identification of candidate stocks/fisheries/métiers presenting a wide scope for regional sampling and for which Member States could share sampling tasks), we performed an analysis aimed at identifying stocks and fisheries (métiers) suitable for regional sampling. The results of the analysis performed under WP2 were reported in the **Deliverable D2.1** "Identification of the most important stocks at regional level and relative fleets (métiers)".
The analyses performed under WP2 of the project STREAM provided new insights on the identification of stocks and métiers driving the fisheries in the EU Mediterranean and Black Sea GSAs. On the basis of the 2013-2015 data, and taking into account a 75 % threshold of the cumulative value and volume of landings, it was possible to identify the most important target species for all the demersal and small pelagic fisheries.
The outputs of WP2 provided the elements to identify the case studies for the training workshops on the sampling optimization tools and the analyses performed under WP3.

The **Work package 3** (WP3, Design of a regional sampling plan covering commercial fisheries/ stocks/métiers) was organized in 4 Tasks:
Task 3.1 Data Sharing among all Member States of the regions (Mediterranean and Black Sea);
Task 3.2 Apply and/or refine reference (or code) lists to be used by Member States in the region and identify possible solution for data storage system, processing and analysis of the data at regional level;
Task 3.3 Carry out simulations to propose a RSP for 2019;
Task 3.4 Develop rules on how to allocate tasks and costs among Member States and evaluate costs implication.
The data sharing agreement (DSA) expected under Task 3.1 was finalized specifying the type of data to be shared, the common data format and rules for the usage of these data. The DSA was shared through the project sharepoint with National Correspondents for their feedback and agreement (in cooperation with WP0 and WP8). The DSA was signed by most NCs (Cyprus, Italy, Slovenia, Greece, Bulgaria, Romania), while others have ensured the data delivery though they have not signed the DSA (France, Croatia and Malta). A data call was launched with the deadline on 19th July 2018. Dedicated sections of the STREAM sharepoint were made available to each NC who will use own authorization to access and upload the data. The data received were used for the analyses performed under Task 3.3, Task 6.1 and Task 6.2.

Under Task 3.2, some modifications were made to the RCG Med&BS Data Call format to allow the recording of individual measures (e.g., weight, sex, maturity and age) useful for analyses on biological variables, and information related to the fishing area and (port) that can be used in the analyses performed by the Sampling Design tool (under Task 3.3) in order to perform the analyses in different areas. The introduction of these additional fields implied necessary modifications to the scripts for the conversion of the simplified format (RCG Med&BS Data Call) to the SDEF (Standard Data Exchange Format) used in COST.
A regional data storage system for Mediterranean and Black Sea is not available, though requests for establishing a RDB have been proposed in past occasions. Currently, aggregated data for stock assessment are stored at EU JRC facilities, while detailed data have been made available to the RCG Med&BS in the recent years for selected GSAs and target stocks trough specific data calls. This data were analysed for several purposes related to the sampling evaluation, and stored on the RCG Med&BS share point.

This task, besides the revision of the reference lists and data format also contributes to examine solutions related to the storage, processing and analysis of the data at regional level, taking into account the current situation, ongoing studies and developments. A list of expectations of the various stakeholders from the RDB (requirement specifications), the potential users (actors) and the list of actions defining the interactions between a user and the system to achieve a goal (use cases) is described. Different information sources were considered: the inventory and analysis of the main existing tools in support of DCF carried out in MARE 2014/19 Med&BS, consultation of the relevant end-users/stakeholders.
Auxiliary tools to standardize and ease the procedures for data processing and management are made available through *ad hoc* scripts for the conversion of primary data into the formats for data transmission to specific data call (e.g. EU-JRC DCF, GFCM DCRF) and use of existing tools (e.g. COST) for data analyses.

The work done in Task 3.3 can be subdivided in two areas: a methodological part focused on the development of tools for the sampling optimization, and aimed at the design of a regional sampling plan; another one based on the application of the developed tools to specific case studies. The initial plan was to cover and analysed at least four case studies, while it was finally decided to provide the results of five case studies in order to have a wider overview on the potentialities of the developed tools and their applications.

The work carried out can be summarized as follows:

a. Generalization of the scripts developed in the project MARE/2014/19 Med&BS for the optimization of the number of trips and calculating the CV of the length distribution of a given species. The old version of SD Tool allowed to perform the analysis by metier (level 6), quarter and commercial category, while the new version carries out the optimization also by GSA, by area (e.g. combination of GSAs), country and gear (level 4), thus allowing different samples' stratifications.
b. Implementation of new scripts, which following the approach as in the previous **SD Tool**, are performing simulations, based on the resampling of a certain number of trips through the bootstrap procedure (e.g. 100 resamplings). The number of trips can be selected among the results from the optimization scripts (SD Tool) based on the performance of the CV of the length distribution of each species relevant for the case study (point a). Different sub-sampling sizes can be also explored through this new version of the tool.
c. Implementation of additional scripts grouped in the **BioSim Tool** to allow the evaluation of different hypotheses of resampling of biological variables, thus computing the sex-ratio-at-length, the maturity-at-length and the age-at-length from the biological measures (sex, maturity, age) of the resampled individuals.
d. Implementation of scripts allowing the comparison of the different simulations (done through the scripts mentioned at the previous points) assessing the increase/decrease in the CVs compared to the current situation and implementing the calculation of EMD (Earth Mover's Distance) for the comparison of two different distributions (e.g. length frequency, sex ratio at length, maturity at length and age distributions).

The proposed approach can be summarized into the two following phases:

- Phase 1: run the optimization scripts for each target species in order to find the "optimal" sampling size range analysing the precision of the sampling (i.e. in terms of the CV of the length structures);

- Phase 2: run different scenarios resampling historical data following different hypothesis and assess the performance of the scenarios compared to the past sampling (scenario obtained by bootstrapping the dataset following the same hypothesis in terms of number of trips and measured individuals as used in the current situation, hereinafter referred as “baseline”). The scenarios can be defined:
  - ✓ i varying the number of sampled trips according to the different “optimal” range found for each species (phase 1), using the same stratification as in the historical sampling;
  - ✓ ii varying the number of sampled trips and simulating, for example, an increase of this number, while reducing the length measurements taken (making subsamples) for each trip.

A wide number of outputs are made available to the user to evaluate the different scenarios respect to the current sampling (baseline):

- a summary table including the numbers of trips, the number of measured individuals and the value of CV for each species and scenario by sampling stratum;
- the increase/decrease (in %) of the CV and the EMD of the length structures respect to the baseline for each species and scenario by stratum;
- a plot showing the value of total CV corresponding to a given number of trips and a given number of measured individuals;
- Earth Mover’s Distances (EMD) calculated for each length distribution and for each species;
- a plot of the total length frequency distributions simulated in all the scenarios is saved;
- for each species and area the original numbers of measured individuals by trip/haul and the reduced numbers through the subsampling simulation are plotted in a barplot to give an idea of the number of samples affected by the reduction;
- coefficient of Variation (CV) by length class of the species included in the analyses are overlapped in distinct plots (one for each scenario), in order to observe how the values of CVs are varying.

The methodology and the R tools developed in Task 3.3 of the project have been applied to 15 case studies during the 2 training workshops organized under WP7. Data for the case studies were obtained after a data call of RCG Med&BS, following a Data Sharing Agreement (deliverable 3.1). In some cases data were integrated and/or corrected by the experts during the Workshops. Five case studies covering all the sub-basins of Mediterranean Sea and the Black Sea were retained, following the project plan. However in some case studies biological variables were missing.

- *Case study in GSA 22, 23, 25 (Greece, Cyprus) on M. merluccius, M. barbatus and A. foliacea*
- *Case study in GSA 29 (Bulgaria, Romania) on M. barbatus*
- *Case study in GSA 17-18 (Italy, Croatia, Slovenia) on E. encrasicolus and S. pilchardus*
- *Case study in GSA 9-10-11 (Italy) on A. antennatus and A. foliacea*
- *Case study in GSA 1-5-6-7 (Spain, France) on E. encrasicolus and S. pilchardus*

Under Task 3.4, R scripts to implement rules on how to allocate tasks or costs between Member States and assessing results from simulations under the economic perspective were developed. Cost implications if Member States will implement the regional sampling plan proposed under Task 3.3 were evaluated and compared to the "business as usual" approach that consists of national sampling plans. The outcomes of Task 3.4 can be used as reference for future regional sampling plans. The approach developed under Task 3.4 considers the different components of sampling and processing costs and simulates and estimates cost

differences in relation to the status quo. The methodological approach was developed under the R language environment.

The work of **Work package 4** (WP4, Regional Sampling Program for the collection of data on fisheries impacts on the ecosystem) was organized into two Tasks:
Task 4.1 Develop/refine methodologies for data collection and processing;
Task 4.2 Allocate task and costs among Member States and evaluate cost implications.
The main objective of Task 4.1 was to develop a RSP adapted to the characteristics of the stock/fisheries object of regional monitoring, which were identified by the WP2 of this project. This task was divided into 3 sub-Tasks:

- Sub-task 4.1.1 Data on stomach contents of fish;
- Sub-task 4.1.2 Data on co-occurrence and relative abundance of species/stocks;
- Sub-task 4.1.3 Data on incidental catch of non-target species, such as protected, endangered or threatened species (PET species).

Under Sub-Task 4.1.1, the methodologies developed by the MARE/2014/19 Med&BS project for the collection and analysis of fish stomach content data for selected stocks were reviewed, both as concerns the selected stocks and sampling size and stratification.
In addition to the main stock proposed by MARE/2017/19 for stomach content data collection, e.g. European hake in Mediterranean GSAs and turbot in the Black Sea, some additional stocks were proposed for this data collection in the new sampling program: anglerfish, *Lopius piscatorius* and *L. budegassa*, in the Mediterranean, Mediterranean horse mackerel, *Trachurus mediterraneus*, and sprat, *Sprattus sprattus*, in the Black Sea. As main criteria followed for the selection of the new species, we considered the species importance in terms of landings and commercial value, the trophic relationships (e.g. predator, prey) with European hake in the Mediterranean, and turbot in the Black Sea. This will allow increasing the overall knowledge from an ecological point of view on the stocks, and gathering information that could be used to evaluate the natural mortality. On this basis a new sampling scheme was proposed, taking into account, for each species, factors such as size class, season (quarter), and type of sampling (e.g. experimental fishing and biological sampling on commercial fishery).
In Sub-Task 4.1.2, a common procedure of analysis to estimate the structure of the exploited fish and shellfish assemblages (in terms of species occurrence and relative abundance) was designed using the MEDITS trawl survey data. The proposed methodology was tested on a case study represented by the GSA9, using MEDITS data from 2015 to 2017. The methodology is based on a multivariate analyses (Cluster analysis, SIMPER) to identify the species characterizing the main demersal assemblages. Once the different assemblage were identified, the Spearman rho test will be applied to check for correlation within the trend of biomass and density abundance.
Under Sub-Task 4.1.3 “Data on incidental catch of non-target species, such as protected, endangered or threatened species”, the methodological approach developed under the project MARE/2014/19 Med&BS was reviewed and updated. An analysis of pros and cons of the approach was performed, also taking advantage of the preliminary results that came from the pilot studies carried out under the MSs work plans. A cooperation started with experts from GFCM working on the implementation of a monitoring program on the incidental catch of vulnerable species, and the colleagues involved in the WP4 of the FishPi^2 project.

Deliverable D4.3 “Updated guidelines, protocols and handbooks for monitoring incidental by catch of vulnerable species” is the results of the activities performed under Sub-Task 4.1.3. The new programme on data collection of incidental by catch was designed taking into consideration three case studies, two in the Mediterranean (trawl fisheries in the Gulf of Lions and the Adriatic Sea), one in the Black Sea (beam trawl fishery targeting Rapana whelk). The monitoring programmes are based on a combined approach coupling the fleet observer monitoring scheme already foreseen for the collection of biological data on commercial fisheries and discards with a self-sampling programme (log-books filled in by fishermen) through the proactive involvement of the fishing industry.
The sampling designs and analyses developed under Task 4.1 were converted into task and cost allocation under Task 4.2. The results are presented in the Deliverable D4.4 “Guidelines and rules on how to allocate tasks and costs between Member States with Routine on the evaluation of costs implications for Member States”.

The **Work Package 5** (WP5, Small-scale fisheries and recreational fisheries) performed a thorough review of the knowledge on SSF and RF in terms of characterization of the fisheries, data collection approaches and needs, data quality and existing gaps has been performed. The outcomes of this review analysis are reported in the Deliverable D5.1 “Review of the availability, quality and existing data gaps for SSF and RF in four case studies”. Furthermore, WP5 formulated guidelines for the collection of data in SSF and RF, and provided a list of recommendations for the implementation of monitoring programs on RFs. These guidelines and recommendations were presented in the Deliverable D5.2 “Guidelines on the best practice methodologies for sampling, processing, analysing and managing biological and spatial data on SSF and RF“.
WP5 proposed a roadmap listing the steps that shall be taken by MSs to implement pilot studies on RFs in the new EU MAP. In doing this, we hypothesized the implementation of the new EU MAP for a 6 years time (2020-2025), before further revision.

	Step	**Aim and decription**	**Responsible**	**Estimated duration**	**Timing**
1.	Preparation o pilot study	Determine the recreational fishers population structure, effort and target species/catches to enable selection of the best methodology	MS National Focal Points	1 year	2020
2.	Execution of pilot study	Implementation of the selected methodology for monitoring RFs	MS National Focal Points	2 years	2021-2022
3.	Revision Workshop	Evaluate the efficiency and adequacy of the monitoring and implement adaptations if necessary	RCG/ MS National Focal Points	1 week	End of 2022
5.	Regional work plan on RFs	Implementation of a regional programme on RFs	RCG/ MS National Focal Points	3 years	2023-2025

WP6 – Procedures to assess the quality of biological data stored at regional level

The work of WP6 has been organized and performed in three tasks:

Task 6.1 Agree on a set of national data quality assessments

Task 6.2 Agree on a set of regional data quality assessments

Task 6.3 Annual calendar for the data checks

Task 6.1 developed a series of a priori and a posteriori data quality checks to be performed at national level. Two different R scripts were developed:

- a priori QC: quality checks carried out on the sampling data in RCG CS format;
- a posteriori QC: quality checks on the Med&BS Data Call tables.

The a priori QC script is aimed at detecting the errors or inconsistencies on the sampling data, before the raising procedures were applied. Once the warnings have been addressed, the conversion tools developed within STREAM Task 3.2 can be used to obtain the COST objects and the SDEF tables (RCG_to_COST script); subsequently, the SDEF tables can be used to obtain the Med&BS Data Call tables applying the SDEF_to_DGMARE_Med_BS script, also developed within Task 3.2.

Then, the a posteriori quality checks can be carried out to get a report containing information on the spatial and temporal coverage of all the relevant tables, as well as to detect records with discrepancies between the product number of raised individuals * individual weight at age in the landings, discards, and catch by metier, quarter, species and GSA.

A cooperation with the FishPi^2 initiative was attempted. The STREAM coordinator and Isabella Bitetto (COISPA) attended the FishPi^2 WP6 workshop in October 2018. However, due to the delay in delivering the main outcome of FishPi^2 WP6, namely an R library (CLEFRDB) containing the basic structure of the RDB and the main methods to handle the data, it was not possible to finalize the collaboration. Nonetheless, , an attempt was made to apply the same functions of the CLEFRDB library to the RCG CS format to create simple Time, Landing and Space objects and show how to apply that library also in Mediterranean and Black Sea context. It is also foreseen to continue the cooperation in the further development of the library and the additional functions to work with the RDB data format.

The work performed under Task 6.2 has been implemented taking into consideration two case study species: red mullet, *Mullus barbatus*, and common pandora, *Pagellus erythrinus*. In particular, the work was focused on the age data and two main actions were implemented:

- identification of the main drivers influencing the variability in the age data of red mullet, predict missing values and estimate uncertainty linked to the sampling strategy;
- improvement and harmonisation of ageing approach and protocols in common pandora.

The analyses performed on the age variability in red mullet and the procedures set up for the implementation of an exchange exercise and a workshop on the ageing of common Pandora will represent common procedures to be extended to other species with the aim checking the quality of age data.

Task 6.3 developed a detailed calendar for national and regional checks by means of the a priori and a posteriori data quality check scripts developed by Task 6.1. A first draft of the calendar was presented and discussed with Member State National Correspondents and stakeholders during the STREAM Knowledge Exchange Workshop (Rome, 11-12 April 2019), and the proposed final version of the calendar took into account their comments and suggestions.

The **Work Package 7** (WP7, Training of Member State experts) performed an analysis aimed at mapping the training needs and the expertise in the various fields of biological data collection. This analysis was performed through an *ad hoc* questionnaire. The results of the answers received from the questionnaire were presented at the RCG Med&BS meeting in Kavala (September 2018).
In cooperation with WP3, two workshops were organized for the experts in the region. The two workshops involved training on use of regional tools developed for optimising sampling intensity, and took place in Kavala (in parallel with the RCG Med&BS meeting, September 2018) and in Bari (1-4 October 2018). A third workshop (Workshop on age reading of common pandora) was organized in cooperation with Task 6.2, and took place in Livorno (26-28 March 2019).

The **Work Package 8** (WP8, Inputs from a regional consultation) worked in strict cooperation with WP0 and WP7 to establish consultations with all Member States, either participating in the grant or not, regarding the outcomes of the WPs from 1 to 6. The project sharepoint (with a repository section) was created and implemented in cooperation with WP0. Each user was granted with a personal access code with differentiated levels of execution permissions (e.g. according to responsibility of a partner, or user external to the Consortium). Progress of the project (documents, deliverables, workshops, relevant milestones) were communicated through the sharepoint. A written consultation was carried out with NCs after the STREAM Knowledge Exchange Workshop (11-12 April 2019), asking them to evaluate the main points tackled in the WPs 1-6, and express their level of agreement/disagreement on a scale of semantic scores ranging from -3 to +3, with the value 1 representing a judgement of indifference and the value ±3 representing highest agreement/disagreement. The feedback from the National Correspondents was generally positive and the average value of their level of agreement with the project activities and tools developed was ranging from 2 to 2.5. While the need to planning training workshops for progressing in the implementation of the tools developed by the project was ranked with an average value of 2.4.

The final versions of all the deliverables produced under the STREAM project are available as annexes to this report. Furthermore, they are stored on the project sharepoint (https://streampartner.coispa.eu/WebInterface/login.html), and the repository section for stakeholders (https://streamstakeholder.coispa.eu/WebInterface/login.html).

The R scripts and tools developed under the STREAM project are stored in the project sharepoint, in the stakeholder repository section of the project sharepoint, and in a GitHub repository (https://github.com/aleligas/STREAM_MARE-2016-22).

2. INTRODUCTION

STREAM was a collaborative research project in response to the European Commission's Call for Proposals MARE/2016/22 "Strengthening regional cooperation in the area of fisheries data collection".
The STREAM consortium partners included 12 scientific institutions, from 8 EU Member States (MSs) in the Mediterranean and Black Sea. In total, forty-five scientists have been working in the project, with skills

ranging from fisheries science, survey design and implementation, to software development, IT and management. The consortium included individuals attending the Regional Coordination Group for the Mediterranean and Black Sea (RCG Med&BS).

STREAM aimed at improving the international cooperation and regional collaboration to facilitate the data availability to end-users. STREAM proposed a framework to "optimise" the sampling intensity for biological samplings, allocating sampling intensity and data collection in a way that accuracy can be reliably assessed at regional level, developing indicators of data accuracy and improving standardization, reference and code lists for all selected variables.
To streamline the new approach with the provisions of the CFP, STREAM designed a sampling program for the collection of data on the by catch of protected, endangered or threatened species, and on stomach content of fish.
STREAM provided training to MSs experts on the procedures and main outcomes developed in the project was another working area of STREAM, and performed consultation with the research institutes and scientists (either participating in the grant or not) from all relevant Member States regarding the points tackled by the project.

STREAM developed guidelines and software tools to optimize sampling strategies and evaluate the quality of fisheries data at both the national and regional level with the main objective to promote commonly accepted quality assurance (QA) standards. The use of a standard sampling data format and harmonised code lists, compatible with the future regional data base (RDB), shall enable region-wide transparent and consistent data standards. A calendar for the application of these data quality routines was also developed.

The STREAM project started in December 2017 with an initial 15 months timescale, though this was extended to 17 months in recognition of the existing workload on staff in scientific institutions. A similar grant was addressed to MSs and scientific institutions from the NE Atlantic and North Sea regions. Furthermore, two other projects have been implemented under the Call MARE/2016/22 working on large pelagic fisheries and socio-economic aspects of fisheries. Cooperation among the four consortia has been implemented.
A proactive cooperation was established and has been implemented with the GFCM initiatives on the monitoring of the by catch of vulnerable species and the sampling of recreational fisheries. STREAM WP and Task leaders have been actively involved in the work performed by GFCM. This allowed creating synergies between the STREAM and GFCM initiatives, while avoiding duplications at the same time.

3. PROJECT IMPLEMENTATION AND OUTPUTS

The STREAM project "Strengthening Regional cooperation in the area of fisheries biological data collection in the Mediterranean and Black Sea" aimed at providing support to the Commission and MSs to build up experience in new areas of regional cooperation in the Mediterranean and Black Sea for the realization of Multiannual Regional Work Programme (MRWP).
The project was organised in 9 Working Packages, 9 Tasks (and 3 sub-Tasks), and produced 20 deliverables.

In the following sections, progress towards objectives and main results are described following the structure in Work Packages of the project, recalling objectives, deliverables and related responsibilities.
The deliverables are standing alone documents and are provided as Annexes to this report, which represents the **Final Report (D0.3)**.

3.1. WP0 - PLANNING ACTIVITIES, GENERAL COORDINATION AND SYNTHESIS OF THE PROJECT RESULTS

WP0 Leader: Alessandro Ligas (CIBM)
Partners involved: CIBM, COISPA, CNR-ISMAR, NISEA, HCMR, FRI, IEO, DFMR, IOF, IO-BAS, NIMRD, REVIVO.
Core team: WP leaders (participants to the Steering Committee)
Duration: 17 months, from 19 December 2017 to 19 May 2019.

Milestones
M0.1 Kick-off meeting (10 January 2018)
M0.2 Organization and setting of the sharepoint (February 2018)
M0.3 Mid-term meeting (28 September 2018)
M0.4 Final meeting of the Consortium and Workshop (11-12 April 2019)
Deliverables
D0.1 Inception Report (Responsible A. Ligas, 12 February 2018)
D0.2 Interim Report (Responsible A. Ligas, 13 July 2018)
D0.3 Final Report (Responsible A. Ligas, 19 July 2019).
Draft Final Report submitted on 19 May 2019

WP0 started with the preparation of the administrative documentation (e.g. Consortium Agreement). The Coordinator has ensured the Consortium agreement be signed by all partners.
The Kick-off meeting with DG MARE was held in Brussels on the 10th January 2018. The minutes of the Kick-off meeting were drafted and submitted in due time to the Commission for their approval.
The Kick-off meeting was followed by a web conference of the Steering Committee (Project coordinator and WP leaders) that took place on the 16th January 2018 (see Annex II, minutes of the first SC) to discuss the outcomes of the Kick-off meeting and the work plan for next months.
In cooperation with WP8, the project sharepoint (https://streampartner.coispa.eu/WebInterface/login.html), including a repository section (https://streamstakeholder.coispa.eu/WebInterface/login.html), was implemented, and served as a support tool for the communication, share of documents and information along the project life among project partners, European Commission, Member States (including those not represented in this Consortium), end-users, and stakeholders. Each user was granted with a personal access code with differentiated levels of execution permissions (e.g. according to responsibility of a partner, or user external to the Consortium). The participation of IFREMER scientists (France) was agreed in relation to activities such as the consultation and dissemination of the project outcomes. IFREMER, on behalf of French Ministry, provided the data as requested by the STREAM project.

Also the NC of Malta expressed their willing to contribute to the project STREAM. Data were provided by Malta and used to run the simulation scenarios under WP3.

The **Inception Report** (**D0.1**) was submitted on the 12th February 2018 (approved by the Commission in May 2018) and took into account all issues raised during the kick-off meeting. It contained (i) a detailed roadmap of the work based on the call for proposals, the proposal offer and the documents and information received from DG MARE during or following the kick-off meeting, (ii) the detailed methodology to be followed, (iii) the areas considered to be of high risk.
A Steering Committee meeting (Skype meeting) took place on the 6th July 2018 to discuss on the project progressing and finalize the preparation of the Interim Report.

The **Interim Report** (**D0.2**) was submitted on the 13th July 2018 (approved by the Commission in November 2018). It contained a summary and description of the activities and results achieved by the STREAM project during the interim period.

The Mid-term meeting was held at the DG MARE premises in Brussels on the 28th September 2018, and was devoted to the evaluation of the Interim Report. The meeting minutes were made available to the Commission and also to the partners, end-users and stakeholders on the sharepoint of the project.
A project mid-term internal meeting with participants (WP and task leaders) was held on 4-5 October 2018 in Bari (Italy) (Annex 4). This meeting discussed on the possibility for a project extension, on the comments received by DG MARE to the Interim Report and on the organization of KEW meeting with stakeholders.
The request for a 2-months extension of the STREAM project deadlines was submitted to DG MARE by the Coordinator on the 15th October 2018. The request was accepted and the Grant Agreement amended accordingly.
The STREAM Knowledge Exchange Workshop took place on the 11-12 April 2019 in Rome, and was devoted to share the results of the STREAM project including draft recommendations for regional sampling designs and plans. The discussions were targeted for those with high-level responsibility for organizing and delivering national fisheries data for statutory purposes.
The communication with the FishPi^2 project (and the other two grants under the Call MARE/2016/22, namely SECFISH and RECOLAPE) was kept during the project life, especially through bilateral interactions between WPs. The Coordinator attended the Knowledge Exchange Workshop of the FishPi^2 project, held in Brussels on the 20th February 2019.
The project initiative was communicated and discussed at the RCG Med&BS held in Kavala in September 2018. The project outputs were also presented at the RCG Med&BS meeting held in Madrid, 11-12 June 2019).

