Copernicus For Fisheries and Aquaculture Workshop

Framework Contract 386/PP/2014/FC

Copernicus User Requirements Framework Contract

Prepared for:

European Commission - DG GROW

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1 INTRODUCTION

The European Commission (EC), overall manager of the Copernicus programme, has initiated actions aimed at gathering user requirements for the Next Generation of the Copernicus Space Component.
This workshop, organised in the framework of the User Requirements study "NEXTSPACE", intended to explore how the Copernicus programme can support now and in the future a number of Fisheries & Aquaculture applications, with reference to the Common Fisheries Policy (CFP) and the Blue Growth agenda.

In particular, the workshop has:

- Summarised the current (and planned) Copernicus offer
- Provided an overview of the user needs related to the domain of Fisheries and Aquaculture at global, EU, and National/Local level
- Discussed about potential Copernicus evolutions and innovation paths to address the identified gaps and/or improved the current offer vis-à-vis the user needs

99 people registered for the workshop. The agenda is available in Annex 1.

2 HIGHLIGHTS AND OUTCOMES

2.1 Welcome speech by DG GROW

The workshop was opened by **Elisabeth Hamdouch, Deputy Head of Unit I2 (Copernicus), DG GROW**, who highlighted how this event strongly aligns with the Copernicus philosophy of being user- and policy-driven. Fisheries and Aquaculture is an essential topic of the Common Fisheries Policy and the Blue Growth Agenda. Moreover, it is linked to a number of other policies looking at sustainable development.

The current Copernicus offer can already satisfy a number of user requirements in the Fisheries and Aquaculture domain. Nevertheless, gaps exist and need to be identified. This workshop represented a timely opportunity to list them and consider them for the potential evolution of the Copernicus Services and Space Component.

2.2 Session I: Setting the scene

The first presentation of Session I was given by **Felix Leinemann, Head of Unit "Blue Economy Sectors, Aquaculture and Maritime Spatial Planning", DG MARE.** Mr Leinemann introduced the Common Fisheries Policy (CFP), which is a set of rules for managing European fishing fleets and for conserving fish stocks. Designed to manage a common resource, it gives all European fishing fleets equal access to EU waters and fishing grounds and allows fishermen to compete fairly. Stocks may be renewable, but they are finite. Some of these fishing stocks, however, are being overfished. As a result, EU countries have taken action to ensure the European fishing industry is sustainable and does not threaten the fish population size and productivity over the long term. To this day, the impact of fishing on the fragile marine environment is not fully understood. For this reason, the CFP adopts a cautious approach which recognises the impact of human activity on all components of the ecosystem. It seeks to make fishing fleets more selective in what they catch, and to phase out the practice of discarding unwanted fish. The CFP also includes rules on aquaculture and stakeholder involvement. At the end of his speech, Mr Leinemann stressed the importance of the workshop vis-à-vis DG MARE's activities going in the same direction and look forward to further inter-DG cooperation and collaboration.

The second presentation was given by **Vytautas Lukas, European Fisheries Control Agency (EFCA)**, who introduced EFCA's operational capabilities. While the EC formulates the CFP and verifies its implementation by Member States, EFCA coordinates and assists Member States and the EC. EFCA's operational capacity is available for Multipurpose Operations in cooperation with FRONTEX, EMSA and MS relevant authorities. The Agency coordinates control activities in Union and international waters and on land. This is done through the Joint Deployment Plans (JDPs), the vehicle through which EFCA organises the deployment of human and material resources of control and inspection pooled by Member States and EFCA. The deployment of pooled national means is coordinated by the EFCA in cooperation with Member State and frequently with the presence of national coordinators at EFCA premises. In addition to operational coordination, EFCA ensures that good quality data is available for the planning, risks assessment, implementation and evaluation of JDPs, facilitating the data exchanges between EFCA and Member States or regional fisheries management organisations. EFCA also coordinates the collection and analysis of information systems' related requirements, providing assistance with data analysis, on an ad hoc basis, developing some reporting tools used for risk analysis, compliance indicators and data quality monitoring. Lastly, EFCA collaborates with DG MARE in the definition and implementation of standards for the exchange of fishery activity and fishery control data. Integration of the different systems is currently a key challenge as part of the implementation of the agency's data governance framework, which will contribute to improving data quality and capacity to deliver a service to end-users. This includes of course the use of Copernicus data and information.