The Final meeting was held at the DG MARE premises in Brussels on the 14th June 2019, and was devoted to the evaluation of the project outcomes and the Draft Final Report. The meeting minutes were made available to the Commission and also to the partners, and are attached as Annex IV to this report.

3.2. WORK PACKAGE 1 - SET OF PREREQUISITES FOR THE FUNCTIONING OF THE REGIONAL COORDINATION GROUPS (RCGS)

WP1 Leader: P. Carpentieri (NISEA); Co-chair: T. Zaharia (NIMRD)
Partners involved: NISEA, NIMRD, CIBM, COISPA, CNR-ISMAR, FRI, DFMR, IOF.
Core team: C. Charilaou, E. Koutrakis, G. Lembo, P. Sartor, G. Scarcella, N. Vrgoc
Duration: 8 months, from 19 December 2017 to July 2018.

Milestones
M1.1 Completion of the review of the performance of RCMs and coordination groups (May 2018)
Deliverables
D1.1 Rules of procedures and Workplan of Regional Coordination Group (RCG) for the Mediterranean and Black Sea (Responsible P. Carpentieri and T. Zaharia, July 2018)

WP1 aimed at complementing the work already developed under the Regional Coordination Groups for the Med&BS proposing 1) inputs to complement the existing rules of procedures 2) some prerequisites for the functioning of the RCG Med&BS, and 3) draft a work-plan with the inclusion of ad hoc meetings and/or working groups under the RCG umbrella.
The outcome of WP1 will support the functioning of the Regional Coordination Group and the overall regional approach to data collection activities. To this end, the work to complement the rules of procedures (objective 1), to suggest prerequisites for effective RCG work (objective 2), and to draft a work-plan (objective 3) was presented at the RCG Med&BS (Kavala, Greece, September 2018), in order to be assessed by the group and to help RCG Med&BS in the process of implementing appropriate rules of procedures.
The first objective of WP1 was tackled by means of a consultation process involving several experts on the evaluation and review of the activities carried out by the different RCGs and coordination groups, the analysis of the agreements and rules of procedures of the different end users, and the requirements of the EU Regulations and Decisions.
As a first step, the achievements relevant to regional cooperation (e.g. reports of LM 2016, RCMMed&BS 2016, RCGs 2017, etc.), and the work carried out by the ICES Working Groups related to Data Collection have been analyzed and discussed.
Then, the effort was concentrated on the work carried out by different RCGs (RCG Baltic, 2017; RCG LDF 2017; RCG NA, 2017; RCG NS&EA, 2017) in organizing their RoPs, and the review of existing rules of procedures of main end-users (e.g. GFCM, ICCAT).
The activity was focused mainly on the:

- Structure of the RoPs and its contents
- Mechanisms for communication within and between RCGs
- Mechanisms for formal communication with end-users
- Identification of subgroups (regional and/or pan-regional) needed
- Identification of expertise needed
- Data handling and request
- Storage and access to data

Building on these works, the WP1 core team has analyzed the existing rules of procedures for the Med&BS, identified gaps, and, where appropriate, suggested further actions to the RCG Med&BS.

Parts of the work have been done by correspondence and the main outputs, for possible changes and improvements to ensure compliance with EU data collection requirements and end-user's needs, are presented in the section 4.1 of Deliverable 1.1 (see Annex V of this report). The outcomes of this first objective should allow MSs to clearly understand their roles and responsibilities within the RCG Med&BS.

The second and third objectives of WP1 are closely connected and based on a wider consultation and not restricted only to the partners involved in WP1. In order to facilitate a structured consultation process, the activity was carried out by written procedure through an ad hoc questionnaire and through consultation process. The purpose of the questionnaire was to get MS experts view on the 1) Role of Regional Coordination Group for the Med&BS, the 2) Role of the end users and on the 3) Use of the data.

The questionnaire included specific questions on the major needs for improving regional coordination activities, on regional sampling plans, on the way to improve the data collected and the quality of those data, on the requirement by the end-users and their role in the data collection activities, on the existing methodological protocols (e.g. surveys, bycatch and discards monitoring), and on the improvements in data availability and data submission. The questionnaire was sent to all National Correspondents (NCs) for data collection in Mediterranean and Black Sea Member States, different experts which have participated during last years to the main regional coordination initiatives (e.g. RCM Med&BS, RCG Med&BS, and PGMed), and the experts of the surveys Steering Committees (e.g. Medias, Medits and Solemon). Another questionnaire was sent to JRC, GFCM and ICCAT, as they could give important inputs for the development of the RCG.

The overall response rate to the questionnaire was around 70%. All Mediterranean and Black Sea countries involved in the European data collection framework (EU, 2017) were represented in the replies. In general, there was a high level of agreement in views expressed by both NCs and experts. The results clearly showed the urgent need to progress towards common regional methodological approaches (especially for what concern the collection of commercial data on fisheries, recreational fisheries, and marine ecosystem in general). Respondents emphasized the necessity to better develop statistical and quality check aspects related to the collection of all biological data at regional level, and strengthen the cooperation between MSs sharing the same marine resources in the region. Regarding this last point, even though the improvements made in the data collection and sampling activity on shared stocks (Spedicato, 2016) have been acknowledged, more steps should be taken to gain efficiency by developing regional data collection systems using shared resources. So far, several data collection systems remain essentially national data collection systems. Finally, a strong support to the implementation of a regional database was also highlighted.

Furthermore, there was a substantial amount of experts responding the questionnaire who acknowledge to RCG Med&BS the ability to work on what concerns the collection of data on commercial fisheries (i.e. performing ranking systems, harmonizing data collection, reporting data through specific data call, optimizing the regional view for the discards sampling activities, etc.), and on the outputs and needs of the scientific research surveys (i.e. Medits and Medias). However, most of the experts have also identified some shortcomings in the current RCG Med&BS. Main issues were raised on what concerns the data collection for incidental catch of vulnerable species (e.g. seabirds, marine mammals, sea turtles, sharks and rays), the collection of marine ecosystem data (e.g. stomach contents, benthos, marine litter, etc.), the information related to the recreational fisheries and stomach contents, macro-benthos, and marine litter.

For all these data requirements, although identified as recent actions which need time to be incorporated properly in data collection programmes, experts recognized the need to strengthen and reinforce regional cooperation among MSs and end-users. For these topics, agreed regional data collection methodologies and guidelines are missing and should be developed. These methodologies must be driven by RCG Med&BS (in cooperation with end-users) to ensure a regional level of cooperation and coherence between national data sets. Furthermore, some respondents have remarked that all data related to the ecosystem should be collected not only to better manage the fisheries, but also to develop synergies with delivering indicators on the good environmental status under the Marine Strategy Framework Directive (EU, 2008a). Therefore, there is the need to develop such indicators of population and community status at regional level. RCG Med&BS should focus on developing both regional formats and common methodologies that would underpin the implementation and the production of those ecological indicators.

Another area of agreement among experts was represented by the strong support to the overall concept of harmonization of data collection, of sampling designs associated with regional estimation methods, and standardized quality check. Therefore, steps should be taken (by RCG) to develop and implement regional sampling designs, taking into account that the primary need is to identify the most suitable fisheries/stocks for regional programs. Such regional designs are considered the best approach to improve quality of data and the cost-effectiveness of current national sampling plans. It is important to make sure that regional and national data collection plans and objectives are complementary. This is a pre-requisite for several respondents: national sampling requirements need to be taken into consideration. Most respondents suggest that RCG Med&BS should establish working groups for the identified key fisheries/stocks to oversee the development of regional sampling schemes including methodology, objectives, strategies, measures and indicators. These groups, which should include data collectors, lead scientists in the countries, and experts in sampling procedures, should be done in strict consultation with the main end-users. This means that identified groups should operate along the lines of GFCM, STECF and ICCAT expert groups under the umbrella of the RCG Med&BS.

Most respondents pointed out different problems also related to the sampling of biological, effort and landing data for small scale fisheries. Reliable landing statistics (e.g. species composition and quantities, discards data, etc.) are a well-known problem in many small-scale fisheries. The main problem seems to be both administrative (e.g. permits to sample on board, difficulty to access the vessels) and logistic (i.e. the multitude of landing sites). The experts responding to the questionnaire highlighted the need to support member states in enhancing data collection (e.g. drafting the best practice guidelines for sampling of this fleet component) and monitoring all the aspects (i.e. biological, socio-economic) of small-scale fisheries in the region.

Regional cooperation is also needed to ensure the quality and usability of data linked with an accessible and transparent data collection. One of the main reasons for not using data at the regional level, as highlighted by the experts, is linked to the difficulties in getting access to MS data and to the fact that quality control both at national and regional level is scarce or missing, and no analysis on the possible source of variability is performed. The need to increase cooperation on this topic at regional level has been strongly encouraged by experts.

Concerning the use of the data, it has been stressed the fact that even though all requested data are transmitted in due time to the main end-users in the region, there is a duplication of work and effort for providing the same data in different formats. This applies mainly to data on surveys and commercial

fisheries, and transversal data. There is a strong consensus among experts that only when data are collected and stored in a consistent way across MSs in the region, the comparability can be assured to enable the main end-users and all potential data users to conduct properly evaluations and assessments at regional level. Following the above mentioned issues, the development of a regional data base is recognized as fundamental to the complete implementation of a regional sampling coordination (e.g. production of regional estimates, reporting data flows, data exchange formats, and data quality check), and the implementation of regional statistical analysis; moreover, end users could have direct access to data avoiding several data calls. Furthermore, a more pro-active participation by the end-users (e.g. GFCM) is also requested, because through the current system it seems that not all the collected data serve the end-user needs properly and are relevant for end users. RCG Med&BS is recognized as the right forum to improve the communication between end users and MSs.

Regarding the review of the rules of procedures (RoPs) developed by the RCG Med&BS, the complete list of suggestions is presented in Table 1 of Deliverable 1.1, and summarized in the points below.

- The scope of the RCG Med&BS should not be limited only to drafting regional sampling plans, but it should be wider (e.g. implementing regional database, ensure standard quality, harmonized guidelines, methods etc.) and should be clearly reflected in the RoPs.
- The mandate of each participant to the RCG should be clearly defined at the beginning of the meeting as this could have important effects on possible common agreement and/or recommendations at regional and national level. The same should apply to end-users participating to the RCG, as also their role should be better defined.
- Definition of voting procedures and voting arrangements should be better detailed. In the RoPs, it should be clearly detailed how the situations of non-unanimity must be treated, and what could happen to a MS which does not intend to participate in an activity agreed at regional level.

In addition to these comments, experts have identified also some specific sections (e.g. on the use of data; on data processing and exchange, on data storage and data confidentiality) that were missing in the RoPs. A shared agreement on these identified topics was be discussed in the RCG and was clearly reflected in the adopted RoPs.

Finally, based on the consultation process, it has been expressed by the participants the need to establish ad-hoc working groups and meetings for addressing regional activities (e.g. WG on regional sampling plan, WG on commercial fisheries with emphasis to the small scale fisheries, WG on data quality, WG on methodologies, etc.). It has been considered fundamental to avoid duplication of work on common topics with meetings already established at regional and European level (e.g. under EU, STECF, GFCM and ICES). It would be necessary to establish a closer link with those existing groups where expertise is already available. Participants proposed to create small sub-groups within those existing groups, which should address regional specific issues, and then meetings/workshops could be organized in parallel with the RCG Med&BS for dissemination of knowledge, training and adjustment of sampling plans to regional specificities.

Among the experts responding to the questionnaire, there is also a general agreement on the establishing (under the RCG Med&BS umbrella) of other meetings covering some particular issues like sampling plans and guidelines for monitoring vulnerable species, guidelines for the collection of recreational fishery and marine ecosystem data (e.g. stomach contents, macro-benthos, marine litter etc.), and establishment of regional sampling plans for shared resources. A draft list of possible meetings/WGs was drafted and

presented to the RCG Med&BS, providing a significant contribution to the preparation of the RCG Med&BS roadmap.

Table 3.2.1. Workplan proposed by STREAM to RCG Med&BS 2018, and adopted recommendations.

Proposed Work-plan			**RCGMED&BS 2018 recommendations**
Meeting on	**Scope**	**Timeframe**	
Recreational fishery	Harmonization of existing guidelines/methodologies; identification of data needs; sharing of knowledge and experience in the data collection	*To be decided*	RCG Med&BS recommended the organization of an ad-hoc workshop on recreational fisheries (Ancona, April 2019).
Data transmission issues	assessing the data failures identified by main end users in the Region;	Every year	RCG Med&BS considers the need to establish a permanent subgroup on data requirements and data related regional specificities and issues by end users.
Marine ecosystem data	Addressing regional needs for the collection of stomach contents, benthos and marine litter; identification of data needs; share knowledge and experience in the data collection.	*To be decided*	RCG Med&BS considers that there is no need of a specific subgroup under RCG for the time being because these points are covered by the STREAM project that is expected to produce the final results by spring 2019. RCG recommends that the final results of the STREAM project should be presented at the next year RCG meeting in 2019.
GES under the Marine Strategy Framework Directive	Identification of data needs and common methodology for delivering indicators on the good environmental status under the Marine Strategy Framework Directive.	*To be decided*	Not discussed
Sampling stratification and optimization of biological	Revision by country of the sampling stratification and proposing sampling optimisation using the sampling design tool and	Every year	RCG Med&BS agrees on the need to set up a network of experts to be trained on statistical tools and R packages on sampling stratification and optimization of biological data.

data	data.		
Incidental catch of seabirds, marine mammals, sea turtles, sharks and rays	Harmonization of common protocol on data collection; issues related to data sharing; analysis on data quality.	*To be decided*	RCG Med&BS considers that there is no need of a specific subgroup under RCG for the time being because these points are covered by the STREAM project that is expected to produce the final results by next spring. In addition, GFCM is implementing a handbook on data collection methodologies for by catch and vulnerable species (FAO, 2019a,b).
Regional/sub-regional sampling plans	Harmonization of common protocol on data collection; issues related to data sharing; analysis on data quality.	Every year	RCG Med&BS suggests that conclusions of the WP3 of the STREAM project will be presented in the next year meeting. A specific subgroup could then be established to actually draft a regional sampling plan for some stocks/sub regions (to be proposed for implementation in 2021).

3.3. WORK PACKAGE 2 - IDENTIFICATION OF CANDIDATE STOCKS/FISHERIES/MÉTIERS PRESENTING A WIDE SCOPE FOR REGIONAL SAMPLING AND FOR WHICH MEMBER STATES COULD SHARE SAMPLING TASKS

WP2 Chair: M. Panayotova (IO-BAS); Co-chair: G. Scarcella (CNR-ISMAR)
Partners involved: IO-BAS, CNR-ISMAR, CIBM, COISPA, NISEA, HCMR, IEO, IOF, NIMRD, REVIVO.
Core team: C. Garcia, K. Kapiris, P. Pengal, D. Pinello, V. Maximov, A. Santojanni, M. Sbrana, M.T. Spedicato, N. Vrgoc
Duration: 6 months, from 19 December 2017 to May 2018.

Milestones
M2.1 Review of the information available on MPAs, discard plans, and the current status of the main stocks exploited by the fisheries in the Mediterranean and Black Sea (April 2018)
Deliverables
D2.1 Identification of the most important stocks at regional level and relative fleets (métiers) (Responsible M. Panayotova and G. Scarcella, May 2018)

Description of work
WP2 was aimed at identifying the most commercially important stocks and fisheries (métiers), beneficial for regional sampling, for which Member States could share sampling tasks using agreed methodologies, ensuring coherent regional data sets with sufficient quality for the end user's needs. The activities foreseen under WP2 have been accomplished with the production of the Deliverable D2.1 "Identification of the most important stocks at regional level and relative fleets (métiers)" (Annex VI in this report). Deliverable D2.1

reports the results of the analyses performed under WP2 and proposes the stocks and fisheries (métiers), beneficial for regional sampling.

The datasets used were the 2017 EU DCF Data Call Med&BS and the 2017 Economic data call (to estimate the mean price per kg of each species) available on the (the Data Dissemination web site (https://stecf.jrc.ec.europa.eu/data-dissemination).

Despite the original proposal was to work on 2014-2016 data, it was decided to work on the period 2013-2015 because 2016 French data were reported with unknown unit of weight. This issue could bias the selection of the stocks shared between Spain and France.

The methodology used to rank species by fishery took inspiration from the work done at the STECF EWG 15-14. However, we did not focus on the species with MCRS only (as it was done at STECF EWG 15-14), but on the whole set of species reported into the EU DCF Data Call Med&BS. In addition, we coupled the outputs of the ranking process with other criteria, such as the consideration of the species in specific management or discard plans, the inclusion of the species in the list of GFCM priority stocks and the status of the stock in term of ratio F/F_{MSY}.

Furthermore, an overview of the percentage contribution by fishery and GSA of the species that have been highlighted by means of the 75% cumulative contribution analysis has been performed. This overview gave also the geographical dimension of the spreading of the different fisheries by GSA and the focus of the main target stocks. It was thus highlighted that while some fisheries are common to several GSAs of the Mediterranean and Black sea, other ones are very limited in terms of geographic dimension, with very few, if not only one, target species. With this approach, the species not included in the 75% of the cumulative distributions of the landings from all the fisheries were excluded from the candidate stocks for regional sampling.

The most important target species, fisheries and métiers were identified by using a ranking system, which takes into account a 75% threshold of the cumulative value and volume of landings in the period 2013-2015, following the approach used under the framework of the STECF-EWG 15-19 (STECF, 2015). Due to some inconsistencies in 2016 data, it was opted to focus the attention on the period 2013-2015.

The selection of candidate stocks took also into account their status in terms of overexploitation assessed in the framework of relevant working groups (GFCM and STECF). The selection of such stocks was based on high ratios of F/F_{MSY} (e.g., $F/F_{MSY} > 1.66$). Moreover, the following principles were used:

1. stocks subject to an advice to close the fishery, to prohibit directed fisheries, to reduce the fishery to the lowest possible level, or similar advice from an international advisory body, even where such advice is given on a data-limited basis; or
2. stocks subject to a fishing opportunities regulation which stipulates that the fish should be returned to the sea unharmed or that landings are prohibited; or
3. stocks listed on the IUCN ‘red list’ or listed by CITES; or
4. stocks which are considered shared by the management bodies as GFCM; or
5. stocks and fisheries, for which share of sampling tasks is beneficial.

The list of stocks and métiers proposed for regional sampling and for the activities foreseen under WP3-WP6 of the STREAM project is summarized in Table 3.3.1. The outcomes of the ranking carried out, which took into consideration the same approach of STEC-EWG 15-19, where a critical analysis of DCF data on value and volume of landings, as well as on fishing effort, have allowed identifying the main European

demersal fisheries in Mediterranean. Taking into account a 75% threshold of the cumulative value and volume of landings, on the basis of the data 2013-2015, it was possible, for each fishery (not only the demersal ones), to identify the most important target species.

In order to draft the list of candidate stocks and métiers in Table 3.3.1 in the most objective manner, the logical framework depicted in Figure 3.3.1 was applied. After having identified the most important stocks and fisheries/métiers by means of the analyses previously described, we considered the species and fisheries/métiers overlapping in neighboring GSAs, even if belonging to a single MS (e.g., Italy). Sampling is designed at GSA level and not at national level, therefore it is worth sharing sampling activities also among different GSAs belonging to the same MS. If the selected species are considered as shared stocks among countries and GSAs according to the STOCKMED[1] project outcomes, they were taken into consideration for sharing sampling tasks. A provisional list of shared stocks in the Mediterranean Sea is also defined by SAC-GFCM[2] and it was used in combination with STOCKMED outcomes.

Furthermore, we took into consideration the species identified as priority species by GFCM-SAC (www.fao.org/gfcm/activities/fisheries/stock-assessment/priority-species), and those included in the management and discards plans (both those already enforced and in preparation). Finally, the selection of stocks was also based on high ratios of F/F_{MSY}. In the case priority species, species included in management and discard plans, or with high overexploitation level were not identified by the analyses, they were incorporated into the list of candidate stocks.

In contrast, taking into account that a very few of the identified stocks were subject to an advice to close the fishery and/or were listed on the IUCN 'red list' or listed by CITES, such criteria were not considered.

[1] Fiorentino F., E. Massutì, F. Tinti, S. Somarakis, G. Garofalo, T. Russo, M.T. Facchini, P.Carbonara, K. Kapiris, P. Tugores, R. Cannas, C. Tsigenopoulos, B. Patti, F. Colloca, M. Sbrana, R. Mifsud, V. Valavanis, and M.T. Spedicato, 2014. Stock units: Identification of distinct biological units (stock units) for different fish and shellfish species and among different GFCM-GSA. STOCKMED Deliverable 03: FINAL REPORT. September 2014, 310 pp.

[2] GFCM, 2006. *Report of the ninth session of the Scientific Advisory Committee. Rome, 24–27 October 2006.* FAO Fisheries Report No. 814. Rome, FAO. 106 pp.

Table 3.3.1. List of proposed stocks/fisheries/métiers presenting a wide scope for regional sampling (criteria for selection are shown).

Area	GSAs	Countries	Fisheries	Species	Ranking	GFCM priority species	MAP or DP	$F/F_{MSY} > 1.66$	Stockmed
Western Mediterranean	1, 2, 5, 6, 7	Spain, France	OTB_DES, LLS	*M. merluccius* (HKE)	X	X	X	X	X
				P. longirostris (DPS)	X	X	X		
Western Mediterranean	9, 10, 11	Italy	OTB_DES, OTB_MDD, LLS, GNS	*M. merluccius* (HKE)	X	X	X	X	X
				P. longirostris (DPS)	X	X	X		
				N. norvegicus (NEP)	X		X	X	X
Western Mediterranean	1, 2, 5, 6	Spain	OTB_DWS	*A. antennatus* (ARA)	X		X	X	X
Western Mediterranean	9, 10, 11	Italy	OTB_DWS, OTB_MDD	*A. antennatus* (ARA)	X		X		X
				A. foliacea (ARS)			X		X
Western Mediterranean	1, 2, 5, 6, 7	Spain, France	PS_SPF	*E. encrasicolus* (ANE)		X	X	X	
				S. pilchardus (PIL)		X	X	X	
Western Mediterranean	9, 10, 11	Italy	PS_SPF	*E. encrasicolus* (ANE)	X	X	X	X	
				S. pilchardus (PIL)	X	X	X		
Adriatic Sea	17,18	Italy, Croatia, Slovenia	OTB_DES	*M. merluccius* (HKE)	X	X	X	X	
				M. barbatus (MUT)	X	X	X		X
				N. norvegicus (NEP)	X				
Northern Adriatic	17	Italy, Croatia, Slovenia	TBB, GNS	*S. solea* (SOL)	X		X		
South Adriatic and Ionian sea	18, 19, 20	Italy, Greece	OTB_DES, OTB_DWS, OTB_MDD	*P. longirostris* (DPS)	X		X		X
				A. antennatus (ARA)	X				X
Adriatic Sea	17, 18	Italy, Croatia, Slovenia	PS_SPF, PTM_SPF	*E. encrasicolus* (ANE)	X	X	X	X	
				S. pilchardus (PIL)	X	X	X	X	
Strait of Sicily	15, 16	Italy, Malta	OTB_DES, OTB_DWS, OTB_MDD	*M. merluccius* (HKE)	X	X	X	X	
				P. longirostris (DPS)	X	X	X		
				A. foliacea (ARS)	X		X		
Eastern Mediterranean	22, 23, 25	Greece, Cyprus, Italy	OTB_DWS, OTB_DES	*M. merluccius* (HKE)	X		X		
				A. foliacea (ARS)			X		X
Black Sea	29	Bulgaria, Romania	GNS_DEF, GNS_MDPSP	*S. maximus* (TUR)	X	X	X	X	
Black Sea	29	Bulgaria, Romania	OTM_MDPSP, FPN_MDPSP, GNS_SPF	*M. barbatus* (MUT)		X			
Black Sea	29	Bulgaria, Romania	OTM_SPF	*S. sprattus* (SPR)	X	X			

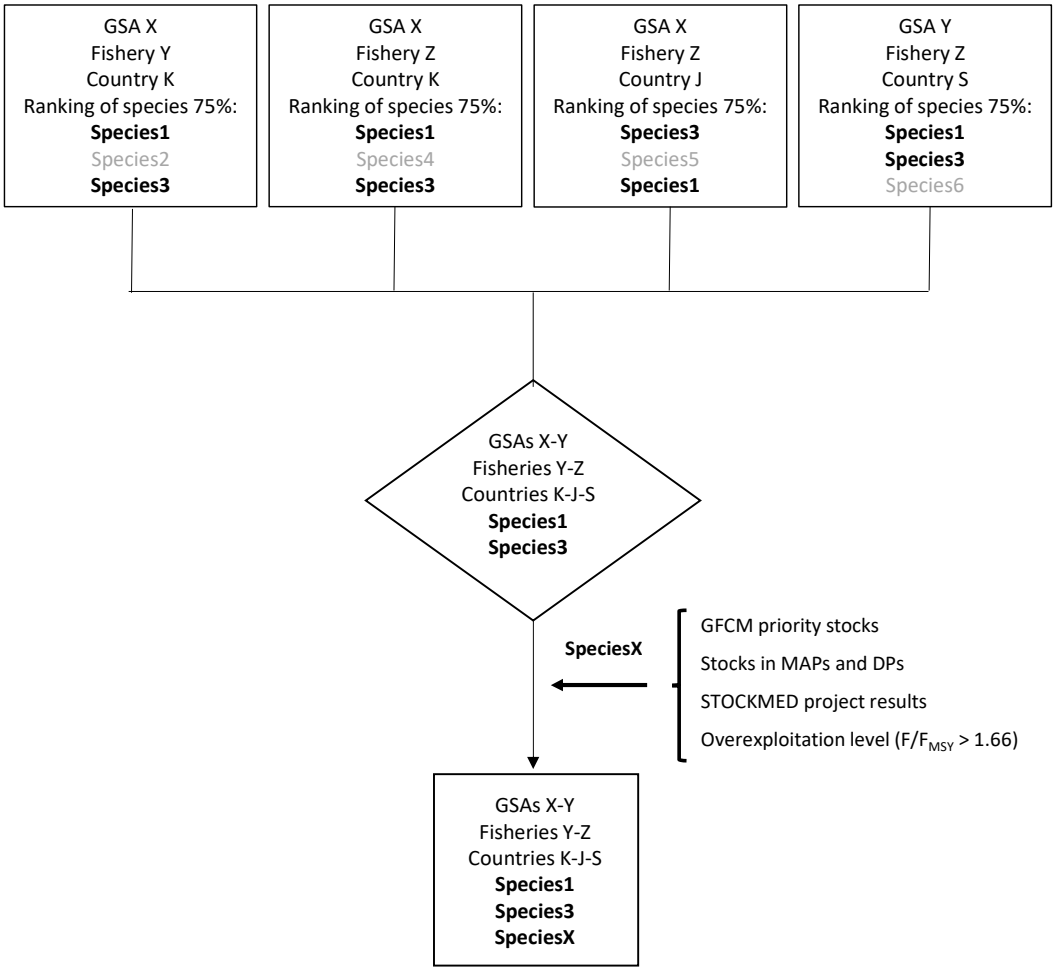

Figure 3.3.1. Logical framework for the selection of stocks and fisheries/*métiers* for which sharing sampling tasks would be beneficial in neighbouring GSAs.

The outcomes of the analyses carried out under WP2 were presented to the National Correspondents of the involved MSs via an e-mail exchange. The NCs provided their feedback, which helped finalizing the results of WP2 and the list of candidate stocks and fisheries/métiers presenting a wide scope for regional sampling.

Regarding specific requests from NCs and the Commission, we confirm that small pelagics, in particular anchovy and sardine, in the eastern Mediterranean and the Strait of Sicily cannot be considered as suitable stocks for regional sampling plans, as they are not shared among two or more GSAs or EU countries. In the eastern Mediterranean, anchovy and sardine are not targeted by Cyprus fishing fleets, while in the Aegean Sea they are shared with non-EU country (i.e., Turkey). In the Strait of Sicily, the Italian fleets are exploiting anchovy and sardine, while Maltese fleets are exploiting other small pelagics species (i.e., *Scomber* spp.).

Regarding *Rapana* whelk stock in the Black Sea, the available landings statistics in Bulgaria do not report information on the gear/metiér used to exploit the stock as MOL, MOL_GNS, MDPSP_OTM and MDPSP_TBB and species as RPN and RPW. Romanian landings were reported as RPW and gear/metiér as

DEMSP_TBB. None of these fisheries reached 75% cumulative contribution. Therefore, it is not possible to select the fisheries that could be taken into account for a regional sampling.
In contrast, some stocks exploited by only a national fishing fleet in different GSAs (i.e., GSAs 9, 10, 11 exploited by Italian fleets) were selected as possible candidates, as they could also represent interesting case studies for the sampling optimization analyses performed under WP3.

The Deliverable D2.1 (Annex VI in this report) is available for consultation and downloading on the project sharepoint (https://streampartner.coispa.eu/WebInterface/login.html) and on the repository section (https://streamstakeholder.coispa.eu/WebInterface/login.html).

3.4. WORK PACKAGE 3 – DESIGN OF A REGIONAL SAMPLING PLAN FOR 2019 COVERING COMMERCIAL FISHERIES/ STOCKS/MÉTIERS

WP3 Chair: M.T. Spedicato (COISPA); Co-chair: S. Kavadas (HCMR)
Partners involved: COISPA, HCMR, CIBM, CNR-ISMAR, DFMR, FRI, IEO, IO-BAS, IOF, NIMRD, NISEA.
Duration: 16 months, from 19 December 2017 to April 2019.

WP3 aimed at designing and proposing a regional sampling plan (RSP) covering commercial fisheries/stocks/métiers (RSP-CF), taking advantage of the experience of the previous grants (i.e. MARE/2014/19 Med&BS and FishPi). The design and proposal of the RSP was supported by the implementation of selected case studies involving relevant species/fisheries in the Mediterranean and Black Sea areas.
This RSP will be presented and discussed at the RCG Med&BS meeting foreseen in June 2019 in Madrid. It will be part of the regional Work Plan and may replace the relevant parts of the Member States' national Work Plans in the region where appropriate.

Description of work
The work of WP3 was organized in four tasks:
Task 3.1 Data Sharing among all Member States of the regions (Mediterranean and Black Sea)
Task 3.2 Apply and/or refine reference (or code) lists to be used by Member States in the region and identify possible solution for data storage system, processing and analysis of the data at regional level-
Task 3.3 Carry out simulations to propose a RSP for 2019
Task 3.4 Develop rules on how to allocate tasks and costs among Member States and evaluate costs implication for 2019.
WP3 interacted with the other grants under the Call MARE/2016/22, in particular with RECOLAPE project for aspects related to Task 3.1 (Data Sharing Agreement, Deliverable D3.1) and data formats for the RCG data call.

Task 3.1 - Data Sharing among all Member States of the regions (Mediterranean and Black Sea)
Responsible: C. Charilaou in cooperation with C. Garcia
Participants: All WP3 partners

Core team: A. Adamidou, S. Kavadas, V. Raykov, E. Sabatella, C. Viva, T. Zaharia
Duration: 5 months, from 19 December 2017 to April 2018.

Milestones
M3.1 Mapping the data to be shared (February 2018)
Deliverables
D3.1 Data Sharing Agreement (Responsible C. Charilaou, April 2018)

The data sharing agreement (DSA) was finalized in cooperation with all the institutes involved in STREAM, and specified the type of data to be shared, the common data format and the rules for the use of the data. In cooperation with WP8 and WP0, the DSA was shared with National Correspondents for their feedback and agreement (communication via the project sharepoint). A frame detailing and mapping the type of data needed for the optimization of the sampling intensity in the regional sampling plan (RSP) was included in the DSA. In addition, the DSA included the age-related data required for fulfilling the task of agreeing on a set of regional data quality assessments (Task 6.2).
The DSA was signed by most NCs (Cyprus, Italy, Slovenia, Greece, Bulgaria, Romania, Spain), while others have ensured the data delivery though they have not signed the DSA (Croatia, France and Malta). This fact had no impact on the project activities as the data have been delivered.
A Data Call was finally launched with the deadline on the 19th July 2018, as the whole process and the needing of receiving a feedback by the NCs took longer time than foreseen. Dedicated sections of the STREAM sharepoint were made available to NCs to access and upload the data.
A pro-active cooperation with the RECOLAPE project took place in the drafting of the DSA. The outline of actions needed to ensure data sharing among MSs, and basic criteria and principles were shared. In addition, the procedures and data format used in STREAM for red mullet age data were shared with RECOLAPE for the swordfish age data in the Mediterranean.

The DSA (Deliverable D3.1) is attached as Annex VII to this Final Report (D0.3).

Task 3.2 - Apply and/or refine reference (or code) lists to be used by Member States in the region and identify possible solution for data storage system, processing and analysis of the data at regional level
Responsible: M.T. Facchini in cooperation with I. Thasitis
Participants: COISPA, DFMR, CIBM, HCMR, FRI, IO-BAS, IEO
Core team: C. Charilaou, B. Guijarro, S. Kavadas, E. Mantzouni, M. Panayotova, M. Sbrana, W. Zupa
Duration: 8 months, from 19 December 2017 to July 2018

Milestones
M3.2 List of requirement specifications, actors and use cases of the RDB (April 2018)
Deliverables
D3.2 Updated RCG Med&BS-LP standard format and code lists and identification of possible solution for data storage system, processing and analysis of the data at regional level (M.T. Facchini, I. Mantzouni, I. Thasitis, July 2018; revised version March 2019)

Under Task 3.2, besides the revision of the reference lists and data formats, an analysis of the current situation, ongoing studies and developments has been done in order to provide useful information for the identification of solutions related to the storage, processing and analysis of the data at regional level. Furthermore, pending the implementation/adoption of a common data base at regional level, tools were provided to standardize the data preparation for the different data calls at regional level, starting for a common format. This will also contribute to ease the work of data processing at regional level, improving the data quality.

Task 3.2 performed an analysis of the possible solutions for hosting the RDB Med&BS. Three possible scenarios were considered: GFCM, JRC, ICES. All the three actors are already managing databases at regional and European level, and have expertise and IT skills for building and managing a regional database, although currently it is ICES only which is finalizing the development of a database to store detailed (primary) data.

Following the outcomes of the "Training Workshop on sampling intensity – use of tool developed by MARE/2014/19 Med&BS project" (March 2017, Cyprus) some modifications have been implemented to the RCG Med&BS Data Call format to allow the registration of:

- individual measures on weight, sex, maturity and age useful for analyses on biological variables;
- information related to the fishing area and (port) in the analyses performed by the Sampling Design tool in order to perform the analyses in different areas and, consequently increasing the significance of the results.

The introduction of those additional fields in the RCG Med&BS Data Call format implied modifications to the scripts developed in MARE/2014/19 Med&BS for the conversion of the simplified format (RCG Med&BS Data Call) to the Standard Data Exchange Format (SDEF) used in COST project. These "re-shaping" files updated in the STREAM project are very important as they allow the import of data in COST objects and the elaboration of data with functions of the COST package for the investigation and estimation of: (i) discards volume; (ii) length and age structure of catches and landings; and (iii) biological parameters such as growth, maturity and sex-ratio.

The absence of a centralized regional database in the Mediterranean and Black Sea region and the existence of different formats and codes for reporting DCF data through various Data Calls require a huge effort in preparing data in different formats. In addition, it increases the risk of non-compliance with each requested coding and, in turns, threatens the quality of information provided (RCG Med&BS Final Report, 2017), as the probability of producing data misaligned among the data calls for incompleteness, different codification, different level of aggregation, etc. can be very high.

Nowadays further developments, i.e. the new RDBES data model[3], are ongoing in order to enrich the data format, adding metadata to describe the sampling method, sampling scheme and sampling stratification.

This ongoing experiences suggest that there is room for improving standardization, for example in the new organization of RCG Med&BS, building on the past experience.

[3] ICES 2018. Report of the Workshop on new data model for the Regional Database (WKRDB-MODEL), 15 – 18 January 2018, ICES HQ, Copenhagen, Denmark. ICES CM 2018/ACOM:41, 44 pp.

In the current situation, MSs have their own internal IT systems for data storage: in some cases adopting the RCG MED&BS Data Call format, in other cases using some internal routines to convert the primary data from their own format to the RCG MED&BS Data Call format.
Some "reshaping" scripts developed during the MARE/2014/19 project and updated in STREAM project under WP3 (Task 3.3) are already available for the conversion of RCG MED&BS Data Call format to SDEF format. Those scripts can be also used as starting point for the implementation of scripts allowing the conversion of dataset into RDBES format, although most of the information related to the sampling (design, scheme, stratification) is not codified and then should be compiled by the owner of the knowledge on the sampling performed to obtain a given dataset.
For the time being and in the context of this project, the SDEF format was considered as the standard format used for the storage of "primary data" from commercial sampling. Then three routines were developed in the R language aimed at producing some of the tables needed for the main Data Calls: EU Med&BS, GFCM and FDI, starting from the SDEF format.
These scripts can be useful to MSs that would benefit from an automatic support in producing correct tables and preserving the coherence of tables answering to the main Data Calls. Also the end users would take advantage of the use of such scripts as data tables available from Data Calls would be produced in a standardized way by all the MSs and thus the number of errors can be significantly reduced.
The Deliverable 3.2 "Updated RCG Med&BS-LP standard format and code lists and identification of possible solution for data storage system, processing and analysis of the data at regional level" reports the main outcomes of the activities performed under Task 3.2, and is attached as Annex VIII to this report.

Task 3.3 – Carry out simulations to propose a RSP for 2019
Responsible: M.T. Facchini in cooperation with S. Kavadas
Participants: COISPA, DFMR, CIBM, CNR-ISMAR, FRI, HCMR, IO-BAS, IEO, IOF
Core team: S. Angelini, G. Daskalov, B. Gujiarro, I. Isajlovic, A. Ligas, E. Mantzouni, M. Martinelli, I. Thasitis
Duration: 12 months, from March 2018 to March 2019.

Milestones
M3.3 Availability of biological data and landings by GSA, mètier and quarter (March 2018)
M3.4 Results from WP2 (April 2018)
M3.5 Routine update/upgrade (July 2018)
M3.6 Results from Tasks 3.1 (April 2018)
M3.7 Results from Tasks 3.2 (July 2018)
M3.8 Data availability from RCG Med&BS (July 2018)
M3.9 Workshop for western and central Mediterranean (September 2018)
M3.10 Workshop for eastern Mediterranean and Black sea (October 2018)
Deliverables
D3.3 Upgrade the methodological framework and tools for sampling optimization, implement and report case studies (M.T. Facchini, I. Bitetto, M. T. Spedicato and S. Kavadas, March 2019)

In the project MARE/2014/19 Med&BS, a Sampling Design tool based on bootstrap technique (Deliverable 2.5 by F. Gontrand and T. Rouyer) was developed in R language to explore the consequences in terms of

variation of precision (Coefficient of Variation, CV) of several changes in sampling design (e.g. trips). This was achieved through the resampling of historical data. The underlying statistical principle is that the value of CV decreases with the increase of the number of sampling units, defining a curve. In the Sampling Design tool, the part of the curve where the tangent changes and begins to flatten (i.e. the curvature range) is considered as a suitable trade-off between precision and sampling effort and proposed as "optimal" sample size (in terms of number of trips).

The approach adopted in ICES WKBIOPTIM (Lisbon 20-22 June, ICES 2017a) was instead developed on the concept that, under a stratified multistage sampling design, the collection of an excessive number of samples at lower levels (e.g. individuals) is inefficient, because the sampling effort is immeasurably higher than the gain in precision. The WKBIOPTIM scripts are aimed at addressing the optimization of the number of individuals to be collected from biological samples simulating well-characterized samples that have a better chance to meet both present and future data needs. The approach of WKBIOPTIM is based on the resampling of each sample (trip/haul) from historical data, testing different sample sizes (in terms of number of individuals), according to some relevant indicators characterizing the sample structure: mean, median, minimum, maximum and CV of the lengths, mean weighted coefficient of variation of the sample, number of sampled length classes and number of modes. Increasing the sample size, the indicators are expected to be more stable, reaching a sort of plateau. A possible optimal sample size could be established choosing in the range of the sizes returning a sufficiently low CV (e.g. the sample size associated to the third quantile of the CVs calculated on all the resampling). As this approach is independent from upper levels in the sampling hierarchy (e.g. trips), which are known to be the ones responsible for most variance (WKCOSTBEN, ICES 2017b), it can be deemed complementary to the approach developed in MARE/2014/19 Med&BS project.

Considering that the two approaches outlined above return two independent outcomes, both crucial in the proposal of a sampling design, the Task 3.3 was aimed at integrating the two tools, to take advantage from the statistical basis of both. New scripts have been developed in R environment on the basis of the existing routines to allow the communication and the integrated use among the different scripts.

The huge amount of work performed under Task 3.3 can be summarized in the following points:

a. Generalization of the scripts developed in the project MARE/2014/19 Med&BS for the optimization of the number of trips and calculating the CV of the length distribution of a given species. The old version of SD Tool allowed to simulate the effect of a sampling by metier (level 6), quarter and commercial category, while the new version also by GSA, by area (e.g. combination of GSAs), country and gear (level 4), thus allowing additional samples' stratifications.
b. Implementation of new scripts, which following the approach as in the previous **SD Tool**, are performing simulations, based on the resampling of a certain number of trips through the bootstrap procedure (e.g. 100 resamplings). The number of trips can be selected among the results from the optimization scripts (SD Tool) based on the performance of the CV of the length distribution of each species relevant for the case study (point a). Different sub-sampling sizes can be also explored through this new version of the tool.
c. Implementation of additional scripts grouped in the **BioSim Tool** to allow the simulation and the evaluation of different hypotheses of sampling of biological variables, by resampling techniques,

thus computing the sex-ratio-at-length, the maturity-at-length and the age-at-length from the biological measures (sex, maturity, age) of the resampled individuals.

d. Implementation of scripts allowing the comparison of the different simulations (done through the scripts mentioned at the previous points) assessing the increase/decrease in the CVs compared to the current situation and implementing the calculation of EMD (Earth Mover's Distance) for the comparison of two different distributions (e.g. length frequency, sex ratio at length, maturity at length and age distributions).

The proposed approach can be summarized into the two following phases:

- Phase 1: run the optimization scripts for each target species in order to find the "optimal" sampling size range analysing the precision of the sampling (i.e. in terms of the CV of the length structures);
- Phase 2: run different scenarios resampling historical data following different hypothesis and assess the performance of the scenarios compared to the past sampling (scenario obtained by bootstrapping the dataset following the same hypothesis in terms of number of trips and measured individuals as used in the current situation, hereinafter referred as "baseline"). The scenarios can be defined:
  - ✓ i varying the number of sampled trips according to the different "optimal" range found for each species (phase 1), using the same stratification as in the historical sampling;
  - ✓ ii varying the number of sampled trips and simulating, for example, an increase of this number, while reducing the length measurements taken (making subsamples) for each trip.

The methodology developed at ICES WKBIOPTIM (ICES WKBIOPTIM Final Report, 2017) is used to identify the "optimal" number of individuals to be measured "at sample level" (i.e. per trip/haul) to obtain an accurate representation of the catches. The update of the abovementioned scripts is mainly represented by the possibility to evaluate the impact on the biological estimates (maturity, sex ratio at length, etc.) globally rather than by trip, allowing to focus on the final outcome of the sampling related to biological variables. From the analyses on the length distributions by trip/haul the minimum number of fish to be measured can be found, thus allowing to obtain representative samples of the sampled population, and avoid oversampling (e.g. several hundreds of measurements per sample, over a relatively short size/age-class range). This "optimal" number of individuals to be measured can be used as a guide for exploring the extent of different sub-samplings in the definition of the scenario (point ii listed above).

The aim of simulating the design of sampling scenarios with different options is to assess the impact of different sampling strategies both on the values of CV for each species and on the shape of the length structures, comparing them with the baseline (past and current situation). The comparison of the results of the different scenarios can then be used to assess if it would be possible, for example, to maintain the same level of precision or even gain in precision, increasing the number of trips while reducing the number of length measurements by trip. In this way, the effects of a redirection of the sampling effort into sampling more trips (catching more the characteristics of the sampled population), rather than taking more length measures in laboratories can be quantified.

Following the approach "*at sample level*" developed at the ICES WKBIOPTIM 2 (Nantes, May 2018) a resampling by trip/haul is also done for the other biological variables, i.e. age, sex and maturity. Varying for all the trips/hauls the number of individuals for which the biological measures are taken (e.g. simulating by trip/haul a fixed number of biological measures for each length class from 20 cm to 100 cm), it is possible to extract the sex-ratio at length, the maturity-at-length and the age-length keys (ALK) calculated on all the

resampled trips (and respectively hypothesizing 2, 4, 6, ... measures of the biological variable for each length class and for each trip/haul). Thus, it is also possible to assess the impact of changes in the number of measurements on the biological variables, compared to the baseline (current situation), through the CV and the Earth Moving Distance.

The "optimal" number of measurements to be taken for a given biological variable by trip/haul can be also derived by commercial category for each species. Then, the annual number of measurements can be estimated by multiplying the optimum number of measurements per trip/hauls with the number of trips that, when compared to the sampling scenarios (point ii above), returns the best performance in terms of gain in precision, with the same or an acceptable increase in sampling effort, with respect to the current sampling plan.

A large number of outputs are made available to the user to evaluate the different scenarios with respect to the current sampling (baseline):

- a summary table including the numbers of trips, the number of measured individuals and the value of CV for each species and scenario by sampling stratum;
- the increase/decrease (in %) of the CV and the EMD of the length structures respect to the baseline for each species and scenario by stratum;
- a plot showing the value of total CV corresponding to a given number of trips and a given number of measured individuals;
- Earth Mover's Distances (EMD) calculated for each length distribution and for each species;
- a plot of the total length frequency distributions simulated in all the scenarios;
- for each species and area, the original numbers of measured individuals by trip/haul and the reduced numbers through the subsampling simulation are plotted in a barplot to give an idea of the number of samples affected by the reduction;
- coefficient of Variation (CV) by length class of the species included in the analyses are overlapped in distinct plots (one for each scenario), in order to observe how the values of CVs are varying.

Outcomes from the Case studies

The methodologies and the R tool developed in Task 3.3 of the project and described in this deliverable have been applied to 15 case studies during the 2 training workshops organized under WP7. Data for the case studies were obtained after a data call of RCG Med&BS, following a Data Sharing Agreement (deliverable 3.1 of STREAM). In some cases data were integrated and/or corrected by the experts during the Workshops.

The corrected dataset are available on the STREAM sharepoint (https://streampartner.coispa.eu/WebInterface/login.html), in the folders 1st Training Workshop Kavala and 2nd Training Workshop Bari -> Case studies -> Case study name -> final input-output. For this deliverable, five case studies covering all the sub-basins of Mediterranean Sea and the Black Sea were retained, following the project plan. For these 5 case studies, the final input and output are also reported in the folder on the Sharepoint, WP3-> Task 3.3 -> Input_Output case studies.

Furthermore, the R scripts developed under WP3 are stored in a GitHub repository, and can accessed at the following link: https://github.com/aleligas/STREAM_MARE-2016-22.

Case study in GSA 22, 23, 25 (Greece, Cyprus) on M. merluccius, M. barbatus and A. foliacea

Data on biological variables were not available (Greece) or were scant (Cyprus), thus only data on length were used for the sampling optimization, in addition for GSA22 and 23 only data from 2014 and 2016 were available. The results suggest that there has been oversampling for *M. barbatus* in GSA 22 for both gears (OTB and NETS) and for *M. merluccius* in GSA 22 for OTB. Undersampling was detected instead for both species in GSA 23 for NETS. The optimization results were comparable between the species in most cases, while pronounced differences were evident only for NETS in GSA 22. Sampling for OTB in GSA 23 was found close to optimal for both species, at least in 2016.

In GSAs 22&23 – Greece, the optimization results suggest an increase of sampling effort in GSA 23 and a considerable decrease of trips in GSA 22. In GSA 22, the decrease in the optimized number of trips is especially prominent for OTB. The CV is increased due to the lower number of sampled individuals. In GSA 23, an increase in sampling effort (both in terms of trips, and thus also in the number of individuals) is advocated for all gears, and in particular for nets (this result should be treated with caution, given the high recycling rate). Given the multi species nature and the high variability both in the composition and the production of fisheries in the Greek waters, the analyses should be verified using the most important species caught by each gear, and especially a longer times series. This also because, the 12 major sub-areas considered in the stratification of the baseline sampling were not taken into account in setting the minimum sampling size in the simulations, as the available dataset did not allow to set a higher minimum sampling size, without a disproportionate increase in the recycling rate. Thus, the adopted setting of the minimum number of trips could result in an underestimation of trips and increased CV in GSA22.

In GSA 25 – Cyprus, the simulations suggest that the increase of sampled trips would reduce the value of CV of *M. barbatus* for OTB and NETS in respect to the CVs obtained in the Baseline. Following the results from the optimisation analysis, it is proposed to increase the sampling intensity in terms of sampled trips for OTB and NETS fisheries. An increase is also proposed on the number of sampled individuals by trip for *M. barbatus*, for both fisheries.

Case study in GSA 29 (Bulgaria, Romania) on M. barbatus

Only data from Bulgaria were available and only for the variable length. The optimization results suggest an increase of sampling effort in GSA 29 (Bulgaria) and a subsequent increase of individuals measured, that would be about 60 individuals per trip for a total of 1140 individuals. Respect to the current sampling, the possibility to apply a sub-sampling of ½ for all the samples could be also feasible, measuring at least about 800 individuals and only if associated to a number of trips equal to 19.

Case study in GSA 17-18 (Italy, Croatia, Slovenia) on E. encrasicolus and S. pilchardus

The analysis was carried out by country, as the datasets provided by the different MS were non-homogeneous, and as biological variables were available for Italy and Slovenia.

In general the recycling rates obtained in the optimization process were rather low for Croatia and Italy, so all the results could be considered robust.

The simulations indicate that the minimum number of individuals to be measured per trip varies between 120 for *S. pilchardus* in Italy to 160 individuals for both species in Slovenia, considering the sample size when the MWCV start to be below the 25th percentile as criterion for selection. Also, the values of EMD are coherent with the chosen minimum number.

According to the outcomes obtained for Croatia, two scenarios:

- B3: number of trips equal to the maximum number of trips -common for the two species- suggested by the optimization process, no subsampling applied;
- C4: number of trips as in B3 but equally distributed between the different quarters, subsampling of individual measurements;

resulted as the best performing among the 8 explored alternatives, representing the optimal compromise between the two species in terms of precision of the sampling. The two scenarios are characterized by a number of trips increased of about 10% respect to the current sampling and a number of lengths measurements for sardine that is about double respect to anchovy, differently to the baseline, where for the two species almost the same number of measurements are collected. This seems consistent to the fact that *S. pilchardus* in the Adriatic sea is distributed unevenly, showing greater numbers in the East (Croatian) side (the catching ration between sardine and anchovy in the Croatian fleet is almost 4:1).

For the Italian PTM fleet (GSA 17 and GSA 18 together) the case study results (4 scenarios tested) suggest that an increase in the number of trips could have a small effect on *S. pilchardus* (-10%) CV, while CV associated to *E. encrasicolus* would benefit more (mainly in the 2nd and 3rd quarters, respectively 15 and 20% CV decrease), even with subsampling on length measurements of ½ or ¼. The planning of the number of trips based on pooled GSAs could be proven quite helpful. However, some degree of difficulty can still remain on the field. More specifically, it would probably be rather unfeasible to increase the number of trips especially in the 3rd quarter, due to temporal fishery closures for Italian PTMs. Thus, for the time being no changes are proposed in the sampling strategy of PTM for the Italian fleet.

For the Slovenian case study optimization outcomes indicated under-sampling. As a result, the CV associated to the target species generally decreases as the number of samples increases. However, it has to be noted that the corresponding fleet is very small, so the number of feasible samples per year is quite limited.