The third presentation was given by **Nikos Zampoukas, DG RTD**, who expanded on DG RTD's Research & Innovation in support of Blue Growth. The implementation of the CFP, the Marine Strategy Framework Directive (MSFD) and the Marine Spatial Planning (MSP) has to be tailored made to the regional and sub-regional specificities and needs scientific support for which national funding can be appropriate. Despite the regional specificities, policy implementation should be equally ambitious in all Member States and fulfil common objectives, such as maximum sustainable yield and good environmental status. Consequently, the approaches of Member States should be comparable in order to achieve coherent implementation across the EU. This needs sharing of know-how and best practices and adjustment of national approaches that can be best achieved by EU funded multinational research consortia. H2020 can make this funding available, deliver the results to the whole EU economy, promote their uptake and their translation to innovative products and services and boost its competitive advantage.

The last presentation of Session I was given by **Iain Shepherd, Blue Growth, Data and Innovation Senior Expert, DG MARE**, who presented DG MARE's tools for data management: EMODnet and DCF. The European

Marine Observation and Data Network (EMODnet) is a network of organisations supported by the EU's integrated maritime policy. These organisations work together to observe the sea, process the data according to international standards and make that information freely available as interoperable data layers and data products. This "collect once and use many times" philosophy benefits all marine data users, including policy makers, scientists, private industry and the public. It has been estimated that such an integrated marine data policy will save at least one billion Euros per year, as well as opening up new opportunities for innovation and growth. An overview of the data portals can be found at: http://www.emodnet.eu/portals

In addition to EMODnet, DG MARE's fisheries management relies on data collected, managed and supplied by EU countries under the Data Collection Framework (DCF). The data is collected on the basis of National Programmes in which the MS indicate which data is collected, the resources they allocate for the collection and how data is collected. MS must report annually on the implementation of their National Programmes and the Scientific, Technical and Economic Committee for Fisheries (STECF) evaluates these Annual Reports. Part of the data collected by the MS is uploaded in databases managed by DG JRC in response to data calls issued by DG MARE. This data is analysed by experts of the STECF and forms the basis for scientific opinions and recommendations formulated in STECF reports. The resulting scientific advice is used to inform the CFP decision making process.

2.3 Session II: The Copernicus offer for Fisheries & Aquaculture

Session II was opened by **Edmée Durand, CMEMS,** who introduced the CMEMS offer for Fisheries and Aquaculture, which is summarised in the image below.

	Variables	CMEMS Products
Physical variables	**Temperature** **Salinity** **Currents** **Sea Level** **Waves**	Modelled and observed **hydrographic conditions** Global Ocean or Regional Seas GLOBAL_**ANALYSIS_FORECAST_PHY**_001_024 GLOBAL_**REANALYSIS_PHY**_001_025 GLOBAL_**ANALYSIS_FORECAST_WAV**_001_023 GLOBAL_**REP_PHY**_001_021 **INSITU**_GLO_**NRT_OBSERVATIONS**_013_030 **SST**_GLO_SST_L4_**NRT_OBSERVATIONS**_010_014
Biogeochemical variables	**Nutrients** **Oxygen** **Chlorophyll-a**	Modelled and observed **concentrations** Global Ocean or Regional Seas GLOBAL_**ANALYSIS_FORECAST_BIO**_001_014 GLOBAL_**REANALYSIS_BIO**_001_018 **OCEANCOLOUR**_GLO_CHL_L4_NRT_**OBSERVATIONS**_009_033 **OCEANCOLOUR**_GLO_CHL_L4_REP_**OBSERVATIONS**_009_082 **INSITU**_GLO_**NRT_OBSERVATIONS**_013_030

Moreover, there are several coastal downstream services for fisheries and/or aquaculture using, amongst other sources, CMEMS data and information:

- Rheticus® Marine Services - Seawater quality – link
- OCEBIS (OCEan Biological Information Service) – Denmark - Link
- CADEAU - Seawater quality – Link
- SkyFish - Seawater quality
- RENAQUA-DSS - Renewable Energy and Aquaculture Decision Support System