Case study in GSA 9-10-11 (Italy) on A. antennatus and A. foliacea

In general the recycling rates obtained in the optimization process were rather low for Croatia and Italy, so all the results could be considered robust. The performed scenarios suggested minimum number of trips between 25-31 in GSA 9, 24-38 in GSA 10 and 24-27 in GSA 11, respectively *for A. antennatus* and *A. foliacea.* Scenario 4 (number of trips increased and the samples by trip reduced by ½ without a threshold limit) was the better performing in most cases.

The new design proposes an increase in the number of trips for the métier OTB_DWS and an increased or comparable number of individuals to be measured by species (both *A. antennatus* and *A. foliacea*) for length and for the other biological variables. The number of trips proposed for the métier OTB_MDD is slightly higher compared to the current one, but this should be further evaluated considering the species that are the main target of this métier in the three GSAs, as for example *Merluccius merluccius* and/or *Nephrops norvegicus* in GSA9 and/*or Parapenaeus longirostris* in GSA10, as *A. foliacea* cannot be considered as the main driver target species of the métier OTB_MDD.

Case study in GSA 1-5-6-7 (Spain, France) on E. encrasicolus and S. pilchardus

Dataset did not include biological data, because they were not available, thus analyses were not carried out for these variables.

In general, the optimization results suggest Scenario 4 as the best performing, corresponding to a decrease of about 45% in the sampling effort in GSA 1 (Spain) and about 120 individuals of *E. encrasicolus* measured per trip, for a total of 7680 individuals, while for *S. pilchardus* the alternative scenarios have not returned

remarkable improvement in precision respect to baseline. Respect to the current sampling, the possibility to apply a sub-sampling of ½ to all the samples could be also feasible, measuring at least about 2241 individuals and only if associated to a number of trips equal to 64.
Concerning GSA 5, the increase of the trips and length measurements of four times respect to the current sampling, would decrease the CV of *E. encrasicuolus* of 11%, leaving almost unchanged the precision in *S. pilchardus* sampling. Regarding GSA 6, the suggested decrease in the number of trips and length measurements of about 85%, would increase the CV to 23% for *E. encrasicolus* and 16% for *S. pilchardus*. In GSA 7 the optimized number of trips and length measurements were very similar to the baseline, thus the alternative scenarios return a precision that is very comparable to the current situation for both species. This could suggest that a trade-off between the current number of trips and the optimized ones could be a solution to improve the sampling design.

Conclusions and recommendations

The tools developed within Task 3.3 and described in this deliverable, namely SDTool and BioSim Tool, have been demonstrated to help in the evaluation of alternative sampling strategies in 5 case studies, involving areas and stocks distributed in the different sub-basins of Mediterranean and in Black Sea. In several cases, inputs for new design were delivered, though further insights are needed at different levels (type of variables investigated for data limitations, assumptions, etc.). Thus, some remarks can be summarized as follows:

- the developed tools rely upon the completeness of the information in the available sampling and landing data. For this reason, it is of paramount importance to run the R codes using consolidated dataset, including all the available types of information (catch data, biological variables, etc.), in order to avoid unreliable and/or incomplete results;
- given that the tools take into account the performance of sampling design in terms of precision and not of bias it is important to take also into account, when designing scenarios, the characteristics of the current sampling (e.g. spatial and temporal coverage, fisheries and métier, etc..);
- the assumptions when setting scenarios foreseen by the tools should be carefully evaluated against the characteristics of the current sampling design, to avoid setting that would result in inconsistent outcomes (e.g. the minimum number of trips to constraint the tool in searching further solutions);
- it would be useful to evaluate alternative sampling designs also considering a trade-off of sampling effort in terms of costs;
- despite the test of a wide range of alternative sampling strategies within each case study, further applications of the tool are recommended to simulate additional sampling strategies and/or options.

Concerning the proposed sampling plans some recommendations are listed below for the development of future work.
GSA22– Greece. It is recommended to explore alternative sampling scenarios, taking into account the use of 12 major sub-areas in the stratification of the current sampling. Moreover, the biological data should be made available to further analyses in order to evaluate the sampling optimization also for variable as sex, maturity and age.

GSA 25 – Cyprus. The new design proposes an increase of sampling (trips and individuals) for M. barbatus; *M. merluccius* was considered less relevant for this area. The other relevant stocks could be also considered to expand the scope of the analysis.
GSA 29 – Bulgaria and Romania. It is recommended to refine the present analysis, currently related only to Bulgaria, by including also the data from Romania.
GSA 17-18 – Italy. It is recommended to consider in depth the scenarios' outcomes (increase of the number of trips and measurements) for further improvements of the sampling design.
GSA9-10-11. Italy. In a further development of this case study it would be worth for the metier OTB_MDD to take into account also the other species which are the main targets of this metier, as for example *Merluccius merluccius* and/or *Nephrops norvegicus* in GSA9 and/or *Parapenaeus longirostris* in GSA10.
GSA1-5-6-7. Spain and France. It is recommended to explore more in depth the scenarios' outcomes, especially for GSA6 and consider the trade-off also in terms economic costs of sampling effort.
Recommendations for the RCG Med&BS can be summarized as follows:

- the organization of training workshops on the use of R environment in general and more specifically on the developed methodology and R tools is also recommended, in order to allow the experts involved in the definition of the Work Plans to familiarize with the tool and facilitate the interpretation and use of the results;
- in order to avoid problems due to data limitations and availability for the application of the sampling optimization tools, the RCG Med&BS may plan specific working sessions on the data preparation and formats, providing specific guidelines;
- specific working sessions and/or workshops to discuss the results of the case studies can be useful to give further insights and progress on the Sampling design issues. The RCG Med&BS can play a pivotal role in proposing a calendar/plan of such working sessions.

The work and analyses performed under Task 3.3 and the results are described in much more details in Deliverable D3.3 "Upgrade the methodological framework and tools for sampling optimization, implement and report case studies", which is embedded as Annex IX into the present report.

Task 3.4 – Develop rules on how to allocate tasks and costs between Member States and evaluate costs implication for 2019

Responsible S. Kavadas in cooperation with G. Radu
Partners involved: COISPA, CIBM, DFMR, FRI, HCMR, IO-BAS, IEO, NIMRD, NISEA
Core team: A. Adamidou, P. Carpentieri, C. Charilaou, A. Esteban, G. Lembo, A. Ligas, V. Raykov, G. Tserpes, N. Vrgoc
Duration: 7 months, from October 2018 to April 2019.

Milestones

M3.11 and M3.12 Sampling intensities from case studies (March 2019)

Deliverables

D3.4 Guidelines with rules on how to allocate tasks and costs among Member States and routine to evaluate costs implications for Member States and application to case studies (Responsible S. Kavadas, April 2019)

Task 3.4 developed rules on how to allocate tasks and costs between Member States and assessing results from simulations under the economic perspective. Cost implications of the regional sampling plans designed by means of the application of the sampling "optimization" tools developed by Task 3.3 and applied to five case studies were evaluated and compared to the "business as usual" approach that consists of national sampling plans (as is the case to date).
The five case studies covering all the sub-basins of the Mediterranean and the Black Sea were fully finalized and included in Delivearable 3.3 were used in the work done in Task 3.4:

1. Case study in GSA 9-10-11 (Italy) on *Aristeus antennatus* and *Aristaeomorpha foliacea;*
2. Case study in GSA 22, 23, 25 (Greece, Cyprus) on *Merluccius merluccius* and *Mullus barbatus;*
3. Case study in GSA 29 (Bulgaria, Romania) on *Mullus barbatus;*
4. Case study in GSA 17-18 (Italy, Croatia, Slovenia) on *Engraulis encrasicolus* and *Sardina pilchardus;*
5. Case study in GSA 1-5-6-7 (Spain, France) on *Engraulis encrasicolus* and *Sardina pilchardus.*

The methodological approach developed under Task 3.4 took advantage of the experience gained under the previous grant MARE/2014/19 Med&BS.
The approach developed under Task 3.4 considers the different components of sampling and processing costs and simulates various scenarios regarding sampling intensity to identify cost differences in relation to the status quo. The collection of biological data mostly includes the identification of parameters related to the growth and reproduction patterns of a series of species. It was assumed that the Total Cost (*Tc*) of such activities can be split into two components: Sampling Costs (*Sc*) and Processing Costs (*Pc*). Furthermore it was considered that:

$$Sc = (Uc \times Nu) + (Uc\_trips \times Nu\_trips)$$

where,
Uc is the cost of sample unit (calculated as the mean wholesale price per sample)
Nu is the number of samples units
Uc_trips is the compensation cost for boarding/visiting landing sites/markets by day
Nu_trips is the number of trips

and

$$Pc = Cc + (Nu \times Pd \times Dr)$$

where,
Cc is the overall coordination costs
Pd is the processing time per sample
Dr is the man/day rate.
Coordination costs were assumed as constant, equal to 40 man/days per year;

hence

$$Cc = 40 \times Dr$$

Given that *Tc* = *Sc* + *Pc*, it can be concluded that:

$$Tc = f(Uc,Nu,Pd,Dr, Uc\_trip,Nu\_trip) = (Uc \times Nu + Uc\_trip \times Nu\_trip) + Dr \times (40 + Nu \times Pd)$$

This approach was used to identify cost changes due to the implementation of an optimized sampling design, in terms of trips and biological measurements, in specific case studies. The considered case studies and the necessary information regarding changes in sampling intensity were obtained from Task 3.3.

Based on the current cost rates and according to previous exercises realized in MARE/2014/19 project, it was assumed that *Uc* and *Dr* are randomly drawn from normal distributions having means equal to 14 and 75 respectively. The corresponding CVs were 0.4 and 0.2. The processing time (Pd) per sample (refer to the biological parameters: lengths, sex, maturity and otoliths) was assumed equal to 0.5 day. For each sampling level (starting from 100 sampling units and decreasing down to 50 at 5 units interval steps) 100 simulations were performed. In addition, sample specific cost rates (see details below) were considered with a CV = 0.1 (10%).

The following initial values were set up to run the simulations:
N.baseline = number of individuals collected to measure length, sex, maturity, and age from the status quo scenario;
N.optimal = number of individuals collected to measure length, sex, maturity, and age in the optimal sampling scenario;
n_baseline_trips = number of trips from the status quo scenario;
n_optimal_trips = number of trips in the optimal sampling scenario;
Sample.mean.cost = sample mean cost by species and country;
DailyRate.mean = average man/day rate;
CV.sample.cost = 0.1;
CV.daily.rate = 0.2
Uc_trip_baseline = compensation cost for boarding by day from the status quo scenario;
Uc_trip_optimal = compensation cost for boarding by day in the optimal scenario;
Pd = processing time per sample

The results of the analysis performed on case studies and for the 3 scenarios are shown in Figures 3.4.1-3.4.6. In general, the optimized sampling designs for the examined case studies demand higher number of samples in 21 cases and lower number of samples in 11 cases. Regarding the number of trips, there is an increase in sampling effort (n. of trips) in 21 cases, a decrease in 5 cases, while the number of trips remained unchanged in 7 cases. The costs related to optimized sampling strategies will increase in GSA 9 for OTB_DWS fishery for *A. foliacea (~10,000 euro)*, in GSA 10 for OTB_MDD fishery for *A. antenatus (~12,000 euro),* in GSAs 6 (~5,000 euro) and 17-HRV (~7,000 euro) for *E. encrasicolus* due to increased sample numbers. The costs will be respectively decreased in GSA 10 for OTB_MDD fishery for *A. foliacea (~26,000 euro),* in GSA 9 for OTB_DWS fishery for *A. antenatus (~17,000 euro)* and in GSA 1 for *E.*

encrasicolus (~16,500 euro). In the case of *M. merluccius* caught by trawlers in GSA 22, the significant reduction of the samples results in a high reduction in costs (~50,000 euro).

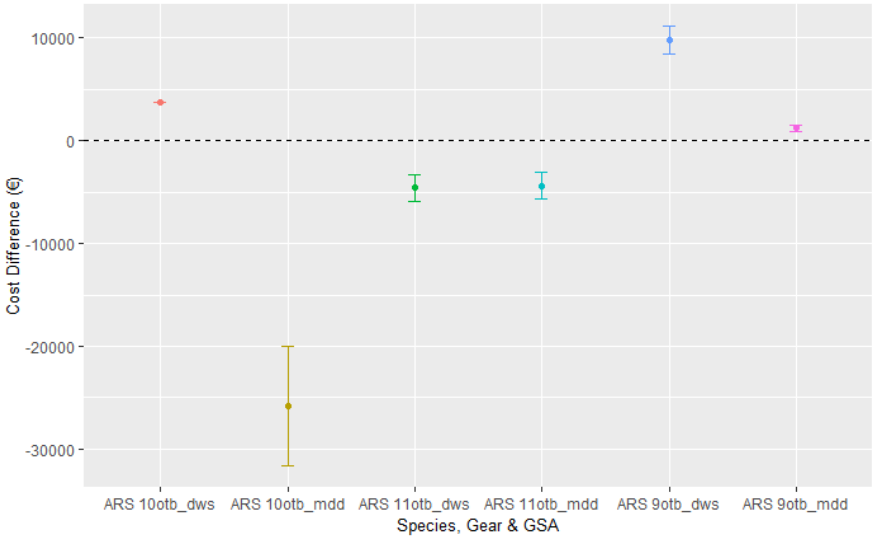

Fig. 3.4.1 – *Aristaeomorpha foliacea* in GSAs 9-10-11 (Italy). Cost differences between the optimal sampling strategy and the status quo for each fishery and GSA.

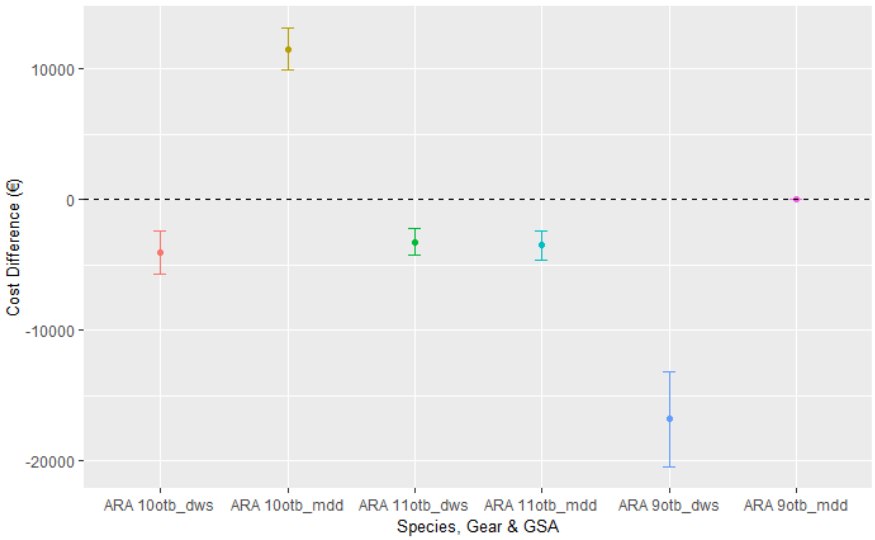

Fig. 3.4.2 – *Aristeus antennatus* in GSAs 9-10-11 (Italy). Cost differences between the optimal sampling strategy and the status quo for each fishery and GSA.

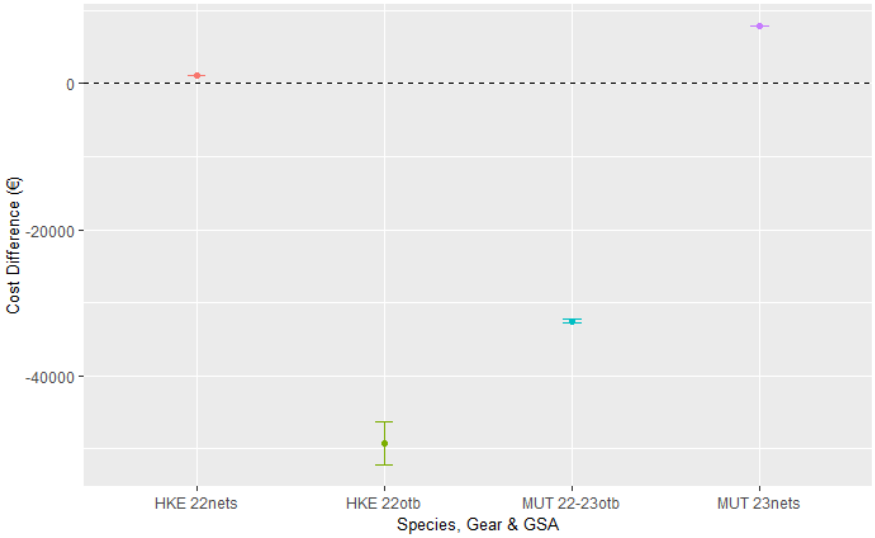

Fig. 3.4.3 – *Merluccius merluccius* and *Mullus barbatus* in GSAs 22-23 (Greece). Cost differences between the optimal sampling strategy and the status quo for each fishery and GSA.

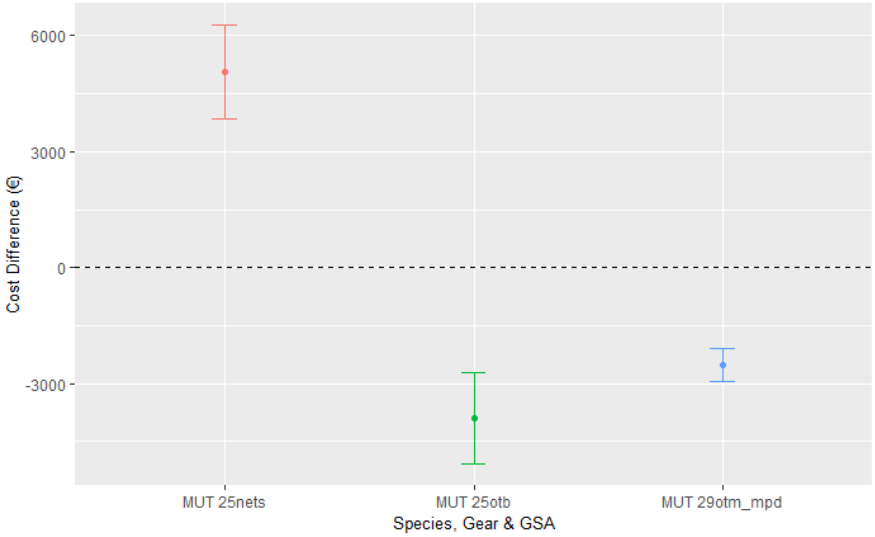

Fig. 3.4.4 – *Mullus barbatus* in GSA 25 (Cyprus) and GSA 29 (Bulgaria and Romania). Cost differences between the optimal sampling strategy and the status quo for each fishery and GSA.

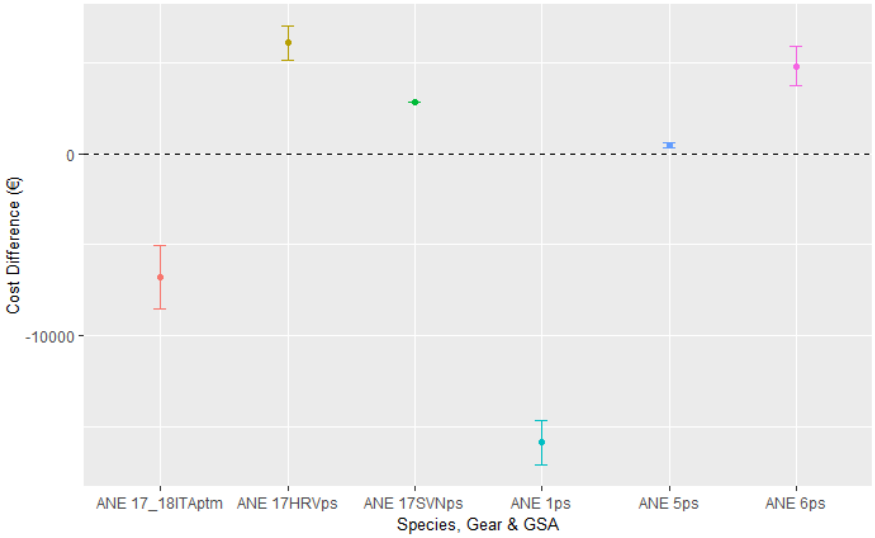

Fig. 3.4.5 – *Engraulis encrasicolus* in GSAs 17-18 (Italy, Croatia and Slovenia) and GSAs 1, 5 and 6 (Spain). Cost differences between the optimal sampling strategy and the status quo for each fishery and GSA.

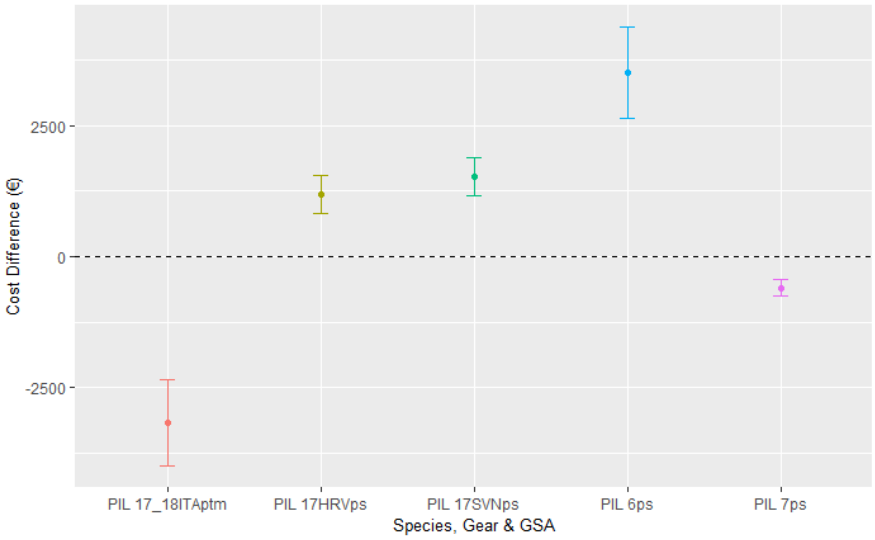

Fig. 3.4.6 – *Sardina pilchardus* in GSAs 17-18 (Italy, Croatia and Slovenia), GSA 6 (Spain) and GSA 7 (France). Cost differences between the optimal sampling strategy and the status quo for each fishery and GSA.

The approach developed under Task 3.4 gave the opportunity to broadly estimate the impact of sampling changes on total costs. Although only the most important cost components were included in the current model (labour and sample costs), additional case-specific sources of cost can be considered (e.g. consumables), and the R code can be easily modified to include them.

The methodological approach developed under Task 3.4 and the results of the analyses performed are described in Deliverable D3.4 (Annex X of the present report).

3.5. WORK PACKAGE 4 - REGIONAL SAMPLING PROGRAM FOR THE COLLECTION OF DATA ON FISHERIES IMPACTS ON THE ECOSYSTEM

WP4 Chair: B. Guijarro (IEO), Co-chair: P. Sartor (CIBM)
Partners involved: IEO, CIBM, COISPA, CNR-ISMAR, NISEA, HCMR, FRI, DFMR, IOF, IO-BAS, NIMRD, REVIVO.
Duration: 14 months, from 19 December 2017 to February 2019.

WP4 aimed at providing support to the design of a Regional Sampling Program covering the collection of data on fisheries impacts on the ecosystem (RSP-IE), taking into consideration the experience of the previous grants (MARE/2014/19 Med&BS and FishPi). WP4 has worked in cooperation with the equivalent WP under the FishPi^2 project. Furthermore, the work performed under the relevant ICES working groups and for the preparation of the GFCM Manual on the monitoring of the by catch of vulnerable species was taken in due consideration. Research institutes involved in the STREAM project are also actively participating to GFCM work. This communication flow allowed creating synergies between the different initiatives, while avoiding duplications.
The sampling plan includes a) fish stomach content analysis; b) co-occurrence and relative abundance of species/stocks; c) incidental catch and by-catch of non-target species, such as protected, endangered or threatened species (PET species).
The work under WP4 was organized in two tasks:
Task 4.1 Develop/refine methodologies for data collection and processing;
Task 4.2 Allocate task and costs among Member States and evaluate cost implication.

Task 4.1 - Develop/refine methodologies for data collection and processing
Responsible: P. Sartor in cooperation with G. Daskalov
Partners involved: IEO, CIBM, COISPA, CNR-ISMAR, NISEA, HCMR, FRI, DFMR, IOF, IO-BAS, NIMRD, REVIVO.
Core team: I. Bitetto, P. Carbonara, L. Casciaro, C. Garcia, B. Guijarro, I. Isajlovic, C. Musumeci, P. Pengal, V. Maximov, A. Santojanni, M. Sbrana, I. Thasitis, K. Touloumis
Duration: 12 months, from March 2018 to March 2019

Milestones
M4.1 Inputs from WP2 (May 2018)
M4.2 Development of the updated RSP (March 2019)
Deliverables
D4.1 Updated protocols and guidelines for collection, processing and analysis of stomach contents (B. Guijarro and P. Sartor, March 2019).
D4.2 Protocols for data analysis and computation of relative abundance indices and species co-occurrence (P. Sartor, C. Musumeci, C. Garcia, March 2019).
D4.3 Updated guidelines, protocols and handbooks for monitoring incidental by catch of vulnerable species (P. Sartor, G. Daskalov and A. Ligas, March 2019).

The main objective of Task 4.1 was to develop further the RSP-IE designed under the grant MARE/2014/19 Med&BS, in order to design and propose a new RSP adapted to the characteristics of the stock/fisheries object of regional monitoring, which were identified by the WP2 of this project. This task was divided into 3 sub-Tasks:

- Sub-task 4.1.1 Data on stomach contents of fish.
- Sub-task 4.1.2 Data on co-occurrence and relative abundance of species/stocks.
- Sub-task 4.1.3 Data on incidental catch of non-target species, such as protected, endangered or threatened species (PET species).