The following presentation was given by **Sven Tahon, European Fisheries Control Agency (EFCA),** who expanded on operational use of EMSA's Copernicus Maritime Surveillance (CMS) Service for fisheries control and law enforcement. The CMS Service provides Earth Observation products (satellite images and value-adding products) to support a better understanding and improved monitoring of activities at sea, within a wide range of operational functions such as maritime safety and security, fisheries control, customs, law enforcement, marine environment monitoring, and others (e.g. defence). Recognising that human activity at sea is intrinsically dynamic, the CMS Service aims to provide timely, relevant, and targeted satellite-based information to member states and EU bodies. Data from earth observation satellites is combined with a wide range of other data, both from EMSA systems as well as from external sources. This includes vessel identification and position information, behaviour patterns, and intelligence from users. The fusion of data provides a more complete overview of activities at sea, enabling a more in-depth analysis than any one data source alone. By offering increased access to earth observation data, Copernicus reinforces and enhances existing EMSA services and opens the possibility of setting up new services too. The type of EO data (Synthetic Aperture Radar. i.e. SAR, or optical) which is most useful depends on the type of monitoring needed in any given maritime security operation at sea.

The third presentation of Session II was given by **Dr Espen Volden, ESA ESRIN**, who presented ESA's perspective on the EO potential for Fisheries and Aquaculture. Satellite instruments can simultaneously gather information across a wide area on important variables such as sea surface temperature, ocean colour and currents, bathymetry, as well as and wind and wave conditions. With the correct scientific interpretation, the combination of these variables can significantly support the management of fisheries and aquaculture. Within the context of the ESA Thematic Exploitation Platforms (TEPs), a set of R&D activities providing access to EO data and the tools, processors, and ICT resources required to work with them, the Coastal TEP (C-TEP) and the Food Security TEP are particularly relevant for Fisheries and Aquaculture.

For what concerns the C-TEP, a relevant initiative is the SAFI (Supporting our Aquaculture and Fisheries Industries) FP7 project, a prototype information service in support to the fishing industry. Using C-TEP, SAFI can work swiftly through tens of terabytes of data at a time to extract the temperature evolution over 20 years. Doing the same with additional variables like water transparency and wave height allows for a quick and easy pinpointing of suitable farming locations across the globe. It is also possible to calculate the environmental carrying capacity of the site, allowing users to forecast likely yields. Regularly updated maps of shallow-water sea beds from Sentinel-2 images can also help to site mussel and other shellfish farms. SAFI is now a commercial undertaking.

Moving then to the Food TEP, a Framework for Aquaculture User Requirements is in place to support:

- Aquaculture Development
- Aquaculture practice and management
- Aquaculture risk management

The main parameters monitored by satellites are:

- Chlorophyll-a concentration
- Primary Production
- Total Suspended Solids (TSS)
- Water temperature / SST / SST Front Detection
- Secchi Disk Depth
- Wave climate (SWH)
- Currents
- Bathymetry

In addition to the TEPs, ESA has started a set of Regional initiatives including science, applications and data infrastructure components (platforms), with a focus on regional priorities with high interest for ESA Member States. The target regions are: Baltic, Black-Sea/Danube, Alpine, Atlantic and Mediterranean. A key priority is to ensure connection with existing EC activities, e.g. EU Regional Strategies and projects, as well as downscaling and adapting to regional conditions and needs.

The last presentation of Session II was given by **Dr Hayley Evers-King, Plymouth Marine Laboratory**, who delivered a presentation on behalf of EUMETSAT. The speech focused on the potential of Sentinel-3 for Fisheries and Aquaculture thanks to the following measurement capabilities:

- Altimetry
- Sea Surface Temperature
- Ocean Colour

A series of applications and use cases have been developed based on S-3 data and information. These includes:

- MESA project: developing Potential Fishing Zones (PFZ) maps and understanding fishing behaviour in Ghana
- Ocean and Coast Information Service as part of SA Operation Phakisa and GMES&Africa developments
- Hera Space – a start-up using CMDS data to optimise sustainable fishing behaviour
- Thermal front frequency, as proxy for marine animal abundance (MPAs)
- Detection of spawning events
- Development of water quality indicators in fishing regions (REVIVAL project, Lake Vembanad, Kerala).
- Early warnings for farmers about potential presence of HAB species from OC, Ecoli using SST, further collaborations with insurance industry for long term risk mapping, and new Lobster Grower project for optimising lobster aquaculture (ShellEye Project)
- Planning aquaculture sustainability (TAPAS H2020)

2.4 Session III and IV: Aquaculture challenges, user needs and innovation paths

Session III was opened by **Cécile Fouquet, Executive Secretary, Aquaculture Advisory Council (AAC),** who discussed the expectations and strategic objectives of the aquaculture industry. The AAC is a balanced stakeholder representative organisation created for consultation on elements of Union policies which could affect aquaculture under Articles 34 and 44 of Regulation (EU) No 1380/2013. The AAC may provide its advice to the European Commission, the European Parliament, the Committee of the Regions, the European Economic and Social Committee, one or several European Union Member States and any other relevant stakeholder, on any new legislative, regulatory or legal measure at European or national level, that is relevant to its objectives and the tasks defined by regulation. The AAC is composed of representatives from the industry and other stakeholders, with a 60% -40% allocation of the seats in the general assembly and the executive committee (Ex-Comm).

In terms aquaculture stakeholders' expectations and objectives, even if there is no official AAC position on the topics, the following aspects could be highlighted:

- Satellite and real time data
    - Move from retro-active measurement positions towards real-time monitoring and more regular site assessment
    - Integration of automated surface/aquatic measurement (sensors) with satellite measurement

    - Data that can support/replace expensive environmental monitoring and impact assessments
- Predictive and analytical tools
    - Tool to measure climate change effects on aquaculture (e.g. ClimeFish & CERES projects)
    - Model of "Phytoplankton evolution forecast" for the shellfish sector
    - Sound basis for environmental policy decisions
- Assess the impact of aquaculture on the environment
    - Monitoring of ecological impacts – including surveying species population and changes in habitats
    - Data on disturbance & displacement effects of aquaculture farms on protected species
    - Data on derogations for shooting protected species per country/per region
    - Data on nutrient input into ecosystems per farm
    - Data on plastic input into ecosystems per farm
    - Data on escapees per farm
- Access to data
    - Open access
    - Accessible for all users
    - Available in several languages

The following presentation was given by **Prof. Dr Johan Verreth, Wageningen University & Research**, who expanded on the user needs and challenges of the seawater, coastal water and freshwater aquaculture. In terms of aquaculture farming volume and type:

- Fish: 54 mT (61% in value)
- Crustacea: 8 mT (22% in value)
- Shellfish:17 mT (12 % in value)
- Seaweed: 30 mT (5% in value)

In terms of economics, the total trade value is ~30 billion €, with an average household expenditure of 107 €/person/yr.

The challenge is linked to the fact that In the next 15-20yrs, ±100 million mT extra seafood will be needed (Subasinghe 2014). As a consequence, we need:

- Intensification; industrialisation
- Responsible farming
    - Improve Health, Welfare, Productivity
    - Reduce Environmental Impact
- Tool: Precision Farming

Solutions include:

- Novel feeds
    - No Feed-Food claims (insects, algae, seaweed, bacteria)
    - Left-over streams Agro-Food industry

- Novel breeds
    - 10%-15% genetic improvement per generation
    - Based on genomics and precision phenotyping
- Recycling nutrients
    - RAS
    - Re-use of nutrients by other commodities (Building with Nature; IMTA; AquaPonics)
- Disruptive technologies (e.g. precision farming)
    - Novel production systems; sensorics and robotics
    - Genomics, Diseases and Farming = Big Data!
    - Internet of things, artificial intelligence