Sub-Task 4.1.1 Data on stomach contents of fish

During the MARE/2014/19 Med&BS project, the stocks to be sampled for stomach content analysis were selected, following the criteria of the Call of Proposals, as well as on the advices requested to the Primary End Users, as STECF, GFCM and MEDAC. During that project, two stocks were selected the European hake, *Merluccius merluccius*, in the Mediterranean, and the turbot, *Psetta maxima*, in the Black Sea. The two species are among the most important resources, both in terms of production and value, exploited by demersal fisheries in the two areas and also play an important role in the demersal species assemblages. To perform a standardised data collection on stomach contents of these two stocks will allow obtaining useful information to better understand their role in the ecosystems, as well as to know and monitor the pool of resources sustaining the two species in the different phases of their life cycle.

Both species are proposed as the main target for the analyses of stomach contents also for the new Regional Sampling Programmes. However, according to the discussions made in several fora (e.g. the Workshop of Palma de Mallorca, WKSTCON 2018, and the STREAM Plenary Meeting held in Bari in October 2018), some additional species have been proposed to be included together with European hake and turbot in the stomach content analyses. As main criteria followed for the selection of the new species, we choose the species importance in terms of landings and commercial value, to belong to the same species assemblage of the target stocks and, possibly, to have trophic relationship (e.g. as a predator) with the target stocks. This will allow increasing the overall knowledge from the ecological point of view and also to increase biological information on the stocks, that could be used to evaluate the natural mortality.

As regards Mediterranean, several potential candidates stocks were taken into account, such as blue whiting, *Micromesistius poutassou*, anglerfish, *Lophius* spp., conger eel, *Conger conger*, and blackmouth catshark, *Galeus melastomus*. After a wide discussion, during the STREAM Plenary Meeting in Bari (4-5 October 2018), the blackbellied anglerfish, *Lophius budegassa*, was proposed as the candidate stock to be coupled with M. merluccius in the stomach content analysis. It is a commercially important and piscivorous species, with European hake among its most important preys; *L. budegassa* is occurring in the same species assemblage of *M. merluccius*, although with notably lower density values. Therefore, in order to reach the expected sample size, it is suggested to include the congeneric species, the monkfish *L. pisctorius*, in the stomach content data collection. The two species show very similar ecological characterisitcs. Therefore, the sampling plan was designed for *Lophius* spp.

The selection of the additional species for stomach data collection in the Black Sea was based on criteria related to trophic impacts on other commercial stocks, as well as on the importance for the fisheries and the ecosystem. In Table 3.5.1, the most important fish predators in the Black Sea, ranked by the amount of fish prey that they consume, are presented. Table 3.5.1 also shows data on biomass and fishery catches of

each predator species. Predatory fishes are obviously priorities for the feeding studies, because of their impact on other fishes including valuable commercial stocks. The classification presented in Tab. 3.5.1 is based on the biomass of fish preys consumed by the most important (commercially and for the ecosystem) predatory fishes in the Black Sea. The estimation of fish consumption is based on the biomass of each stock, as estimated in recent stock assessments (STECF, 2017) multiplied by the annual consumption rates (consumption/biomass, Demirel et al. 2019). As shown by Tab. 3.5.1, the largest amount of fish preys are consumed by the mid-sized pelagic predators: bonito, bluefish and Mediterranean horse mackerel. Bonito and bluefish are commercially and ecologically important, but currently they are not covered by the DCF. Because of their commercial and ecological (as predators) importance bonito and bluefish should be covered by future DCF. It should however be kept in mind, that bonito and bluefish are pelagic migratory species, which overwinter in the Marmara Sea, and their abundance in the EU Black Sea waters vary from year to year, relative to the state of the stocks and migration behaviour. Between the demersal predators, most of prey fish biomass is consumed by the whiting, turbot and dogfish. Between them, turbot is the most important commercial stock in the Black Sea.

Finally, other than P. maxima, other two species were chosen for stomach analyses in the Black Sea: the Mediterranean horse mackerel, *Trachurus trachurus*, as an important predator (Table 2.1) as well as a prey species, and the sprat, *Sprattus sprattus*, as the most important prey species in the EU Black Sea waters. The proposed species are also of great commercial importance and are all already included in the current DCF.

Tab. 3.5.1. Consumption of fish prey, biomass and catches (in thousands tons) of the most abundant predatory fishes in the Black Sea (STECF, 2017, Demirel et al., 2019).

Predatory fishes	Biomass of predatory fishes	Catches of predatory fishes	Total biomass of fish preys consumed by each predator
Bonito	98.1	15.2	166.8
Bluefish	29.1	6.3	56.9
Horse mackerel	34.5	15.5	32.7
Whiting	19.1	9.1	29.9
Turbot	4.8	1.6	20.8
Dogfish	1.6	0.4	4.7

Two possible sources of data shall be considered in the collection of stomachs of the selected Mediterranean and Black Sea species: **experimental bottom trawl surveys** (like MEDITS survey in the Mediterranean) and **biological sampling** (sampling from commercial fishing). In the first case, the sampling would not take into account seasonality but the second would. Sampling can be performed from fresh or frozen individuals, depending on the possibilities, as explained in the Chapter 3.2.

The sampling of stomachs has been planned taking into account the following criteria (strata), which are known to influence the diet of the investigated species:

- **Size class**: for European hake, three different groups should be considered (see Table 2.1.1): i) juveniles (<20 cm TL, which would be part of the discarded fraction, in the case of sampling from commercial catches); ii) sub-adults (20-35 cm TL) and iii) adults (>35 cm LT).

For the anglerfish, *Lophius* spp., two different groups should be considered: i) small (<30 cm TL, which would be part of the discarded fraction in the case of sampling from commercial catches) and ii) large (>30 cm TL) individuals.
As concerns turbot, three size groups have been proposed, taking into account both the length at first maturity and the Minimum Conservation Reference Size (Karapetkova, 1962): i) juveniles (<20 cm TL), ii) discarded adults (20-45 cm TL) and iii) adults taken by the commercial fisheries (>45 cm TL).
For the Mediterranean horse mackerel, two size groups should be considered for the sampling of stomachs: i) juveniles <10 cm TL, and ii) adults >10 cm TL.
Concerning sprat, 2 size groups should be regarded: i) <8 cm TL and ii) >8cm TL.
Seasonality: This stratum will only refer to the samplings from commercial catches and, as explained before, quarter should be the time interval.
- **Sample size**: The proposal on the number of individuals to be sampled for stomach content analysis is reported in the tables below.
The proposed numbers correspond to **full stomachs to be sampled**. For the moment, no estimations of the optimal sample size is available; the samples sizes proposed for each species are the product of a first evaluation based on various aspects: sample size from previous study, heterogeneity of the diet of each species, availability of the samples, including the information on the stomach repletion.

Hake (see Table 3.5.2 below):

- *Biological sampling (commercial fishery)*: In order to take into account seasonality, sampling should be carried out by quarter and 30 full stomachs by quarter and length group shall be analysed by each GSA.
- *Experimental trawl surveys*: 20 full stomachs by length group should be analysed by GSA.

Total number of stomachs to sample per GSA/year: 420. This number is lower than that (690) proposed by the Project MARE/2014/19 Med&BS, due that the results of the Pilot Studies (e.g. those performed in the Italian GSAs) highlighted the difficulty to reach the expected samples size, especially for the first and last size class.

Anglerfish (*Lophius* spp., see Table 3.5.3 below):

- *Biological sampling (commercial fishery)*: In order to take into account seasonality, sampling should be carried out by quarter and 12 full stomachs by quarter and length group shall be analysed by GSA.
- *Experimental trawl surveys*: 12 full stomachs by length group should be analysed by GSA.

Total number of stomachs to sample per GSA/year: 120.

Turbot (see Table 3.5.4 below):

- *Commercial fishery*: In order to take into account seasonality, sampling should be carried out by quarter and 30 full stomachs by quarter and length group shall be analysed. It should be noted, that the number of juveniles in commercial catches is zero or very low. Discarded adults could be found in sprat fisheries using OTM trawls, in Rapana fisheries using beam trawls and in turbot gillnets fisheries, but in low quantities.
- *Surveys*: A total of 15/30 individuals by length group should be analysed. The number of juveniles in survey catches is usually very low.

Total number of stomachs to sample in GSA 29: 315

Horse mackerel (see Table 3.5.5 below):

- *Commercial fishery*: In order to take into account seasonality, sampling should be carried out by quarter and 450 full stomachs should be analysed.
- *Surveys*: A total of 100 individuals should be analysed.

Total number of stomachs to sample in GSA 29: 550.

Sprat (see Table 3.5.6 below):

- *Commercial fishery*: In order to take into account seasonality, sampling should be carried out quarterly and 200 full stomachs (total for all size categories) shall be analysed per quarter.
- *Surveys:* 100 individuals in total should be analysed.

Total number of stomachs to sample in GSA 29: 900.

The outcomes of the Sub-Task 4.1.1 are described in Deliverable D4.1 that is attached as Annex XI to the present report.

Sub-Task 4.1.2 Data on co-occurrence and relative abundance of species/stocks

The main objective of Sub-Task 4.1.2 was to propose a common procedure of data analysis for identifying and monitoring the main species assemblages and to monitor the species co-occurrence, relative biomass and density over time, according to a standardized methodological approach.

The data collected from experimental fishing (e.g. the MEDITS experimental trawl survey, included in the DCF for the EU Mediterranean) can provide a large time series of abundance/biomass standardized indices, as well as useful information to understand the structuring of the main species assemblages. The proposed methodology includes standardised routines to identify and periodically monitor the structure of the main demersal species assemblages and to analyse the co-occurrence and relative abundances of the most important species of each assemblage.

The methodological approach is divided into two phases:

Phase 1 - Identification and monitoring of the main demersal species assemblages:

The classical methods for the ordination and classification of species community will be applied, as follows:

I. Starting from experimental trawl survey data (e.g. MEDITS), **species/station matrices** will be created (using biomass, kg/km^2, and density, n/km^2, data). Year will be the temporal step for each matrix.
II. To reduce variability and skewness, consider possible removal of occasional species, as well as **data transformation** (e.g. log, square root, double square root, presence/absence)
III. Create a **similarity matrix**, The proposed algorithm to evaluate similarity level between samples is e Bray-Curtis index (Clifford and Stephenson, 1975).
IV. **Clustering procedure**. We propose to build dendrograms using the UPGMA method (Unweighted per Group Mean Average, Sneath and Sokal, 1973).
V. Identification of group of samples. In general grouping of station follows the bathymetric criterion, with temporal and spatial stability.
VI. Identification of the species characterizing each group, in terms of percentage contribution to the similarity of the group, density and biomass. SIMPER is the proposed routine.

The routine can be furtherly standardized making available to all the MSs an R routine developing all the steps previously described. Due to the substantial temporal and spatial stability of the species assemblage composition, **we propose to monitor their composition every three yea**r, to detected possible changes.

Phase 2 - To analyse the co-occurrence and relative abundances of the species characterizing each assemblage:

The proposal is to use simple indicators that could be easily applied to survey datasets for the evaluation of impacts of fisheries on the ecosystem. This analysis should be performed routinely every year.

I. **Spearman's rho index** on the time series on the density and abundance indices over time of each species. An R routine to calculate the index is available;
II. To analyse the **temporal evolution of the frequency of occurrence** (e.g. the number of positive hauls/total number of hauls per survey) at species/area level;
III. As regards the small pelagic species (e.g. anchovy, sardine, horse mackerel and Mediterranean horse mackerel, sprat), other than the approaches I and II, another suggestion is to use the **co-occurrence index in small pelagic stocks**, that can be affected also by environmental drivers (see a previous application in the Bay of Biscay).

For small pelagics, it is also proposed the use of the Intersection-union tests (Trenkel and Rochet, 2009), which consists of fitting a nonlinear smoother to the whole indicator series to remove random sampling noise and, if the smoother has sufficient goodness-of-fit, calculating first and second derivatives from the smoothed time series and carrying out a series of tests formulated as an intersection–union test.

The methodological approach developed and proposed under Sub-Task 4.1.2 is described in more details in Deliverable D4.2 (Annex XII in this report).

Sub-Task 4.1.3 Data on incidental catch of non-target species, such as protected, endangered or threatened species (PET species)

In the light of the experience gained under the previous grant (MARE/2014/19 Med&BS), the work performed by GFCM in preparation of a manual for the monitoring of the by catch of vulnerable species, and the preliminary outcomes of the pilot studies on the monitoring of the by catch of vulnerable species run under some MSs National Programmes (e.g. Italy, Greece, etc.), a new proposal for implementing the monitoring of the by catch of vulnerable species in Mediterranean and Black Sea fisheries was developed under sub-Task 4.1.3.

Independent observations made by trained observers are the most reliable and useful means of collecting data on the by catch of vulnerable species. However, these programmes can be quite expensive. In order to be efficient in terms of costs for running such programmes, it is advisable to take advantage of the fleet observer programme already in place for the collection of data on commercial fisheries and discards. During this activity, data on the incidental by catch of vulnerable species can be also collected.

Besides the high costs, fleet observer programmes can only guarantee a relatively low coverage in terms of fishing days. Therefore, it is recommended to couple a fleet observer programme with other monitoring methodologies, such as self sampling monitoring scheme, in order to get results that are more reliable. Integration of self-reporting tools with observer programmes allows for cross-checking and review of self-reported data.

By catch occurrence and absence data provided through self sampling are very useful in flagging up by catch hotspots, which could be missed by a limited number of on board observations. This is particularly true because by catch rates may be very low and so will be missed by low numbers of on board observations.

The self sampling through the completion of a specific and dedicated logbooks has a low cost, but requires a high degree of cooperation from the industry. In this sense, fishers often have too many forms to complete on a daily basis and their voluntary collaboration may suffer from the obligation of reporting different data. There is also the danger that fishers may not always record accurate data, or identify species incorrectly.

Those issues can be overcome if the reporting forms are accompanied by a clear and easy identification guide. Furthermore, self-reporting fishers can also host on board observers, thus providing for basic training in species identification. Self-reporting fishers must be trained by observers so that species identification could be validated by trained observers and specialists. Continuous training, coordination and support from the scientific staff involved in the monitoring is also necessary.

The proposal of a new regional sampling programme focussed on the monitoring of the by catch of vulnerable species is based on three case studies. The approaches and methodologies proposed can be generalized to other areas and fisheries.

The case studies that we considered for the preparation of this Deliverable are the following:

1. Demersal OTB fishery targeting European hale and deep-water rose shrimp in GSA07: this fishery is performed by French and Spanish vessels;
2. Demersal OTB fishery targeting European hake, red mullet and Norway lobster in GSAs 17 and 18: this fishery is performed by Slovenian, Croatian and Italian vessels;
3. Beam trawl fishery targeting Rapana whelk in GSA29: this fishery is performed by Bulgarian and Romanian fleets.

As concerns the Gulf of Lions (GSA07), at the moment, in both France and Spain no specific sampling programme has been implemented for the monitoring of the incidental by catch of vulnerable species in trawl fisheries. However, in both countries, the sampling at sea in place under DCF and focussed at the monitoring of the commercial fisheries and discards is used to collect information on the incidental by catch of vulnerable species.

In order to improve the knowledge on the by catch of vulnerable species, a more conservative approach in terms of costs would be implementing a large monitoring programme based on self-sampling (e.g. specific logbooks to be filled in by fishermen). The information collected using this approach can be complemented using the discard sampling at sea already in place in the two countries.

We recommend to cover at least the 7% of the fishing days using the self-sampling approach. According to effort data available on the JRC Dissemination Tool (https://stecf.jrc.ec.europa.eu/data-dissemination), Spanish trawlers perform around 2500 fishing days per year in GSA07, while French trawl fleets perform around 11000 fishing days per year in GSA07 (these estimates are computed considering the period 2014-2016). Considering an average fishing days per vessel per year of 150, it is recommended to monitor by means of self-sampling (through logbook) 4 Spanish trawlers and 10 French trawlers. This sampling scheme would allow covering a considerable number of fishing days, higher than the expected target of 7%, thus compensating for possible low response or continuity in the compilation of data by some fishermen.

The monitoring by means of self-sampling (log-books) will be coupled with the routine sampling with observers on board carried out under the framework of the Spanish and French National Work Plans. The number of monitored days at sea will be possibly revised and increased through the application of the scripts on the sampling strategy optimization designed by STREAM WP3.

It is recommended a thorough training will be provided to the fishermen involved in the self-sampling scheme for monitoring the by catch of vulnerable species. Furthermore, species identification guides will be provided as well as guidelines and protocols on how to measure and handle incidentally caught vulnerable species when on board.

A similar approach is proposed for the trawl fisheries in the Adriatic Sea (GSAs 17-18), where in 2018 a pilot study for the monitoring of the incidental by catch in trawl fisheries has been implemented within the Italian National Programme (taking into account the guidelines and methodologies proposed by the previous grant MARE/2014/19 Med&BS). The preliminary outcomes of this pilot study provided interesting insights on the frequency of occurrence and spatial-temporal distribution of the by catch of vulnerable species, such as loggerhead sea turtles (*Caretta caretta*) and elasmobranchs (e.g. common stingray, pelagic stingray, picked dogfish, smooth-hound, etc.).

Taking into account the optimal range of coverage suggested by FAO (2009) and ACCOBAMS (2010), we recommend covering the 5% of fishing days by means of self sampling (distribution of log books to the fishermen).

If we consider an average of 60000 fishing days per year performed in GSA17 and 50000 in GSA18 by Italian trawl fleets (estimates are computed considering total fishing days in the period 2014-2016), taking into account an average of 120 fishing days per year per vessel (in the Adriatic Sea, Italian trawlers work for 4 days per week, thus the number of fishing days is lower than in other areas), a total of 30 vessels should be monitored in the GSA17 through the distribution of logbooks, and 25 vessels in GSA18. We recommend a thorough training is provided to fishermen; in addition continuous contacts and cooperation with them is requested to check logbooks are properly filled in and to reply to their questions and doubts.

This should allow reaching the target of 5% coverage of fishing days that is within the optimal range of sampling intensity for by catch monitoring schemes (FAO, 2009; ACCOBAMS, 2010).

In Croatia, considering an average of 35000 fishing days per year, the monitoring through self-sampling by means of logbooks should include 15 vessels to be monitored for the entire year. As concerns Slovenia, considering an average fishing activity by trawlers of 1500 fishing days, we recommend monitoring 2 vessels by means of self-sampling through logbooks over the entire year.

All these activities should be coupled with the fleet observer programme expected under the collection of biological data on commercial fisheries and discards. It is recommend to use the scripts developed by STREAM WP3 to estimate the most appropriate number of fishing days to be monitored under this activity.

The beam trawl fisheries targeting Rapana whelk (*Rapana venosa*) in the Black Sea are performed on sandy-muddy fishing grounds at depths up to 50 m. The by catch species in this beam trawl fishery include juvenile and adult turbot, sturgeons, sharks and several invertebrate species (Petrova, 2017; Kaycac et al., 2018). The Rapana whelk fishing season usually goes from May to mid-October. In the period 2014-2016, an average of 650 and 950 fishing days were spent at sea by the vessels exploiting Rapana whelk using beam trawl in Bulgaria and Romania, respectively.

The proposed sampling scheme consists of 10 fishing days covered by fleet observers on Bulgarian vessels, and 15 fishing days on Romanian vessels. This sampling will be coupled with a monitoring through self-sampling (using log-books distributed to fishermen). We propose to distribute the log-books (to be filled in

by fishermen during each fishing day spent at sea during the Rapana whelk fishing season) to 4 vessels in Bulgaria and 6 vessels in Romania.
This combined approach should allow covering the 7% (that is the upper limit of the optimal range in terms of coverage: see FAO, 2009; ACCOBAMS, 2010) of the fishing activity during the Rapana whelk fishing season, even in a case of limited participation by the fishermen involved in the self-sampling scheme.

The use of cameras and other remote electronic monitoring (REM) tools does not seem a valid alternative for monitoring Mediterranean and Black Sea fisheries. Fishermen are quite reluctant to the installation of cameras on board as it is often seen as an obligation or imposition. In contrast, if they are approached and informed on the objectives of a particular monitoring activity, they can be very participative and proactive. Furthermore, despite cameras and REM are considered tools for reducing costs of monitoring activities, we do not believe they are cost-effective, as the staff costs for checking the hours of recorded information are not negligible.

The use of trawl surveys data can also support the monitoring in terms of preliminary information on the presence, occurrence and spatial distribution of vulnerable species and habitats, as well as on the abundance indices of some species. However, this information cannot be used for estimating the actual impact of fisheries on the vulnerable species and habitats as it does not come from the real fishing strategies and behaviour of the commercial fisheries.

Data storage can be implemented in the Regional Data Base for the Mediterranean and Black Sea, foreseeing specific tables for recording the information collected from the monitoring of the incidental by catch of vulnerable species.

Deliverable D4.3 “Updated guidelines, protocols and handbooks for monitoring incidental by catch of vulnerable species” is attached as Annex XIII to this report.

Task 4.2 - Allocate task and costs among Member States and evaluate cost implication for 2019
Responsible P. Carpentieri in cooperation with P. Sartor
Partners involved: IEO, CIBM, COISPA, CNR-ISMAR, NISEA, HCMR, FRI, DFMR, IOF, IO-BAS, NIMRD, REVIVO.
Core team: B. Guijarro, S. Kavadas, G. Lembo, A. Ligas, P. Pengal, V. Raykov, V. Maximov, G. Tserpes, K. Touloumis, N. Vrgoc
Duration: 6 months, from October 2018 to March 2019

Milestones
M4.3 Completion of proposals for task and cost allocation (March 2019)
Deliverables
D4.4 Guidelines and rules on how to allocate tasks and costs between Member States with Routine on the evaluation of costs implications for Member States (P. Carpentieri and A. Ligas, March 2019)

The objective of this Task was to develop rules on how to allocate tasks among MSs for the collection of data on fisheries impacts on the ecosystem taking into account the RSP developed by Task 4.1.

As concerns Sub-Task 4.1.1, the following tables are summarizing the number of samples that must be collected for each of the identified species in each GSA.

Table 3.5.2. European Hake in Mediterranean; proposal on number of full stomachs to be sampled by type of sampling, quarter and size class, for each GSA.

Biological sampling (landing and discard)	**Full stomachs to sample**			
Quarter	Juveniles	Sub-adults	Adults	Total
I	30	30	30	90
II	30	30	30	90
III	30	30	30	90
IV	30	30	30	90
Total biological sampling	**120**	**120**	**120**	**360**
Experimental trawl survey (MEDITS)	**Full stomachs to sample**			
	20	20	20	60
Total survey	**20**	**20**	**20**	**60**
Total	**140**	**140**	**140**	**420**

Table 3.5.3. Anglerfish (*Lophius* spp.) in Mediterranean; proposal on number of full stomachs to be sampled by type of sampling, quarter and size class, for each GSA

Biological sampling (landing and discard)	**Full stomachs to sample**		
Quarter	Small	Large	Total
I	12	12	24
II	12	12	24
III	12	12	24
IV	12	12	24
Total biological sampling	**48**	**48**	**96**
Experimental trawl survey (MEDITS)	**Full stomachs to sample**		
	12	12	24
Total survey	**12**	**12**	**24**
Total	**60**	**60**	**120**

Table 3.5.4. Turbot in Black Sea; proposal on number of full stomachs to be sampled by type of sampling, quarter and size class.

Biological sampling (landing and discard)	**Full stomachs to sample**			
Quarter	Juveniles	Discarded adults*,**	Commercialized adults	Total
I	0	30	30	60
II	0	30	30	60
III	0	30	30	60
IV	0	30	30	60
Total biological sampling	**0**	**120**	**120**	**240**
Bottom trawl survey	**Full stomachs to sample**			
	15	30	30	75

Total survey	**15**	**30**	**30**	**75**
Total	**15**	**150**	**150**	**315**

*In Romania, according to the legislation, commercial fishing of turbot is carried out only with gillnets (selective gears) and no discards or < 45 cm individuals are reported. Consequently, in Romanian waters is very unlikely to achieve the target value for discarded adults (30 ind. x 4 seasons). ** In Bulgaria, only in the case the annual turbot quota is reached and the catch should be partially discarded or in the case the adults in the catch are under the minimum allowed size (45 cm). The proposed sampling intensity is based on the previous observations and cannot be guaranteed due to high uncertainty whether the above mentioned two cases will happen.

Table 3.5.5. Mediterranean horse mackerel in Black Sea; proposal on number of full stomachs to be sampled by type of sampling, quarter and size class.

Biological sampling (landing and discard)	**Full stomachs to sample**		
Quarter	Juveniles*	Adults	Total
I	30	150	180
II	15	75	90
III	30	150	180
IV**	0	0	0
Total biological sampling	**75**	**375**	**450**
Research survey	**Full stomachs to sample**		
	30	70	100
Total survey	**30**	**70**	**100**
Total	**105**	**445**	**550**

*The number of the samples was determined based on previous observations on horse mackerel feeding but also depends on the availability of the species in front of the Bulgarian coast. The presence of horse mackerel along the Bulgarian coast is conditional to the species migration (to/from Marmara Sea) and depends on the season. Hence, the appearance of horse mackerel in the Bulgarian Black Sea waters is sporadic – fact that cannot always guarantee the exact number of the proposed sampling. **Horse mackerel, is present in Romanian waters only at the end of May (for about 2 weeks); in summer it is missing, and it returns in autumn (starting in September). Reported catches are very small (30 tons), only from pound nets. Thus, likely it will be possible to not achieve the target value in summer (quarter III).

Table 3.5.6. Sprat in Black Sea; proposal on number of full stomachs to be sample by type of sampling, quarter and size class.

Biological sampling (landing and discard)	**Full stomachs to sample**	Total
Quarter		
I	200	200
II	200	200
III	200	200
IV	200	200
Total biological sampling	**800**	**800**
Research survey	Full stomachs to sample	
	100	100
Total survey	**100**	**100**
Total	**900**	**900**

Sub-Task 4.1.2 proposed a common procedure of data analysis for identifying and monitoring the main species assemblages and to monitor the species co-occurrence, relative biomass and density over time. This procedure is divided into two phases:

Phase 1: identification and monitoring of the main demersal species assemblages;

Phase 2: analysis of the co-occurrence and relative abundances of the species characterizing each assemblage.

The analyses needed under the Phase 1 are proposed to be performed every three years, while the Phase 2 must be performed every year. Therefore, for the analyses proposed under Sub-Task 4.1.2, the expected costs (expressed as man/days) are the following:

Phase 1 – every three years.

4 man/days technician staff*

5 man/days scientist staff**

Phase 2 – every year.

3 man/days technician staff*

5 man/days scientist staff**

** Technician staff: data check, preparation of matrices*

***Scientist staff: data analysis, synthesis and reporting*

The proposal of a new regional sampling programme focussed on the monitoring of the by catch of vulnerable species developed under Task 4.1.3 was based on three case studies. The approaches and methodologies proposed can be generalized to other areas and fisheries.

The case studies that we considered for the preparation of Deliverable D4.3 are the following:

1. Demersal OTB fishery targeting European hale and deep-water rose shrimp in GSA07: this fishery is performed by French and Spanish vessels;
2. Demersal OTB fishery targeting European hake, red mullet and Norway lobster in GSAs 17 and 18: this fishery is performed by Slovenian, Croatian and Italian vessels;
3. Beam trawl fishery targeting Rapana whelk in GSA29: this fishery is performed by Bulgarian and Romanian fleets.

In the case study 1, we recommend to cover at least the 10% of the fishing days using the self-sampling approach. According to effort data available on the JRC Dissemination Tool (https://stecf.jrc.ec.europa.eu/data-dissemination), Spanish trawlers perform around 2500 fishing days per year in GSA07, while French trawl fleets perform around 11000 fishing days per year in GSA07 (these estimates are computed considering the period 2014-2016).

Considering an average fishing days per vessel per year of 150, it is recommended to monitor by means of self-sampling (through log book) 4 Spanish trawlers and 10 French trawlers. This sampling scheme would allow covering a considerable number of fishing days, higher than the expected target of 10%, thus compensating for possible low response or continuity in the compilation of data by some fishermen.

By catch monitoring programme in OTB fisheries in GSA 07. Task allocation to Member States.

	FRA	SPA
Log-book (n. of vessels)	10	4

Costs allocation to Spain:
18 man/days technician staff*
Costs allocation to France:
35 man/days technician staff*

** Technician staff: training to fishermen, management and coordination of self-sampling, data entering*.

In the case study 2, taking into account the optimal range of coverage suggested by FAO (2009) and ACCOBAMS (2010), we recommend covering the 5% of fishing days by means of self sampling (distribution of log books to the fishermen). If we consider an average of 60000 fishing days per year performed in GSA17 and 50000 in GSA18 by Italian trawl fleets (estimates are computed considering total fishing days in the period 2014-2016), taking into account an average of 120 fishing days per year per vessel (in the Adriatic Sea, Italian trawlers work for 4 days per week, thus the number of fishing days is lower than in other areas), a total of 30 vessels should be monitored in the GSA17 through the distribution of logbooks, and 25 vessels in GSA18. In Croatia, considering an average of 35000 fishing days per year, the monitoring through self-sampling by means of logbooks should include 15 vessels to be monitored for the entire year. As concerns Slovenia, considering an average fishing activity by trawlers of 1500 fishing days, we recommend monitoring 2 vessels by means of self-sampling through logbooks over the entire year.

By catch monitoring programme in OTB fisheries in GSAs 17-18. Task allocation to Member States.

		ITA	HRV	SVN
GSA 17	**Log-book (n. of vessels)**	30	15	2
GSA18	**Log-book (n. of vessels)**	25	-	-

Costs allocation to Italy:
GSA 17: 80 man/days technician staff*
GSA 18: 70 man/days technician staff*

Costs allocation to Croatia:
45 man/days technician staff*

Costs allocation to Slovenia:
12 man/days technician staff*

** Technician staff: training to fishermen, management and coordination of self-sampling, data entering*.

In case study 3, we propose to implement the monitoring of the by catch of the beam trawl fisheries targeting Rapana whelk (*Rapana venosa*) in the Black Sea. Taking into account that this fishery is performed during a limited fishing season (from May to mid-October) by a limited number of vessels, we believe it will be feasible reaching the target of 7% that is considered as the upper limit of the optimal range in terms of coverage of fishing activities under the framework of the monitoring of the by catch of vulnerable species (FAO, 2009; ACCOBAMS, 2010).
The proposed sampling scheme consists of 10 fishing days covered by fleet observers on Bulgarian vessels, and 15 fishing days on Romanian vessels. We propose to distribute the log-books (to be filled in by

fishermen during each fishing day performed over the Rapana whelk fishing season) to 4 vessels in Bulgaria and 6 vessels in Romania.

By catch monitoring programme in Rapana whelk beam trawl fisheries in GSA 29. Task allocation to Member States.

	ROM	BUL
Log-book (n. of vessels)	6	4
Observations on board (days)	15	10

Costs allocation to Romania:
30 man/days fleet observers*
22 man/days technician staff**

Costs allocation to Bulgaria:
20 man/days fleet observers*
18 man/days technician staff**

** 2 man/days for each day at sea, considering trip planning, travelling, etc.*
*** Technician staff: training to fishermen, management and coordination of self-sampling, data entering*.

3.6. WORK PACKAGE 5 - SMALL-SCALE FISHERIES AND RECREATIONAL FISHERIES

WP5 Chair: F. Grati (CNR-ISMAR); Co-chair J. Dulcic (IOF)
Partners involved: CNR-ISMAR, IOF, CIBM, COISPA, NISEA, FRI, DFMR, IEO, IO-BAS, NIMRD, REVIVO.
Core team: P. Carbonara, L. Casciaro, M. Gambino, B. Guijarro, E. Koutrakis, S. Kyparissis, V. Maximov, T. Papadopulos, P. Pengal, V. Raykov, P. Sartor, M. Sbrana, I. Thasitis
Duration: 12 months, from March 2018 to March 2019

Milestones
M5.1 Inputs from WP2 (May 2018)
M5.2 Review of the availability, quality and existing data gaps for SSF and RF in four case studies (June 2018, postponed to August 2018)
M5.3 Proposal of areas of regional cooperation for SSF and RF (March 2019)
Deliverables
D5.1 Report on the availability, quality and existing gaps of transboundary data for SSF and RF in the CSs in relation to a regional perspective in the Mediterranean and Black Sea (F. Grati, October 2018)
D5.2 Guidelines on the best practice methodologies for sampling, processing, analysing and managing biological and spatial data on SSF and RF (F. Grati, J. Dulčić, S. Matic-Skoko and P. Pengal, March 2019)

Description of work
WP5 performed an exploratory analysis aimed at identifying the available knowledge on Mediterranean and Black Sea small scale fisheries (SSFs) and recreational fisheries (RFs). This analysis was carried out

taking into account four case studies areas: north-western Mediterranean Sea, Adriatic Sea, Aegean Sea, and Black Sea.

For each MS included in the four case studies a thorough review of the information available on SSFs and RFs was performed, in terms of number of vessels, number of fishermen, target species, gears used, catches, etc. This information is described in more detail in Deliverable D5.1 "Report on the availability, quality and existing gaps of transboundary data for SSF and RF in the CSs in relation to a regional perspective in the Mediterranean and Black Sea" (Annex XV).

According to the review performed under WP5, SSFs and RFs are important economic and social activities in the Mediterranean and Black Sea. Unlike large-scale fisheries, official statistics are often limited for SSF, and they are often missing for RF. In some cases, these are a minor part of the total international harvest, but in other cases their contribution to total catch is substantial. SSF and RF are important in nearly all countries of the Mediterranean and Black Sea, but they seem to be trapped in a vicious cycle where due to incompleteness and lower quality of existing data, systematic lower importance was assigned to them compared to large-scale fleets. Although the value generated from the first sale of fish products from Mediterranean and Black Sea fisheries may seem relatively small compared with other sectors, the sector involves some of the most economically vulnerable communities in the region, making it a key player for sustainable development.

Furthermore, WP5 provide guidelines on the best practice methodologies for sampling, processing, analysing and managing catch, biological and spatio-temporal data of SSF and RF. This work is summarized in Deliverable D5.2 "Guidelines on the best practice methodologies for sampling, processing, analysing and managing biological and spatial data on SSF and RF" (Annex XVI). Regional coordination of SSF and RF data collection programmes is needed to ensure that end users are provided with the catch estimates and the other data at the required spatial resolution, temporal coverage, and quality to support scientific advice and management. Coordination among the lead scientists in each country, the Regional Coordination Groups, and the ICES Working Group on Recreational Fisheries Surveys and the ICES Working Group on Commercial Catches (as technical expert advisory groups) is fundamental.

Besides an exhaustive list of best practice procedures for the data collection in SSF, the contribution of WP5 is represented by the novel approach aimed at mapping the spatial distribution of small-scale fisheries fishing effort through a participatory approach with fishermen. This simple method represents the first attempt to draw maps for the main métiers of small-scale fisheries in the Mediterranean and Black Sea. The outcomes of this method (e.g. maps of fishing effort per métier) can be used by MS and end users to improve the knowledge on the spatio-temporal distribution of SSF fishing effort. Furthermore, spatial conflicts with other human activities (e.g. trawling, tourism, wind farms, etc.) can be addressed by means of marine spatial planning and integrated coastal zone management. In addition, this approach can provide useful information on the spatio-temporal distribution of adults of demersal species, such as European hake and common sole, that are targeted by SSF (e.g. gill and trammel nets, and also longlines for hake). This information would be beneficial for both scientific advice and management.

Part of the work under WP5 was implemented in synergy with the activities of the Workshop on Recreational Fisheries organized under the umbrella of the RCG Med&BS. In fact, the Regional Co-ordination Group Meeting for the Mediterranean and Black Sea 2018 (RCG MED&BS, Kavala, 17/09/2018 -

21/09/2018) recommended to organize an *ad hoc* workshop on recreational fisheries. The proposed Terms of Reference were: a) review of pilot studies implemented in EU MED&BS MS; b) presentation of the outcomes of the STREAM project; c) Assessment of the share of catches from recreational fisheries in relation to commercial catches for all species in the Mediterranean and in Black Sea; d) Design of national surveys of recreational fisheries, including list of species and thresholds for data collection for the future EUMAP (2020 and onwards). The workshop was held at CNR premises in Ancona (Italy), 15-16th April, and chaired by Fabio Grati (CNR, STREAM WP5 leader). Furthermore, STREAM WP5 was implemented in synergy with the work performed by GFCM in the preparation of a manual on data collection in RFs, and took the advantage of the preliminary results of pilot studies on RF performed under the National Programmes of five MSs (namely Italy, Spain, Greece, Cyprus and Malta).

Despite this, it was acknowledged that the information available on RFs in the Mediterranean and Black Sea region is still limited and fragmented. Therefore, an approach based on the further implementation of pilot studies on RFs under the new EU MAP is considered more appropriate and precautionary to gather the information and filling the gaps that shall allow designing and implementing full work plans on the collection of data in RFs in the future. This proposal was presented and discussed (along with the other outputs of the STREAM project) at the RCG Med&BS meeting held in Madrid, 11-12 June 2019, and found the agreement of the RCG Med&BS members. The outcomes of pilot studies will form the basis for the design and implementation of work plans for regular data collection on RFs.
In the light of the work done in WP5, and taking into account the outcomes of the workshop on recreational fisheries organized under the umbrella of the RCG Med&BS and the preliminary results of the pilot studies on RFs, the following steps can represent the basis for drafting a roadmap for future work on RFs:

- ✓ It is recommended to create national databases for RF (i.e. registration systems) for all fishing modes (e.g. shore fishing, boat fishing and underwater fishing) to identify the population (statistical universe) of recreational fishers. The registration system shall be linked to an obligation to report catch and effort data in logbooks (either electronic or on paper). National databases of fishers should be designed in a way that an exhaustive number of information are stored in a rational way and constantly updated. If no national databases of fishers are available, then screening surveys (e.g. household telephone surveys, face to face interviews) could be good techniques to collect data of the population (e.g. participation rates, fishing modes, avidity, etc.). A way to reduce the costs is to associate such surveys focused on RFs with other survey already in place for other targets.
- ✓ The methodology for data collection (sampling strategy) shall be identified and adapted to the specific situation within each MS. Design of national surveys can include a variety of sampling strategies, but the methodology should be based on statistically sound principles and include an assessment of quality (e.g. GFCM “handbook”/guidelines; ICES WGRFS Quality Assessment Toolkit). The following list ranks the available methodologies:

1) Onsite surveys: expensive and requiring a great sampling effort, but they can provide precise information on catches and fishing effort. If not correctly designed and implemented, they can be provide misleading results;

2) Logbooks/diaries: efficient if fishers are collaborative and motivated. Logbooks data can be recorded by means of paper templates or smartphone apps;
3) Recall surveys: easy to carry out but they have significant issues and biases. Some examples show that they could be used to collect basic information, when other sampling strategies are not available;
4) Smartphone apps: specifically developed as logbook registration, they include a family of tools (i.e. electronic logbooks, catch records, etc.), and have been used worldwide to collect RFs data. It is recommended they are carried out in parallel with other survey techniques (i.e. logbook, onsite surveys, etc.);
5) Elicitation techniques: by means of Local Ecological Knowledge or a participatory approach with fishers, they can be used as a preliminary approach. It is recommended they are carried out in parallel with other survey techniques (i.e. logbook, onsite surveys, etc.).

- ✓ Data should be collected for all the species caught by RFs, fishing effort, expenditures, fishing modes, catch-and-release. IUU catches could be explored by adjusting the collected data by means of information gathered among collaborative fishers.
- ✓ Concerning the issue of fishers involvement and participation, it is recommended to involve fishing associations in data collection. Doing this can enhance participation, improve quality of data and ensure acceptance of the results.

In light of this, we propose a roadmap listing the steps that shall be taken by MSs to implement pilot studies on RFs in the new EU MAP. In doing this, we hypothesized the implementation of the new EU MAP for a 6 years time (2020-2025), before further revision.

Table 3.6.1 – Roadmap towards implementation of RF data collection in the Mediterranean and Black Sea.

	Step	**Aim and description**	**Responsible**	**Estimated duration**	**Timing**
1.	Preparation o pilot study	Determine the recreational fishers population structure, effort and target species/catches to enable selection of the best methodology	MS National Focal Points	1 year	2020
2.	Execution of pilot study	Implementation of the selected methodology for monitoring RFs	MS National Focal Points	2 years	2021-2022
3.	Revision Workshop	Evaluate the efficiency and adequacy of the monitoring and implement adaptations if necessary	RCG/ MS National Focal Points	1 week	End of 2022
5.	Regional work plan on RFs	Implementation of a regional programme on RFs	RCG/ MS National Focal Points	3 years	2023-2025

A proactive cooperation with the other grants funded under MARE/2016/22 (namely FishPi[2] and SECFISH) has been implemented regarding recreational fisheries. The three WP leaders attended the ICES Working Group on Recreational Fisheries Surveys (WGRFS), which was held at the University of the Algarve, Faro,

Portugal during 11-15 June 2018. This was a unique occasion for the three WP leaders to share common views and agree on a strict collaboration for the projects implementation.
Furthermore, the three WP leaders are working on a common document on data collection needs for recreational fisheries in European waters. This initiative will provide useful insights in the view of the revision of the EU MAP.

3.7. WORK PACKAGE 6 - PROCEDURES TO ASSESS THE QUALITY OF BIOLOGICAL DATA STORED AT REGIONAL LEVEL

WP6 Chair: G. Tserpes (HCMR); Co-chair: P. Carbonara (COISPA)
Partners involved: HCMR, COISPA, CIBM, CNR-ISMAR, FRI, IEO, DFMR, IOF, IO-BAS, NIMRD.
Duration: 13 months, from March 2018 to April 2019

The aim of WP6 was to propose procedures for improving data quality checks and develop a practical framework for detecting and flagging potential sources of bias in biological data at national and regional level.

Description of the work
To fulfil these objectives, WP6 was organized in three tasks:
Task 6.1 Agree on a set of national data quality assessments
Task 6.2 Agree on a set of regional data quality assessments
Task 6.3 Annual calendar for the data checks

Task 6.1 – Agree on a set of national data quality assessments
Responsible M.T. Facchini in cooperation with T. Zaharia
Partners involved: HCMR, COISPA, CIBM, CNR-ISMAR, FRI, IEO, DFMR, IOF, IO-BAS, NIMRD.
Core team: I. Bitetto, C. Charilaou, G. Daskalov, A. Esteban, A. Ligas, E. Mantzouni, A. Santojanni, G. Scarcella, S. Somarakis, N. Vrgoc,
Duration: 13 months, from March 2018 to April 2019.

Deliverables
D6.1 Compilation and classification of quality checks at the national level (I. Bitetto, A. Ligas, G. Tserpes and M.T. Spedicato, March 2019)

The objective of Task 6.1 was to identify areas for regional cooperation and harmonization within the Mediterranean and Black Sea and agree on the necessary data quality assessments at the national level in consultation with Member States and end users.
Within the Task, existing quality checks, such as those included in the COST libraries (i.e. SDEF Quality package), those developed by MARE/2014/19 Med&BS and FishPi for the automatization and standardization of data transmission and checking, and other procedures recently reviewed in the STECF

EWG 17-04 (e.g. ICES 2013c; GFCM 2017) have been taken into account in order to identify shortcomings and propose innovative approaches and additional modules that should be developed in order to improve the current situation and satisfy specific requirements of stock assessment.

STREAM Task 6.1 developed *a priori* and *a posteriori* quality checks at national level with the aim of implementing standard procedures to detect both errors in raw data and those in the raised data required by end-users.

A priori quality checks are aimed at enhance the detection of errors in biological variables (length, maturity, individual weight, sex, age) directly in raw data stored in the RCG CS format (the same used in STREAM WP3).

A posteriori quality checks work on the Med&BS Data Call formats, focusing on providing information on the spatial coverage among the strata (i.e. quarter, metier) and on the assessment of the completeness of biological information. It was decided to develop *a posteriori* quality checks on this format as *ad hoc* conversion scripts from this format to the FDI and GFCM Data Call formats were implemented under STREAM Task 3.2.

The R script developed to perform the a priori quality explore the following aspects:

- consistency of length-frequency distributions (LFDs) by year and commercial category: the sampled LFDs by year and commercial categories are plotted as histograms. The minimum and maximum length in the data are reported in a summary table, together with the trip/s code where lengths outside the allowed range (specified by the user) are detected;
- consistency of length-weight relationships with allowed ranges (specified by the user): the scatter plot of the length versus the individual weight by sex and year is reported. The minimum and maximum weight in the data is also reported, together with the trip of which records (if any) with individual weight outside the allowed range were detected.
- consistency of age-length relationship and consistency with allowed range: the scatter plot of the age versus the length by sex and year is reported. The trip of which records (if any) with age outside the allowed range were detected are reported together with a summary table reporting the number of age measurements by year and length class in the dataset;
- check consistency sex and maturity stage: the scatter plot of the length versus the maturity stage by sex and year is reported. Two summary table respectively reporting the number of sex and maturity measurements by year and length class are also reported. The maturity ogives estimated by sex are finally reported aggregating all the maturity data available in the dataset.

The R script for the a posteriori data quality checks works on the following tables:

- Catch (catch by age);
- Landing (landing by length);
- Discard (discard by length);
- ML (maturity at length);
- MA (maturity at age);
- SL (sex ratio at length);
- SA (sex ratio at age);
- ALK (age-length key);
- GP (Growth parameters).

The implemented checks concern specifically the:

1. Temporal and spatial coverage in all the tables: summary tables are automatically reported in a report in word format to ease the evaluation of the spatial and temporal coverage of all the relevant tables;
2. Sum of products in Catch table: the records with a sum of products differing more than a given (it can be modified by the user) threshold are identified and shown in report;
3. Comparison among the years for ML, SL, MA, SA tables through plots overlapping the available years.

The R scripts for the *a priori* and *a posteriori* data quality checks are described and explained in much more detail in the Deliverable D6.1 (see Annex XVI). D6.1 provides guidelines on how to use the R scripts that are applied on two case studies: red mullet in GSA18 (MUT18) and deep-water rose shrimp in GSA9 (DPS9).

Scientists from the STREAM Consortium attended the meeting of WP6 of the FishPi^2 grant in October 2018 at Port-en-Bassin (France). A common workplan was agreed and will lead to the development of an R library on the CRAN (CLEF-RDB, standing for Core Library for Ecosystem and Fisheries data in the RDB) containing a DB basic structure and the main methods to handle the data with a set of functions for quality checks. Following the discussion and decisions made during the face-to-face meeting in Port-en-Bessin, an attempt was made to apply the same functions of the CLEFRDB library to the RCG CS format to create simple Time, Landing and Space objects and show how to apply that library also in Mediterranean and Black Sea context. This application is described in details in Deliverable D6.1 (see Annex XVII).

Task 6.2 – Agree on a set of regional data quality assessments

Responsible P. Carbonara in cooperation with A. Massaro

Partners involved: HCMR, COISPA, CIBM, CNR-ISMAR, FRI, IEO, DFMR, IOF, IO-BAS, NIMRD.

Core team: G. Daskalov, A. Esteban, I. Isajlovic, E. Mantzouni, V. Maximov, A. Santojanni, G. Scarcella, I. Thasitis, G. Tserpes, C. Viva, W. Zupa

Duration: 13 months, from March 2018 to April 2019.

Milestones

M6.1 Compilation of available ALK data (July 2018)

M6.2 Workshop on ALKs and age reading (March 2019)

Deliverables

D6.2 Guidelines and tools for harmonizing and coordinating age readings (P. Carbonara and A. Massaro, April 2019)

The work performed under Task 6.2 has been implemented taking into consideration two case study species: red mullet, *Mullus barbatus*, and common pandora, *Pagellus erythrinus*. In particular, the work was focused on the age data and two main actions were implemented:

- identification of the main drivers influencing the variability in the age data of red mullet, predict missing values and estimate uncertainty linked to the sampling strategy;
- improvement and harmonisation of ageing approach and protocols in common pandora.

Information about age composition is useful because it can be used to draw inferences about mortality and growth rates, fishery selectivity, relative cohort strength, and other demographic processes useful to stock assessment and management. However, age information is often costly to obtain. These high costs force many sampling programs to limit the number of fish aged directly, and to rely on age-length keys (ALK) or on age slicing from growth parameters to estimate the age composition of the stock and/or catch. The use of ALKs or age slicing procedures to provide an unbiased age composition estimate of the sample requires that aged fish are representative of the population.

Following the Data Sharing Agreement (Deliverable D3.1, see Annex VII of this report), a Data Call was prepared and launched in collaboration with the project partners involved in the task, specifying data types, data formats and metadata (see D3.1, Annex VII). The age data of red mullet were requested together with the data regarding the biological characteristics of each specimen (sex, sexual maturity, weight), data on the age scheme (birth date, margin type), and ageing criteria (number of false ring considered). Also information on reader experience was requested. Data on sampling scheme stratification (e.g. sex, length class, type of hard structures, number of structures per strata) were also requested.

The data obtained by the project partners and/or by a specific data-call addressed to the DCF National Corresponds about the age sampling strategy coming from: Spain, France, Italy, Malta, Croatia, Greece, Cyprus and Bulgaria. No red mullet age data were available for Slovenia and Romania.

The evaluation of the sampling strategy was carried out in terms of precision. The precision of ALKs expressed in terms of coefficient of variation (CV) (Baird, 1983) was estimated in a case of study (red mullet in GSA 18) assuming two sampling strategies: annual and quarterly based, both stratified by length class and sex. The results, obtained using the BioSim Tool developed by WP3, showed that the CV was <4% when at least 8 and 4 otoliths by sex and 0.5 cm length class respectively for the annual and quarterly based strategies.

Poor quality ageing data have also contributed to misleading evaluation of the population status in certain cases, sometimes resulting in the stock collapse. For these reasons, an increasing effort has been devoted during the last decades to improve the age data quality (ICES, 2011; 2013), especially in the context of the European Union Data Collection Framework (DCF), which is implementing ageing exchange exercises and workshops on the ageing of the most important species in the European fisheries (ICES, 2018). In this context, a common ageing protocol could be an important tool to decrease the relative/absolute bias and improve the precision (reduce CV and increase the percentage of agreement) in age determination, and increase the reproducibility among the age readers of the different laboratories (PGCCDBS, 2011).

In order to reach this goal, it is useful to assess the effect of the specific factors (i.e. theoretical birth date, ageing criteria, age scheme, reader's experience) influencing the age reading variability using a multi-parameter approach (Principal Component Analysis). This analysis represents the first step to standardize the reading protocols to obtain unbiased ALKs in red mullet. According to the results of the analyses performed under Task 6.2, the geographical location was found as the most important factor, influencing significantly the age variability, with Longitude (west-east) more correlated with variability than Latitude (north-south). The reader's experience was identified as an important factor affecting the ageing variability, especially when we compared the results of High and Medium *vs* Low experience readers. Reader experience emerged as a key issue in estimating the age mostly in the first year as well as the oldest age groups (4 years).

The results of the present analysis confirm previous studies on the high variability, occurring in the age and growth of red mullet (ICES, 2011; 2012; 2013; Carbonara et al., 2018), and further stress the need of a handbook clarifying and standardizing ageing schemes (e.g. birth date), ageing criteria (e.g. number of false rings before the first winter growth increment) and preparation methods. Being the reader experience the most important factor in explaining the huge variability in the age data in the Mediterranean basin, workshops, age exercises and exchanges are considered fundamental for improving the precision in red mullet age analysis. All these actions can be an important contribution to overcoming the ageing uncertainties, thus providing accurate and robust input data for stock assessments.

As concerns the second case study species, common Pandora, the exchange exercise was based on a total of 339 specimens sampled from 2015 to 2017 in three Mediterranean sites: Tyrrhenian Sea, Adriatic Sea and Aegean Sea. The pictures of otoliths were prepared following a common procedure. For all the samples, whole otoliths were used, while otolith sections were prepared from a sub-sample of 49 individuals. The results of the otolith exchange exercise in terms of percentage agreement (PA), coefficient of variation (CV) and average percent error (APE) were respectively 57.2%, 37.6% and 33.5%. These values are respectively lower and higher than those considered acceptable: 80% PA and 20% CV (PGCCDBS, 2011). The analysis of the precision indices by age group showed a negative trend from the first age group to the oldest ones. In addition, the bias analysis highlighted an underestimation in the oldest age groups, and an overestimation in the first age groups (0-5 years). These results could be explained by the difficulties in recognizing growth increments in the oldest fish (age > 5 years) due to the overlapping of the rings.