The third speech of Session III was given by **Marco Ottinger, DLR,** who focused on the use of Sentinel-1 to estimate aquaculture production. Aquaculture is one of the fastest-growing animal-food-producing sectors and supplies more than half of the fish consumed today. Almost 90% of all aquaculture production comes from Asian counties; China is by far the largest aquaculture producer with 2/3 of global production. Almost two-third of all the aquaculture volume is being produced in inland water aquaculture. Aquaculture in land-based pond systems constitutes the most important culture system and accounts for the largest share of total global aquaculture production. Using complex remote sensing image processing techniques based on earth observation time series, land-based aquaculture ponds were extracted for coastal regions and information on pond area and pond number was used to estimate aquaculture production. Satellite remote sensing data and value-added geoinformation products have the particular potential to assist reporting organisations and governments by providing independent information for large areas that may complement statistical data, or act as an alone-standing source of geoinformation where such data does not exist. A novel and integrated methodological approach for the estimation of aquaculture production was developed using EO data and statistical data. Production and yield statistics were used to link earth EO-based findings with production estimations based on a regression model. A positive correlation was found between the official production statistics and the EO-derived pond area indicating the potential of the aquaculture mapping approach for the approximation of production estimates. As a consequence, it was demonstrated how EO could close the gap in providing aquaculture production estimations for data-scarce, non-reporting, or incomplete-reporting countries.

The following presentation was given by **Dr Mark Dickey-Collas, International Council for the Exploration of the Sea**, who expanded on the monitoring the dynamics of fish populations and fisheries behaviour. Copernicus data and information are useful for a series of applications:

- Habitat description & change
    - Ecology understanding
    - Fish identification
    - Bycatch (e.g. turtles) reduction
    - Monitoring of mesoscale features
- Indicators of ecosystem health (e.g. Chlorophyll-a)
- Ecosystem productivity

  - There is growing interest in monitoring changes in ecosystem productivity/carrying capacity and its impact on fisheries and biomass reference points
- Spatial mapping of vessel activities
- Marine hazards
  - Including harmful algal blooms and turbidity events
- Forecasting and predictions of future scenarios

Several challenges are linked to the use of Copernicus data and information for the above-mentioned applications:

- Data (especially satellite) can be difficult to access, manipulate and process so training is often required
- Working across research fields challenges existing experts. Examples include:
  - Front locations from SST fields
  - Climatologists required to generate anomalies
  - Merging data sets from integrated oceanographic or satellite data with biological or fishery records
- Time-series of oceanography & satellite data are relatively short compared to many fisheries datasets

The following presentation was given by **Dr Thuy Pham, UiT Arctic University of Norway**, who discussed sustainable fisheries and Climate Change within the frame of the ClimeFish H2020 project. The main goal of the ClimeFish project is to co-create a decision support framework which can ensure that the increase in seafood production comes in areas and for species where there is a potential for sustainable growth, given the expected climate scenarios (link to the project website).

To reach this goal, ClimeFish has eight specific objectives:

1. To investigate the effects of climate change on fisheries and aquaculture at European and regional scale, and to collect and harmonize relevant data which will be made available in the H2020 Open Research Data Pilot
2. To develop novel forecasting models to simulate and analyse changes in distribution and production in the fisheries and aquaculture sectors
3. To identify risks and opportunities based on analysis of market and non-market costs and benefits of affected ecosystem services; propose potential mitigation strategies
4. To develop early warning methodologies for these risks, including a traffic-light system
5. In co-creation with stakeholders, develop case-specific Management Plans that mitigate risks and utilize opportunities associated with anticipated effects of climate change on aquatic production, based on ecosystem and results-based management approaches
6. In co-creation with stakeholders, develop guidelines, good practice recommendations and a voluntary European standard outlining how to develop this type of Management Plans in the future
7. In co-creation with stakeholders, develop the ClimeFish Decision Support Framework. This contains the ClimeFish Decision Support System and other decision support resources, such as models, datasets, sample runs and guidelines

8. To provide training and dissemination for industry, policy makers, scientists and other stakeholders; to ensure active use of the developed tools and guidelines beyond the project lifetime in close collaboration with the European Climate Adaptation Platform (Climate- ADAPT)

The last presentation of the day was given by **Marc Taconet, FAO Head of the Statistics and Information Branch,** who presented FAO's BlueBRIDGE project, aimed at providing innovative data management services for sustainable fisheries and aquaculture. BlueBRIDGE (Building Research environments fostering Innovation, Decision making, Governance and Education in fisheries and marine sciences) provides web-based resources with a focus on sustainable growth and development. These resources facilitate science-based policy formulation and evidence-based decision-making, and include:

- Online analytical tools and models to support scientific collaboration among working groups and institutions, including stock assessment methods and sustainable management strategies of data poor, small scale fisheries
- A global register for stocks and fisheries, disseminating comprehensive information on the location, status and trends of fish stocks and fisheries
- Support to aquaculture sites inventories and spatial planning using a combination of satellite data analysis and field collected information
- Online analytical tools and models to support scientific collaboration among working groups and institutions include stock assessment methods and sustainable management strategies for data poor and small-scale fisheries

A knowledge production chain involves multidisciplinary scientific communities and BlueBRIDGE will transform how they co-operate by enabling collaboration and data alignment. Users from different sectors will benefit from data sharing and publication facilities as well as from powerful processing capabilities. As a result, users will have better access to knowledge at lower costs. BlueBRIDGE provides on-line training for the next generation of scientists. This is fundamental to build capacity in often resource-poor environments where these materials are difficult to find. BlueBRIDGE also collaborates with 7 Small and Medium Enterprises (SMEs) the establishment of a self-sustaining user community exploiting the data services.

BlueBRIDGE services have foundations in the iMarine initiative (www.i-marine.eu) and exploit the D4Science infrastructure (www.d4science.org) to capitalise on previous investments made by the European Commission and as a first step towards future sustainability.

2.5 Conclusions and outcomes

The workshop was brought to a close by **Fabienne Jacq, DG GROW Copernicus Unit.** The event represented the first of a series of opportunities for the Fisheries and Aquaculture community to meet with the Copernicus stakeholders. The interaction with the audience proved to be fervent and fruitful. It is normal, at this stage, that many of the questions remain open.

The presentations, and the discussions around them, highlighted how far Copernicus has been reaching, even in domains, like the two addressed here, which were not at the forefront of the portfolio of objectives of Copernicus.

Not surprisingly, a key role has been played, and will continue to be played, by the EU research programs, Horizon 2020 and its successor, in stimulating new developments in these promising domains. Nevertheless, the workshop has shown that the use of EO data, and of Copernicus data in particular, is steadily progressing in the multiple areas belonging to Fisheries and Aquaculture.

While the Copernicus services (CMEMS in this case), ESA and EUMETSAT have detailed their offers, a number of other speakers have provided more information about their needs, the methods and tools currently used and the perspective evolution of their needs.

In the monitoring and surveillance activities of EFCA, for example but also of other agencies and bodies at European and national level, support is required for the identification of IUU fishing practices, for providing an integrated maritime picture. In the future there will be pressure for improving availability and timeliness of data, the quality of automatic processing, the resources for data acquisition and analysis. Some insisted on the need to improve the framework for the operational use of the information gathered.

Also, the different areas addressed under the workshop title require specific expertise from the personnel in charge. Several speakers raised issues related to responsible and sustainable fishing and farming.

Taking into account climate change will require better models in order to forecast the redistribution of the fish stocks and the deployment of facilities for aquaculture (« future scenarios »).

Other important applications in the Fisheries and Aquaculture domain where Copernicus could bring support are:

- Habitat description & change (e.g. spawning habitat, fishing habitat, feeding habitat, fish distribution changes)
- Indicators of ecosystem health (e.g. water quality, eutrophication, disease, toxic blooms)
- Ecosystem productivity (e.g. max allowable catch, fish stock, habitat)
- Vessel activity monitoring and identification of small vessels, detailed fishing behavioural patterns to assess fishing pressure
- Marine hazards
- Improvement of control of non-sustainable practices like identification of discard over board by satellite (fish oil track), assessment of potential damage of fishing practices on the marine environment (in support to MPA, effects on ground, etc.)
- Solutions to assess the impact of climate change on stocks, water quality and environmental parameters of influence of fish stocks

The fact that today Copernicus is already used in relation to these and other areas should be regarded as one of the main messages of the event. Sentinel 1, 2 and 3, along with other satellites, are contributing to these activities thus reinforcing the message that continuity of current observations is essential. Preliminary margins for improvements have been identified during the discussion, e.g. link between Global, Regional and local models, Inland Water products for Fisheries and Aquaculture, development of coastal products consistent with open ocean products, development of products for inland fisheries and aquaculture, access to bathymetry, products to assess diseases, creation of vulnerability mapping for fish stocks or aquaculture farms, indicators for catch certification forms, provision of products as forecasts and long–term projections (habitat, stock, quality), products specific and adapted to pelagic species and benthic species etc.