The comparison of the age estimations between the two preparation methods (whole otoliths *vs* otolith sections) showed that a higher precision was obtained using the otolith sections. In addition, more age groups were identified using otolith sections.

The Workshop on age reading of common pandora (Milestone 6.2, in cooperation with WP7) was held at CIBM premises in Livorno (Italy), 26-28 March 2019. Seven age readers from 2 countries and 4 laboratories (COISPA, University of Cagliari, CIBM, and HCMR) participated in this workshop.

During the workshop, a common protocol for otolith collection, conservation and thin section preparation was agreed. These aspects are considered fundamental to reduce the risk of bias in age determination. The results of the exchange exercise and the workshop pointed out that for large specimens (> 30 cm of TL) the otolith thin section preparation must be recommended. A discussion on the most appropriate ageing scheme took place; it was agreed that if the objective is to construct an ALK, the age scheme with a 1-year resolution is considered more useful, while for growth curve calculation, the age scheme with 0.5 year resolution is considered more suitable. Furthermore, a reference collection of 66 common Pandora otolith images was agreed.

The analyses performed on the age variability in red mullet and the procedures set up for the implementation of an exchange exercise and a workshop on the ageing of common Pandora will represent common procedures to be extended to other species with the aim of checking the quality of age data in the view of stock assessment benchmark. In fact, one of the crucial aspects in benchmarking stock assessment is defining and agreeing on their age-length keys and growth patterns.

The work developed under STREAM Task 6.2 represented an example of cooperation in the context of the DCF among the laboratories from different Member States. In the light of the results of the two case studies tackled under Task 6.2, the following recommendations can be inferred:

- The analyses performed on red mullet allowed evaluating the most important drivers influencing the variability in the age analysis. These analyses can represent a first step towards the standardization of ageing protocols aimed at deriving unbiased Age-Length Keys (ALKs). It is recommended to extend this type of analysis to all the species for which age data are requested. Furthermore, it is recommended to perform the evaluation of the sampling intensity for age data using the BioSim Tool developed by STREAM WP3;
- It is recommended that new exchange exercise and workshop on common Pandora be planned within three years to assess the effects of the common protocols and procedures developed under STREAM Task 6.2 on the ageing accuracy and precision in common pandora;
- The work performed by Task 6.2 allowed establishing procedures (with particular reference to the use of the SmartDots tool) for the organization of exchange exercise and workshop on age reading. Those procedures can be applied and extended to other species. For priority species, the time scheduled for those exchanges and workshops can be designed according to the GFCM benchmark assessment plan, with the exchange and workshop on age determination to be performed 1 year before the benchmark assessment. Those activities can be performed under the umbrella of RCG, with the active involvement of the main end-users (GFCM and STECF) in order to streamline the communication and use of the results.

Following the benchmark program designed by GFCM, a possible scheme for the organisation of exchange exercises and workshops on ageing is proposed below:

		2019								2020											
Species	**Areas**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
European hake	17-18																				
European hake	rest of Med																				
Red mullet	17-18																				
Red mullet	central & eastern Med																				
Anchovy	17-18																				
Sardine	17-18																				
Sardine	west Med																				
Red seabream	west Med																				

The work performed and the results achieved under Task 6.2 are described in more detail in the Deliverable D6.2 “Guidelines and tools for harmonizing and coordinating age readings”, that is attached to the Draft Final Report as Annex XVIII.

Task 6.3 – Annual calendar for the data checks

Responsible G. Tserpes in cooperation with A. Ligas

Partners involved: HCMR, COISPA, CIBM, CNR-ISMAR, IEO, DFMR, IOF, IO-BAS, NIMRD.

Core team: G. Daskalov, A. Esteban, G. Lembo, V. Raykov, V. Maximov, G. Scarcella, M. Sbrana, I. Thasitis, N. Vrgoc, M. Yankova

Duration: 11 months, from May 2018 to April 2019.

Milestones

M.6.3 Calendar for national and regional quality checks (April 2019)

Deliverables

D.6.3 Detailed calendar for national and regional quality checks (Responsible G. Tserpes, April 2019)

The objective of Task 6.3 was to develop and propose a detailed calendar for national and regional checks. A first draft of the calendar was presented and discussed with Member State National Correspondents and stakeholders during the STREAM Knowledge Exchange Workshop (Rome, 11-12 April 2019), and the proposed final version of the calendar took into account their comments and suggestions.

In order to allocate sufficient time to validate and process the data at regional level to respond to the Med&BS EU Data Call, all checks at the national level must be completed by the end of April. A potential extension of national checks in May is possible in cases where regional checks are not foreseen. To ease the whole process, Member States should run the quality checks and validate national data on a quarterly basis, as shown in Table 3.7.1. The national quarterly checks realized within the sampling year refer to the *a priori* checks; the last *a priori* check is foreseen by February in order to allow more time for completing the data entry of the previous year, as well as minor overall checks and corrections. The following checks to be performed in the year *X + 1* concern the *a posteriori* checks applied to the raised samples before submission. Checks at regional level can also be performed using similar procedure as the *a posteriori* checks.

Table 3.7.1. Proposed scheme for data quality checks at the national and regional level.

	Year *X*												Year *X + 1*				
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5
National checks																	
Regional checks																	

a priori
a posteriori
possible extension for *a posteriori* checks (see text)
regional checks (*a posteriori* checks)

The Deliverable D6.3 is attached to the Draft Final Report as Annex XIX.

3.8. WORK PACKAGE 7 - TRAINING OF MEMBER STATE EXPERTS

WP7 Chair: C. Charilaou (DFMR); Co-chair: M.T. Facchini (COISPA)
Partners involved: DFMR, COISPA, CIBM, CNR-ISMAR, NISEA, HCMR, FRI, IEO, IOF, IO-BAS, NIMRD, REVIVO.
Core team: I. Bitetto, B. Guijarro, A. Ligas, M. Panayotova, P. Sartor, G. Scarcella, G. Tserpes, M. Yankova
Duration: 12 months, from April 2018 to April 2019

Milestones

M7.1 Mapping of available expertise in the region (July 2018)

M7.2 Completion of Workshops (March 2019)

Deliverables

D7.1 Report of the outcomes from the training workshops related to the proposed regional sampling plan (Responsible C. Charilaou and M.T. Facchini, April 2019)

Description of the work

The objective of Work Package 7 was to ensure that Member State (MS) experts were trained on the main outcomes resulting from the previous STREAM Work Packages (1-6), through the organization of relevant technical workshops. In order to organise such workshops, all institutes in the Mediterranean and Black Sea involved in biological data collection activities were identified. An *ad hoc* questionnaire was circulated to all identified institutes, for collecting information on their available expertise in key aspects of the proposed regional sampling, as well as possible training needs.

A draft list was prepared listing the relevant institutes, by reviewing information from Member States DCF websites, Annual Reports, National Programmes and Work Plans. This draft list was finalised following communication with the relevant National Correspondents and STREAM partners. In total, 29 institutes involved in biological sampling were identified in the region, all of which received the *ad hoc* questionnaire; 20 institutes from all MSs responded to the questionnaire.

The questionnaire requested basic information on the institute and its relevant fields related to biological data collection. Questions were set at institutional level and were related with the planned work and deliverables under STREAM Work Packages 3, 4, 5 and 6. Particularly, questions involved the following themes:

- General Regional Sampling;
- Sampling design for collection of data from commercial fisheries;
- Sampling program for the collection of data on fisheries- impacts on the ecosystem;
- Collection of data from recreational fisheries;
- Procedures to assess the quality of biological data.

Possible answers included in the questionnaire were “yes”, “partly”, “no”, with possibility to provide relevant comments. The ad-hoc questionnaire was circulated to the 29 institutes of the region, based on the verified list.

The analysis of the received answers allowed the identification of mapping of expertise and training needs in the region. In particular, based on the analysis of the questionnaires received, there is available expertise within the region in the following key aspects:

- Statistical expertise in sampling design and processing of data
- Expertise in programming in R
- IT expertise for the development and management of regional data storage systems
- Expertise in running and interpreting scripts developed in R on sampling optimization
- Expertise in running quality checks on datasets and interpreting outputs in R
- Expertise in stomach analysis
- Expertise on PETS identification, specifically for each category (marine mammals, sea birds, sharks and rays, reptiles)
- High level of experience in age reading.

Moreover, there are institutes with relevant expertise that have reported their availability to participate in the following activities related with regional sampling:

- Participate in a network for developing regional sampling design,
- Participate in a network to develop a regional data storage system
- Provide training on stomach analysis
- Participate in task sharing (receiving samples) for stomach analysis
- Provide training on age reading
- Participate in task sharing (receiving calcified structures) for age reading

The analysis of the *ad hoc* questionnaires revealed also training needs between 60-85% of the institutes in the following activities: Sampling Optimization using R, Quality checks using R, stomach analysis, PETS identification for all categories and Age reading.

The results of the expertise mapping performed under WP7, which allowed identifying the institutes and scientific staff available for providing expertise and training on different aspects of EU MAP, will represent a fundamental support to RCG Med&BS for addressing the needs highlighted by the analysis performed under WP1. The complete list of institutes in the Mediterranean and Black Sea region and the scientific staff identified by the written procedure performed by WP7 is presented in Deliverable D7.1, which is attached to this report (Annex XX).

Following the identification of needs from the analysis of the *ad hoc* questionnaires received, and as foreseen in the STREAM project, namely WP3 and WP6, the following workshops and ageing exchange exercise were organised in collaboration with WP7:

- 1st and 2nd Training Workshops on sampling optimization – use of the SD tool developed by MARE/2016/22 project STREAM (under WP3);
- STREAM otolith exchange exercise on Pagellus erythrinus, followed by a Workshop on age reading of the species (under WP6).

The 1st Training Workshop on Sampling Optimization was organised in parallel with the RCG Med&BS coordination meeting in Kavala Greece, from 18 to 21 September 2018. The training workshop was chaired by Maria Teresa Facchini (COISPA) and was attended by 13 scientists from 6 countries, namely Cyprus, France (offline), Greece, Italy, Romania and Spain (offline).

The training workshop involved both theoretical and practical training on the Sampling Design tools developed under WP3. Practical training included the exploration and analysis of data from 7 case studies, covering Eastern Mediterranean, Black Sea, Strait of Sicily, Adriatic and Ionian Sea fisheries, shown in Table 3.8.1.

Table 3.8.1 - List of case studies developed during the 1st Training Workshop on sampling optimization under MARE/2016/22 project STREAM.

# case study	Area	GSAs	Countries	Fisheries	Species
1	Eastern	22, 23, 25	Greece, Cyprus	OTB_DEF_>=40_0_0,	*M. merluccius* (HKE)

	Mediterranean			OTB_DWS_>=40_0_0	*A. foliacea* (ARS) *M. barbatus* (MUT)
2	Black Sea	29	Bulgaria, Romania	GNS_DEF_>=16_0_0, GNS_DEF_360-400_0_0	*S. maximus* (TUR)
3	Black Sea	29	Bulgaria, Romania	OTM_MPD_>=13_19_0_0, GNS_SLP_>=16_0_0, MDPSP_FPN	*M. barbatus* (MUT)
4	Black Sea	29	Bulgaria, Romania	PTM_SPF_>=20_0_0	*S. sprattus* (SPR)
5	Strait of Sicily	15, 16	Italy, Malta	OTB_DES_>=40_0_0, OTB_DWS_>=40_0_0, OTB_MDD_>=40_0_0	*M. merluccius* (HKE) *P. longirostris* (DPS) *A. foliacea* (ARS)
6	South Adriatic and Ionian sea	18, 19, 20	Italy, Greece	OTB_DES_>=40_0_0, OTB_DWS_>=40_0_0, OTB_MDD_>=40_0_0	*P. longirostris* (DPS) *A. antennatus* (ARA)
7	Adriatic Sea	17, 18	Italy, Croatia, Slovenia	PS_SPF_>=14_0_0 (Croatia, Slovenia), PTM_SPF_>=20_0_0	*E. encrasicolus* (ANE) *S. pilchardus* (PIL)

The available data on the case studies were provided by the MS for the purposes of WP3 work, under the Data Sharing Agreement that was prepared and agreed by the National Correspondents under WP3 (STREAM D.3.1). Participants were assigned to the different case studies in advance of the training workshop, and before receiving any data on their assigned case studies, they were requested to declare that the data would be used only for the purposes of this workshop, and that they will not disseminate and/or use for other purposes any part of these data, in any form. All signed declarations are available at the dedicated STREAM partners sharepoint.

For the practical training, the installation of relevant software (COST libraries, fishPifct package, Sampling Design tools) on participants' laptops was required.

The practical training included the following:

- Conversion of datasets from RCGformat to COST format (*01_RCG_CS_to_COST_CS.Rmd and 02_RCG_CL_to_COST_CL.Rmd scripts*);
- Check of the saved COST objects (costCS.rds and costCL.rds files) through *03_fishPifct_data_check.Rmd* script using FishPict package;
- Correction of data, if required;

- Data investigation - analyses on the past data (04_investigateData.Rmd script);
- Analyses on sampling optimization in terms of trips – obtain an "optimal" sampling size by species based on the analyses of the CV (*05_runOptimizationBYspecies.Rmd script);*
- Preparation of data to be used by the BioSim Tool for the analyses of lengths and biological variables at trip level (*A_data_preparation.R* script);
- Analyses on sampling optimization in terms of number of individuals to be measured (*B_data_simulation_LENGTH.R* script);
- Simulation of alternative sampling design using the results of the previous steps;
- Analyses on sampling optimization in terms of number of individuals to be measured for biological measurements – maturity, sex ratio, age (scripts *C_data_simulation_MATURITY.R, D_data_simulation_SEX-RATIO.R*, *E_data simulation_AGE.R*).

The objective of the training workshop was the participants to become familiar with the SD tool, run the different scripts developed and define the settings of the case studies for the different scripts, in order to obtain draft results. As noted during the workshop, additional work could be required after the workshop to produce final results. Indeed, during the workshop no final results were produced and for some case studies there was no time for running all available scripts. Participants were invited to continue their work in analyzing their case studies and become familiar with the whole SD tool also after the training workshop, with the guidance of the chair and the provision of a manual for performing the analysis. Information on the progress achieved on the case studies during the workshop, and following additional work if it was possible for the participants, is provided below in Table 3.8.2.
The final data used for the case studies are available at the dedicated STREAM partners sharepoint, in the folder created for the Training Workshop. As stated in the relevant Data Sharing Agreement (STREAM D.3.1), the data will be provided to the RCG Med&BS chairs.

Table 3.8.2 - Summary information on the progress achieved and further work required on case studies developed during 1st Training Workshop on sampling optimization under MARE/2016/22 project STREAM.

# case study	**Information on progress achieved**	**Further work required for finalization of case study**
1	Case study was finalized, and is presented in Deliverable 3.3.	--
2	Case study was initiated and the COST objects were produced, but there was no progress after the training and no draft report was available.	Substantial work is required for developing and finalizing the case study, which could be carried out by the RCG Med&BS network on sampling optimization.
3	Case study was finalized, and is presented in Deliverable 3.3.	--
4	The data in the RCG formats were provided, but the case study was not initiated.	Substantial work is required for developing and finalizing the case study, which could be carried out by the RCG Med&BS network on sampling optimization.
5	Case study was developed, with draft results available at the STREAM partners sharepoint.	The preliminary results obtained should be evaluated by the RCG Med&BS, in order to eventually carry out other simulations and to finalize the case study.
6	Case study was developed, with draft results available	The case study is almost complete. The RCG

	at the STREAM partners sharepoint.	Med&BS should only evaluate the results and finalize the case study.
7	Case study was finalized and is presented in Deliverable 3.3.	--

The 2nd Training Workshop on Sampling Optimization was organised in Bari Italy, from 1 to 4 October 2018. The training workshop was chaired by Maria Teresa Facchini and Isabella Bitetto (COISPA) and was attended by 9 scientists from 4 countries, namely Bulgaria, Croatia, Italy and Spain.

The training workshop involved both theoretical and practical training on the Sampling Design tools developed under WP3. Practical training included the exploration and analysis of data from 8 case studies, covering Western Mediterranean and Adriatic Sea fisheries, shown in Table 3.8.3.

Table 3.8.3 - List of case studies developed during the 2nd Training Workshop on sampling optimization under MARE/2016/22 project STREAM.

# case study	Area	GSAs	Countries	Fisheries	Species
1	Western Mediterranean	1, 2, 5, 6, 7, 8	Spain, France	OTB_DEF_>=40_0_0, LLS	*M. merluccius* (HKE) *P. longirostris* (DPS)
2	Western Mediterranean	9, 10, 11	Italy	OTB_DEF_>=40_0_0, OTB_MDD_>=40_0_0, LLS, GNS	*M. merluccius* (HKE) *P. longirostris* (DPS) *N. norvegicus* (NEP)
3	Western Mediterranean	1, 2, 5, 6	Spain	OTB_DWS_>=40_0_0	*A. antennatus* (ARA)
4	Western Mediterranean	9, 10, 11	Italy	OTB_DWS_>=40_0_0, OTB_MDD_>=40_0_0	*A. antennatus* (ARA) *A. foliacea* (ARS)
5	Western Mediterranean	1, 2, 5, 6, 7	Spain, France	PS_SPF_>=14_0_0	*E. encrasicolus* (ANE) *S. pilchardus* (PIL)
6	Western Mediterranean	9, 10, 11	Italy	PS_SPF_>=14_0_0	*E. encrasicolus* (ANE) *S. pilchardus* (PIL)
7	Adriatic Sea	17,18	Italy, Croatia, Slovenia	OTB_DEF_>=40_0_0, FPO_DEF_0_0_0 (Croatia)	*M. merluccius* (HKE) *M. barbatus* (MUT) *N. norvegicus* (NEP)
8	Northern Adriatic	17	Italy, Croatia, Slovenia	TBB_DEF_0_0_0, GNS_DEF_>=16_0_0, GTR_DEF_>=16_0_0 (Croatia)	*Solea solea* (SOL)

As in the case of the 1st Training Workshop, the available data on the case studies were provided by the MS for the purposes of WP3 work, under the Data Sharing Agreement that was prepared and agreed by the National Correspondents under WP3 (STREAM D.3.1). Participants were assigned to the different case studies in advance of the training workshop, and before receiving any data on their assigned case studies, they signed their declarations on the use of the data only for the purposes of this workshop; all signed declarations are available at the dedicated STREAM partners sharepoint.

During the workshop, no final results were produced and for some case studies there was no time for running all available scripts. Participants were invited to continue their work in analyzing their case studies and become familiar with the whole SD tool also after the training workshop, with the guidance of the chair and the provision of a manual for performing the analysis. Information on the progress achieved on the case studies during the workshop, and following additional work if it was possible for the participants, is provided below in Table 3.8.4.

The final data used for the case studies are available at the dedicated STREAM partners sharepoint, in the folder created for the Training Workshop. As stated in the relevant Data Sharing Agreement (STREAM D.3.1), the data will be provided to the RCG Med&BS chairs.

Table 3.8.4 - Summary information on the progress achieved and further work required on case studies developed during 2nd Training Workshop on sampling optimization under MARE/2016/22 project STREAM.

# case study	Information on progress achieved	Further work required for finalization of case study
1	The data in the RCG formats were provided, the case study was only attempted but not finalized.	Substantial work is required for developing and finalizing the case study, which could be carried out by the RCG Med&BS network on sampling optimization
2	Case study was developed, with draft results available at the STREAM partners sharepoint.	The case study is almost complete. The RCG Med&BS should only evaluate the results and finalize the case study.
3	Case study was developed, with draft results available at the STREAM partners sharepoint.	The case study is almost complete. The RCG Med&BS should only evaluate the results and finalize the case study.
4	Case study was finalized and is presented in Deliverable 3.3.	--
5	Case study was finalized and is presented in Deliverable 3.3.	--
6	Case study was developed, with draft results available at the STREAM partners sharepoint.	The case study is almost complete. The RCG Med&BS should only evaluate the results and finalize the case study.
7	The data in the RCG formats were provided, the case study was only attempted but not finalized due to problems with the available dataset. Some draft results are available at the STREAM partners sharepoint.	Substantial work is required for developing and finalizing the case study, which could be carried out by the RCG Med&BS network on sampling optimization.
8	Case study was developed but not finalized due to problems with the available dataset. Some draft results	The case study is almost complete. The RCG Med&BS should only evaluate the results and

	are available at the STREAM partners sharepoint.	finalize the case study.

Based on the information received under WP7 on Training Needs and Mapping of Expertise, and the outcomes of the workshops organised in collaboration with WP3 and WP6, a list of regional activities to be recommended to the RCG Med&BS was drafted (Table 3.8.5).

Table 3.8.5 - Summary of recommended RCG Med&BS regional activities related with training needs.

Subject	Recommendation
Regional work on sampling optimization	Two training workshops on sampling optimization have been organised under STREAM. In the case there are still training needs from the experts who will join the RCG Med&BS network on sampling optimization, it is suggested that further training is organised under RCG Med&BS, either in dedicated training workshops or during the workshops that will be organised by the relevant network for progressing on regional work on sampling optimization. For possible future training, it is suggested that the feedback provided by the participants of the two STREAM training workshops is taken into consideration.
Quality checks on datasets	In the case the STREAM developed R scripts on quality checks are considered suitable for regional implementation by the RCG Med&BS, it is suggested that the relevant national experts test these scripts and provide their feedback on possible difficulties encountered. It is proposed that the relevant feedback is provided to the RCG Med&BS during its coordination meeting in September 2019. If difficulties are encountered on the use of the scripts, the RCG Med&BS is recommended to organise a training workshop during 2019 on performing quality checks with the use of the R scripts developed under STREAM.
Age reading	Under the questionnaire on Training Needs and Mapping of Expertise, institutes in the Med&BS region have reported **species for which age standardization is lacking**. For the **Black Sea**, it is proposed that workshops on age reading are organised during 2019-2021 for all species identified to be lacking age standardization: Rapana whelk, turbot and sharks/rays. Since sharks and rays have been identified also in the Mediterranean as species lacking age standardization, it is proposed that the workshop on sharks and rays will be common for the whole Med&BS. For the **Mediterranean Sea**, a number of species have been reported to be lacking age standardization. At regional level, priority in organising age reading workshops in the Mediterranean during 2019-2021 is recommended to be given for species with stock assessments and shared stocks. The proposed species are: *Engraulis encrasicolus* (Anchovy) and *Sardina pilchardus* (Sardine) *Merluccius merluccius* (hake), *Mullus barbatus* (red mullet) with *Mullus surmuletus* (stripped red mullet), *Pagellus bogaraveo* (black-spot seabream) and *Pagellus erythrinus* (common pandora) *Solea solea* (Common Sole)
Stomach Analysis	A training workshop on stomach analysis in 2020 is proposed to be considered by the RCG Med&BS.
PETS identification	The identification of PETS is an important training need for the institutes in the Med&BS, for all categories of PETS (marine mammals, sea birds, sharks and rays, reptiles). Two Training workshops on PETS identification are proposed to be considered by the RCG Med&BS for the period 2020-2021, one dealing with the identification of sharks and rays, and the other with the identification of marine mammals, sea birds and reptiles.

Similarly, summary tables are provided listing the available expertise in the region at institute level and, where possible, at expert level; these lists may be used by the RCG Med&BS for forming agreements with

experts for training purposes and attendance in relevant meetings and working groups. This information is provided and described in much more details in the Deliverable D7.1 (see Annex XX).

3.9. WORK PACKAGE 8 - INPUTS FROM A REGIONAL CONSULTATION

WP8 Chair: G. Lembo (COISPA); Co-chair: V. Raykov (IO-BAS)
Partners involved: CIBM, COISPA, CNR-ISMAR, NISEA, HCMR, FRI, IEO, DFMR, IOF, IO-BAS, NIMRD, REVIVO.
Core team: A. Adamidou, P. Carpentieri, C. Charilaou, B. Guijarro, E. Koutrakis, A. Ligas, M. Panayotova, P. Pengal, P. Sartor, M.T. Spedicato, G. Tserpes, N.Vrgoc, T. Zaharia
Duration: 16 months, from 19 December 2017 to April 2019.

Milestones
M8.1. Project sharepoint (February 2018)
M8.2 Web-meetings (February 2018)
M8.3 Web-meetings (September 2018)
M8.4 Face-to-face meeting (April 2019)
Deliverables
D8.1. Report on the inputs from a regional consultation (Responsible G. Lembo, April 2019)

Description of the work
WP8 aimed at establishing consultations with all Member States, either participating in the grant or not, regarding the outcomes of the WPs from 1 to 6. Consultations have been established mainly with National Correspondents (NC) of all Member States, regarding the points tackled in the WPs from 1 to 6.
In cooperation with WP0, the project SharePoint were implemented and each user has been granted a personal access code with differentiated levels of execution permissions (e.g. according to responsibility of a partner, or user external to the Consortium).
Progress of the project (reports, deliverables, workshops, relevant milestones) have been communicated through the SharePoint.
A written consultation was carried out with NCs, asking them to evaluate the main points tackled in the WPs 1-6, and express their level of agreement/disagreement on a scale of semantic scores ranging from -3 to +3, with the value 1 representing a judgement of indifference and the value ±3 representing highest agreement/disagreement.
The main topics included in the consultation were: i) Data Sharing among all Member States of the regions; ii) reference (or code) lists for data storage system, processing and analysis of the data at regional level; iii), application of the "**SDTool_v.2**" for the optimization of the number of trips and individuals to be measured by length in the design of a Regional Sampling Plan; iv) application of the "**BioSimTool**" for the optimization of the number of trips and individuals to be measured for the different biological variables (sex, maturity and age) in the design of the Regional Sampling Plan; v) R scripts developed in the Deliverable D.6.1 in order to carry on *a priori* quality checks to ease the detection of errors directly on sampling data in the RCG

CS format; vi) R scripts developed in the Deliverable D.6.1 in order to carry on *a posteriori* quality checks on the DGMARE Med&BS data call formats; vii) agree on a list of training workshops.