Moreover, the link between the Copernicus evolution and the Fisheries- and Aquaculture-related EU policies (e.g. environmental monitoring, compliance, international conventions, SDGs) should be reinforced so to increase the operational use of Copernicus products from the DGs, The EU Agencies and the Member States. A clear example is represented by DG MARE's will to strengthen the collaboration with DG GROW with the aim of exploiting Copernicus data and information at its best in relation to the CFP needs.

On another note, the downstream sector plays a relevant role in providing critical information to the end-users. It is therefore crucial to understand which products for Fisheries and Aquaculture should be delivered by the Copernicus services and which by the downstream sector. It is important for the users that this distinction is better clarified.

As a way forward, DG GROW encourages the relevant user communities to build on this first step and maintain a communication line in order to feed into future Copernicus activities for Fisheries and Aquaculture.

ANNEX 1 WORKSHOP AGENDA

Agenda

09:00 Registration and welcome coffee

09:30 **Welcome by Elisabeth Hamdouch, Deputy Head of Unit I2 (Copernicus), DG GROW**

NB: The moderator will allow the audience to ask a maximum of two questions after each presentation

Session I – Setting the scene

- 09:40 Fisheries & Aquaculture within the Common Fisheries Policy and the Blue Growth agenda – **Felix Leinemann, Head of Unit "Blue Economy Sectors, Aquaculture and Maritime Spatial Planning", DG MARE**
- 09:55 EFCA and its operational capacities - **Sven Tahon, European Fisheries Control Agency (EFCA)**
- 10:10 Research & Innovation in support of Blue Growth – **Nikos Zampoukas (DG RTD)**
- 10:25 DG MARE's tools for data management: EMODNET and DCF – **Iain Shepherd, Blue Growth, Data and Innovation Senior Expert, DG MARE**

10:40 Coffee break

Session II - The Copernicus offer for Fisheries & Aquaculture

- 11:10 The Copernicus Marine Environment Monitoring Service (CMEMS) offer, with a focus on use cases – **Edmée Durand, Mercator Ocean**
- 11:25 Operational use of EMSA's Copernicus Maritime Surveillance (CMS) Service for fisheries control and law enforcement, with a focus on use cases and users' perspective - **Sven Tahon, European Fisheries Control Agency (EFCA)**
- 11:40 The potential of Earth Observation: the ESA perspective - **Dr Espen Volden, ESA ESRIN**
- 11:55 The potential of Earth Observation: the EUMETSAT perspective - **Dr Hayley Evers-King, Plymouth Marine Laboratory**

12:10 **Discussion**

12:45 Lunch break

Session III – Aquaculture challenges, user needs and innovation paths

- 13:45 Expectations and strategic objectives of the aquaculture industry **– Cecile Fouquet, Executive Secretary, Aquaculture Advisory Council**
- 14:00 Seawater, coastal water and freshwater aquaculture: user needs and challenges - **Prof. Dr Johan Verreth, Wageningen University & Research**
- 14:15 Sentinel-1 to estimate aquaculture production: opportunities and challenges - **Marco Ottinger, DLR**
- 14:30 Smart and open data analytics as a service for aquaculture - **Gary McManus, Telecommunications Software and Systems Group**

14:45 **Discussion**

15:15 Coffee break

Session IV - Fisheries challenges, user needs and innovation paths

- 15:45 Monitoring the dynamics of fish populations and fisheries behaviour – **Mark Dickey-Collas, International Council for the Exploration of the Sea**
- 16:00 Sustainable fisheries and Climate Change: the ClimeFish H2020 project – **Dr Thuy Pham, UiT Arctic University of Norway**
- 16:15 Innovative data management services for sustainable fisheries and aquaculture: the BlueBRIDGE data services – **Marc Taconet, FAO (Head, Statistics and Information Branch)**

16:30 **Concluding discussion**

17:20 **Concluding remarks by DG GROW**

17:30 **End of meeting**