The feedback from the National Correspondents was generally positive and the average value of their level of agreement with the project activities and tools developed was ranging from 2 to 2.5. While the need to planning training workshops for progressing in the implementation of the tools developed by the project was ranked with an average value of 2.4.
As regards the list of planned workshops on ageing, the first priority was expressed for the "Red mullet in the central & eastern Med", then the second priority was for "European hake in the rest of Med" and "Anchovy and Sardine in the GSAs 17-18", the last priority was for "European hake and Red mullet in the GSAs 17-18" and "Sardine and Red seabream in the west Med".
Some additional inputs came from NCs:

1. In Croatia data sharing agreements on fisheries are formally signed by the Minister of Agriculture and they cannot be signed by the NC.
2. In order to efficiently implement the procedures, the data checking exercise should be coordinated by the RCG.
3. To planning training on PETS identification.
4. Need of age standardisation for species of national (not regional) interest, i.e. picarel, bogue.
5. It would be useful to have STREAM experts attending national coordination meeting to present the tools.

4. DEVIATION TO THE WORKPLAN

The project Steering Committee envisaged the need for an extension of possibly two months for the completion of all the project activities. The formal request was submitted in May 2018. However, the Commission considered that, at that stage of the project, requesting an extension of the deadline was premature. A realistic estimation of the duration of the extension could only be made at a later stage, in order to avoid multiple amendments of the grant agreement and to reduce the number of administrative procedures.
A new request for a 2-months extension of the project deadlines was submitted in October 2018, after the Mid-term meeting, and approved by the Commission.
The postponing to September 2018 and October 2018 of the workshops foreseen under the cooperation between WP3 and WP7 was envisaged both to take into account some delay due to the finalization of WP2 and facilitate the participation of experts from MSs, avoiding any possible overlapping with the meeting of the RCG Med&BS. The postponing of those workshops produced a slight delay in the processing of the workshop outcomes. However, it did not affect significantly the overall time line of the project and outputs production.
The Data Sharing Agreement (DSA, D3.1) was signed by all Member States, with the exception of France, Croatia, and Malta. France has provided an official document stating the availability of France in providing the data requested by the project STREAM. Croatia informed that for internal administrative reasons it would have been much easier and faster avoiding the signature of the DSA, and providing directly the

requested data. Therefore, no mitigation measure was needed to tackle this issue. Concerning Malta, the continuous internal reshuffle within the DFA impeded a constant communication path between the coordination of the project STREAM and the Maltese NC. The three former Maltese NCs who followed one another provided their availability (one of them participated to the questionnaire under WP1), but left the position without informing the colleagues on the project STREAM initiative. Finally, the new Maltese NC confirmed their availability in supporting the project STREAM. The project coordinator liaised with the Malta NC, and the requested data were provided by Malta and used in the analyses performed under WP3 and WP6.

5. PROJECT LEGACY AND CONCLUSIONS

The final versions of all the deliverables produced under the STREAM project are available as annexes to this report. Furthermore, they are stored on the project sharepoint (https://streampartner.coispa.eu/WebInterface/login.html) and the repository section for stakeholders (https://streamstakeholder.coispa.eu/WebInterface/login.html).

The project sharepoint is also hosting the scripts and input data used for the analyses performed under WP3, WP4 and WP6. The R scripts will be made available to the RCG Med&BS and the MSs in the view of the preparation of the new EU-MAP.
All the products of the STREAM project will serve and support MSs and the RCG Med&BS in the revision of the EU MAP and the development and implementation of national and regional sampling programmes in the Mediterranean and Black Sea.

The R scripts developed under the STREAM project are stored in a GitHub repository, and can be accessed at the following link: https://github.com/aleligas/STREAM_MARE-2016-22.

All the deliverables and the final report will be then published on the DCF website.

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ANNEX I – MINUTES OF THE KICK-OFF MEETING

Kick-off meeting, 10th January 2018, DG MARE (99 Rue Joseph II, 1049 - Brussels), room J99 03/SDR1 "AQUARIUM", 14.00-16.30

Minutes of the meeting

Welcome and Introductions

The meeting was attended by the Commission (DG MARE, JRC and DG ENV) and the beneficiaries of the grant.

Presentation of the project STREAM

The beneficiaries presented the structure of the project and the work packages (see the Annex I). The beneficiaries clarified how they intend to address the weaknesses identified by the Commission during the evaluation of their proposal and discussion during the meeting identified the issues that need to be clarified in the inception report. The following general points were discussed:

- The Commission asked the beneficiaries to be more specific in highlighting the outputs of the previous grant (MARE/2014/19 Med&BS), and clearly describing the innovative aspects of the present project and how STREAM will represent a further development from the achievements of the previous grant.
- The Commission invited the beneficiaries to perform a thorough risk assessment associated to data availability and suitability.

Discussion – Scientific and technical aspects

- The Commission, as well as the STREAM Consortium, highlighted the importance that the grants funded under the Call MARE/2016/22 share outcomes along the way and consider the approaches used in the other projects. This is particularly relevant for aspects such as developing data exchange formats. To facilitate this, the Commission will distribute the Kick-off presentations from each consortium and put in contact project coordinators and WP leaders.
- The Commission urged the beneficiaries to ensure that all MSs (also those not included in the consortium, such as France and Malta) are consulted and informed on the progress of the project and its results. The absence of France was considered by the Commission an important drawback and the beneficiaries were requested to include also scientists among the end-users who will be informed about project outputs. The Commission acknowledged the participation of a Turkish expert, and asked if the expert collaborates with institutes in charge of the fisheries data collection in Turkey, the level of collaboration and if the expert can provide the data if needed. In any case, the Commission recommended to get in touch with the institutes in charge of data collection in Turkey.
- Concerning WP1, the Commission and beneficiaries agreed that work on the rules of procedures already developed during the last Regional Coordination Group for the Mediterranean and Black Sea (Cyprus, 18-22 September 2017) should not be duplicated. WP1 should aim at complementing those rules. A detailed analysis will provide inputs and suggestions for possible changes and improvements (e.g. data use and confidentiality) to ensure compliance with EU data collection requirements and end user's needs. Furthermore, the Commission suggested that the second objective of WP1 (i.e. to produce a work-plan with the establishment of subgroups under the umbrella of RCG, and the identification of standard meetings per year and timing) should be performed also taking into consideration the work carried out by ICES and the other grants under MARE/2016/22. The RCG for the Mediterranean and Black Sea will analyse and assess the new proposal prerequisites both for the rules of procedures and for the draft work-plan. Unit D1 highlighted that, concerning WP1, care should be taken not to duplicate work already done.
- Unit D1 stressed that work on Work Package 2 (identification of candidate stocks for regional sampling) has already been done under a STECF EWG. The beneficiaries were requested to update this EWG report and to consider the variable fishing effort, that was not dealt by the EWG. In addition, stocks that will be assessed in RFMOs are considered of high priority and should therefore be included.

- The Commission asked for clarifications on the Data Sharing Agreement and the official data call, because the link between the two and the associated timeline were not clearly presented. In addition, more details on the actual data to be requested are needed.
- Regarding Work Package 3, the Commission questioned how the Western Med will be assessed in the absence of France from the consortium. The beneficiaries were advised to contact IFREMER and IRD and involve them in this part of the project. Unit D1 asked whether number of hauls will be considered in the sampling design tool, but the beneficiaries replied that this parameter is not relevant for all fisheries.
- Unit D1 suggested including Greece in the Work Package dealing with small scale fisheries (WP 5), as it has the largest EU small scale fleet. Another suggestion was for the beneficiaries to explore alternative methods used by the MS to collect data on small scale fisheries.
- The Commission asked for a revised timeline, taking into account the actual start of the project. The Commission suggested to identify possible overlaps with other projects, as well as critical periods. This may allow identifying the need for some changes or extensions in the timing of completion of some tasks and deliverables.
- All abovementioned issues are expected to be better detailed in the Inception Report, where the actual dates of completion of tasks and deliverables should be reported.

Administrative aspects

The beneficiaries are expected to submit the minutes of the kick off meeting in 10 working days from the meeting and the inception report by 12 February, where all comments by COM are to be addressed.

All correspondence between the Commission and the beneficiaries will be done through the functional mailbox MARE-2016-22@ec.europa.eu. The contact points of the beneficiaries will be Alessandro Ligas and Paolo Sartor.

Magdalena Urbanska introduced some administrative aspects related to the management of the project, recalling the fact that the balance payment will be based on the cost statements provided by the beneficiary.

The meeting closed at 16.30.

ANNEX II – MINUTES OF THE MID-TERM MEETING

Mid-term meeting, 28th September 2018, DG MARE (99 Rue Joseph II, 1049 - Brussels), room J99 03/SDR1 "AQUARIUM", 09.00-13.00

Minutes of the meeting

Welcome and Introductions

The meeting was attended by the Commission (DG MARE and DG ENV; hereafter COM) and the beneficiaries of the grant.

The COM informed that an informal meeting with the project coordinator and representatives of the STREAM Consortium took place in Kavala (during the Regional Coordination Group Med&BS) for a preliminary discussion on the comments by the COM on the draft Interim Report.

Presentation of the project STREAM

The beneficiaries presented the progress of the activities of the project STREAM and the Draft Interim Report. The beneficiaries clarified how they intend to address the comments provided by the COM on the Draft Interim Report.

The following points were discussed:

- The COM asked clarification on the methodologies and data sets used for the analysis under WP2. The COM invited the beneficiaries to be more specific in highlighting the innovative aspects of the approach used under WP2 compared to the analyses done by STECF EWG 15-14. The COM also asked to detail the issues in the data that hampered using the data set range (2014-2016) foreseen by the project proposal. It was underlined that the most recent data sets should be used in this study. In addition, the COM noticed that there were some possibly relevant stocks and fisheries not contemplated in the present list of case studies, i.e. small pelagics in the Eastern Mediterranean and in the Strait of Sicily. Regarding the Black Sea, *Rapana* whelk stock could be relevant as case study. The COM questioned the relevance of having a regional sampling plan between different GSAs of the same country (rather than between countries). The consortium explained that the sampling design is still based on the GSA and not on a national level, so differences exist also within the same country. Finally, the COM asked to add information on the criteria that were used to select each stock and fishery (i.e. adding a column to the final table).
- On WP 3, the COM drew the attention of the consortium to the fact that long time series are needed, otherwise fluctuations of the fishery may not give representative results. It was further suggested that the consortium should outline the data needed to run the proposed tools. The consortium explained that long time series of data are not necessary to run the optimization tools developed under WP3. Series of 3-4 years of data are sufficient for achieving representative results. The most important point is having sufficient number of samples (trips) in order to avoid high recycling rates in the bootstrap simulations.
- The COM requested to prepare a summary table of the next steps that should be taken according to the outputs of WP1. A list of specific actions and to whom they should be addressed and who should take them, possibly in the form of recommendations.
- A similar proposal was raised for the outputs of WP7. A list of steps forward to address the training needs highlighted by means of the questionnaire, and also a list of expertise. Work should be done in achieving a bilateral agreement between experts and RCG Med&BS to provide the RCG with a list of experts available for training purposes and attendance to the relevant meetings and working groups. The COM also highlighted that it would be worth paying particular attention to the application of the tools to the Black Sea case studies and monitor possible needs. The absence of BG experts in the workshop that took place during the RCG Med & BS 2018, dealing, amongst others, with BS stocks, was noted. The COM stressed the need for their active participation.

- The beneficiaries asked the possibility to combine Deliverable D4.1 “Protocols for collection and processing of data on fisheries impacts on the ecosystem” and Deliverable D4.3 “Updated Guidelines, manuals and handbooks for collecting stomach contents, monitoring incidental by catch and processing the collected data” (foreseen in the project proposal) into a single document. This will better integrate the different aspects reducing the risk of possible duplication, without hampering the outputs of the project in terms of products and information provided. In addition, it will not require any amendment to the Grant Agreement. The COM requested clarifications on the stocks chosen for this WP.
- Regarding the involvement of a Turkish expert in the Black Sea case study, the beneficiaries explained that his involvement is expected to be particularly useful in methodological aspects, i.e. fish ageing methodologies and issues.
- The COM asked for clarifications on the Data Sharing Agreement, with particular reference to the reasons why some MSs did not sign the DSA. The beneficiaries explained that even MSs that have not signed the agreement have in any case delivered the data, except Malta, where different national correspondents have alternated so far.
- All abovementioned issues are expected to be better detailed in the revised Interim Report.

Administrative aspects

The beneficiaries are expected to submit the minutes of the Mid-term meeting and the revised Draft Interim Report in 10 working days from the meeting.

Some administrative aspects related to the management of the project were discussed, recalling the fact that the balance payment will be based on the cost statements provided by the beneficiary. It was also pointed out that possible request for extension of the project duration should be submitted by the end of October at the latest, in order to allow the COM to amend the Grant Agreement.

The meeting closed at 13.00.

ANNEX III – MINUTES OF THE STREAM KEW

Knowledge Exchange Workshop, 11-12 April 2019, Ateneo Garden Palace Hotel, via dei Salentini 3, Rome (Italy)

Minutes of the KEW

11 April 2019, 14.30-18.30

14.30 The coordinator opened the workshop welcoming and thanking the participants for their availability and support to the STREAM project. He then provided some logistic information, and invited the participants to introduce themselves, mentioning their role in the project or their interest in the project outcomes as external participants.

The coordinator provided a general overview of the objectives of the STREAM project and the structure in Work Packages (WP), and then left the floor to Paolo Carpentieri, WP1 chair, who provided a presentation on the main outcomes of the WP focussed on the functioning of the RCG Med&BS, the revision of the Rules of Procedures (RoPs) and the identification of a workplan. The outputs of WP1 were also presented in September 2018 at the RCG Med&BS in Kavala, and contributed in drafting a workplan, including the workshop on recreational fisheries (that will take place on 15-16 April 2019 in Ancona), the steering committee on the Regional Data Base (RDB), etc.
The discussion that followed the presentation of WP1 tackled several aspects, including the proposal from the sister grant FishPi2 of creating a secretariat for coordinating the activity of all the RCGs; they also proposed each RCG to design a logo, and a webpage. It was also pointed out the need to take immediate action to better define the workplan of the RCG Med&BS for the near future, trying to avoid as much as possible duplications and promote synergies with the activities of other for a (e.g. GFCM, ICES, STECF, etc.).

Giuseppe Scarcella, co-chair of WP2, presented the analyses performed to identify and propose candidate fisheries and stocks suitable for regional sampling plans. In the discussion, it was suggested to make the final list of candidate stocks a bit clearer in terms of metier identified.

Isabella Bitetto, presented the activities performed under WP3 on behalf of Maria Teresa Spedicato, WP3 leader, including the Data Sharing Agreement (DSA) produced under Task 3.1 and the R scripts developed under Task 3.2 to convert different data formats. These scripts can be implemented within the Regional Data Base (RDB) in order to response the different data calls. Regarding the RDB, Task 3.2 performed an analysis of the possibilities for hosting the RDB Med&BS, identifying three possible candidate: GFCM, ICES, and JRC. These analysis was already presented at the Regional Coordination Group (RCG) in Kavala, and the output used for further discussion and analyses by the Member States (MSs) and the Steering Committee on the RDB created under the umbrella of the RCG. Task 3.3 developed two R routines, SD Tool v.2 (previous version developed under FishPi and MARE/2014/19 Med&BS) and BioSim Tool, for the sampling intensity optimization. These tools were tested on 15 case studies (among those identified by WP2) during the two training workshops (Kavala in September 2018, and Bari in October 2018) organized in cooperation with WP7. Five out of those 15 case studies were selected and presented in the Deliverable D3.3.

During the discussion, it was pointed out that the results of WP3 were presented by Charis Charilaou at the ICES WGCATCH; further cooperation with ICES WKBIOPTIM is also foreseen, as Isabella Bitetto will attend the meeting in 2019. The scripts developed under WP3 are stored in the STREAM sharepoint (including the Repository section for the stakeholders) and will be made available to DG MARE, MSs and the RCG. As pointed out by Venetia Kostopoulou, DG MARE, the main objective of the grants funded under the Call MARE/2016/22 is to provide support to MSs in the implementation of regional sampling plans. One of the case studies analysed under WP3 dealt with anchovy and sardine stocks in GSAs 17-18. The outputs of this case study can provide support to the relevant MSs and the RCG for the design and implementation of a regional sampling plan of small pelagic stocks in the Adriatic.

Charis Charilaou reminded that the RCG in Kavala agreed on working with the scripts and routines developed by STREAM WP3; they also agreed in organizing further trainings, if needed (as it was done also with the routines developed under the previous grant MARE/2014/19 Med&BS).

George Tserpes presented (on behalf of Stefanos Kavadas, HCMR, Task 3.4 leader) the analyses performed under Task 3.4 and aimed at estimating costs and task allocation for the implementation of the regional sampling plans according to the outputs of the case studies tackled by Task 3.3. Some refinements will be performed on the R scripts developed by Task 3.4 in order to include more variables in the analysis of costs. The deliverable foreseen under Task 3.4 is including also a manual on how to use the scripts. This will help the MSs experts in running the analysis.

12 April 2019, 09.00-13.30

Beatriz Guijarro, WP4 leader, presented the updated protocols and guidelines for the collection, processing and analysis of fish stomach contents. These new guidelines take into account the outcomes of the Workshop on Sampling, Processing and Analysing the Stomach Contents (WKSTCON, organized under the umbrella of the RCG Med&BS) and the preliminary results of the pilot studies performed by some MSs following the methodological approach provided by the previous grant MARE/2014/19 Med&BS. Together with the species identified by the previous grant (namely European hake and turbot in the Mediterranean and Black Sea, respectively), STREAM WP4 suggested to developed a regional sampling program for anglerfish (*Lophius budegassa* and *L. piscatorius*) in the Mediterranean. Anglerfish is opportunistic predators (feeding also on hake) and represent an important commercial bycatch of both trawl and small-scale fisheries in the Mediterranean. As regards the Black Sea, the Bulgarian and Romania experts (Violin Raykov, Marina Panayotova and Magdalena Nenciu) proposed to consider Mediterranean horse mackerel, *Trachurus mediterraneus*, and sprat, *Sprattus sprattus*. This proposal was supported by Ertug Duzgunes, the Turkish expert involved in STREAM, who also attended the meeting. These two species mostly feed on zooplankton, although large horse mackerel are also piscivorous. Both species are prey items of turbot.
WP4 will also provide cost estimations for implementing this new regional sampling plan, and will liaise with ICES and FishPi^2 regarding the database for stomach content data.
Paolo Sartor, WP4 co-chair, presented the outputs of sub-Task 4.1.2 on the on co-occurrence and relative abundance of species/stocks. He described a methodological approach for the analysis of MEDITS data aimed at identifying the species characterizing the demersal assemblages. This routine can be performed every three years. The analysis of trend using the Spearman correlation index should be performed every year. These methods can also be applied to the trawl survey data performed in the Black Sea. It was pointed out that this approach could be very relevant in the eastern Mediterranean to monitor the spreading of invasive species from the Red Sea.
He then presented the regional sampling plan for the monitoring of the incidental by catch of vulnerable species. This plan was implemented taking into consideration three case studies (trawl fisheries in GSA7, involving Spanish and French fleets; trawl fisheries in GSAs 17-18, involving Italian, Croatian and Slovenian fleets; Rapana whelk beam trawl fishery, involving Bulgarian and Romanian fleets). The methodological approach is based on both fleet observers at sea and self-sampling (log-books). Ivana Vukov, Croatia National Correspondent (NC), pointed out that log-books used under the Control Regulation are also including information on the by catch of vulnerable species; in this sense, it is important to avoid duplications.

Fabio Grati, WP5 leader, presented the outcomes of the review performed on the available information on SSFs and RFs in the Mediterranean and Black Sea. He also provided some proposal in terms of monitoring activity for SSFs (including a novel approach for the mapping of fishing effort) and RFs. During the discussion, it was pointed out that, despite improvements are required, SSFs are already sampled in the Mediterranean and Black Sea, while there is the need to implement a regional sampling plan for RFs.

Isabella Bitetto presented the outcomes of Task 6.1 on the data quality check at national level. She proposed a set of R routines to perform both *a priori* and *a posteriori* data quality checks to be run on biological data in the RCG Med&Bs

format and the EU Data Calls formats, respectively. The Deliverable D6.1 contains all the scripts as well as a user manual. In the case the RCG will consider the need for further training, training workshops can be organized as it was done with the routines developed under the previous grant MARE/2014/19 Med&BS.

Pierluigi Carbonara, WP6 co-chair, presented the outputs of Task 6.2 with particular reference to the analyses done on the red mullet age data (provided by all MSs through the STREAM data call and the DSA) and the outcomes of the recent workshop on the ageing of common Pandora, organized in cooperation with WP7. The exchange and workshop on common Pandora were performed using the platform developed by ICES (Smartdots). Task 6.2 will provide a feedback to ICES on the use of this new tool. The methodological procedures developed by the exchange and workshop on common Pandora will represent the basis for further development of age reading workshops in the Mediterranean and Black Sea.
George Tserpes, WP6 leader, presented the proposal of the calendar for data quality checks. During the discussion, some suggestions were proposed to postpone some of the quality checks proposed.

Charis Charilaou, WP7 leader, provided an overview of all the activities performed under WP7. In particular, she presented the results of the questionnaire aimed at mapping the expertise and training needs in the Mediterranean and Black Sea. A preliminary information on these results was provided also to the RCG in Kavala. She also presented some of the outcomes of the post training evaluation of the two training workshops on the sampling strategy optimization tools developed by WP3.

As regards WP8, the coordinator, on behalf of Giuseppe Lembo, WP8 leader, informed that a written procedure will be performed in the next days to gather the feedback of the NCs on the outcomes presented at the STREAM KEW.

List of participants

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ANNEX IV – MINUTES OF THE STREAM FINAL MEETING

Call for Proposals MARE/2016/22

STrengthening REgional cooperation in the Area of fisheries biological data collection in the Mediterranean and Black Sea, STREAM (SI2.770115)

Final meeting, 14th June 2019, DG MARE (99 Rue Joseph II, 1049 - Brussels), room J99 03/SDR1 "AQUARIUM", 09.00-13.30

Minutes of the meeting

Welcome and Introductions

The meeting was attended by the Commission (DG MARE; hereafter COM) and the beneficiaries of the grant.

Presentation of the project STREAM

The beneficiaries presented the results and outcomes of the activities of the STREAM project, and the following points were discussed:

- The COM proposed to add a column in the table showing the draft work-plan built under WP1, and presented to the RCG Med&BS 2018, to highlight the meeting and workshops that already took place following STREAM recommendations; the COM also proposed to clarify whether the revision of the RoPs of the RCG proposed by STREAM WP1 has been addressed or there is the need for further discussion;
- The COM pointed out that a discussion between RCG and end-user would be beneficial to sort the issues dealing with the collection of data for all the metiers;
- The COM requested to check whether any results of the analyses performed under STREAM Task 3.3 on the turbot case study in GSA 29 were available, and could be beneficial for the implementation of the multi-annual management plan of turbot in GSA 29. The beneficiaries informed the COM that the input files and some preliminary results on optimization are available on the STREAM Sharepoint, in the folder of the First Training workshop, and can be used as a starting point for further explorations;
- The COM asked whether the R tools for sampling strategy optimization should be run every year. The beneficiaries explained that it would be beneficial to run them before the design of a new sampling plan, and not every year; the COM proposed to include a time frame for including these tools in the regional sampling plans;
- Regarding the monitoring of the by catch of vulnerable species, the COM requested details on the possible design and implementation of large fleet observer programmes; in particular, indications about the possibility to collect data on vulnerable species in parallel with the routine sampling of commercial fisheries, the reliability of the data collected by means of self-sampling respect to the fleet observer the data, and the novelty of what was carried out by the project respect to GFCM guidelines. Beneficiaries answered that the PET data collection could be carried out in parallel with the routine data collection and that the cooperation between the scientists and fishermen can improve the reliability of the data;
- On WP6, the COM highlighted the importance of the data quality check implemented by STREAM to streamline the work of data quality check in preparation of the working groups on stock assessment;
- The COM found very useful the inventory of the different expertise in Mediterranean and Black Sea drafted under WP7.
- The COM will send to the STREAM coordinator specific comments on the Draft Final Report ASAP.

Administrative aspects

The beneficiaries are expected to submit the minutes of the final meeting in 10 working days from the meeting.

Magdalena Urbanska presented some administrative aspects related to the closure of the project and the balance payment. The costs for the activities of the project were closed on the 19th May, with the exception of the costs for attending the Final Meeting on the 14th June. The cost statement and the Final Report must be submitted by the 19th July 2019. The cost statement should be submitted as an Excel file following the structure of Annex IV of the Grant Agreement. An additional column should be included in order to compare the expected costs with the actual costs for the project implementation.

The STREAM consortium agreed in making available all the R scripts and routines developed under the project. A GitHub repository will be created to store all the scripts, making them available to the experts of the Med&BS MSs and the RCG.

The meeting closed at 13.30.

The following annexes are embedded as files in the Interim Report

ANNEX V – DELIVERABLE D1.1

ANNEX VI – DELIVERABLE D2.1

ANNEX VII – DELIVERABLE D3.1

ANNEX VIII – DELIVERABLE D3.2

ANNEX IX – DELIVERABLE D3.3

ANNEX X – DELIVERABLE D3.4

ANNEX XI – DELIVERABLE D4.1

ANNEX XII – DELIVERABLE D4.2

ANNEX XIII – DELIVERABLE D4.3

ANNEX XIV – DELIVERABLE D4.4

ANNEX XV – DELIVERABLE D5.1

ANNEX XVI – DELIVERABLE D5.2

ANNEX XVII – DELIVERABLE D6.1

ANNEX XVIII – DELIVERABLE D6.2

ANNEX XIX – DELIVERABLE D6.3

ANNEX XX – DELIVERABLE D7.1

ANNEX XXI – DELIVERABLE D8.1