Copernicus training workshop report

1. Programme and attendance

The European Aquaculture Technology and innovation Platform (EATiP) and Mercator Ocean International as implementer of the Copernicus Marine Environment Monitoring Service (CMEMS or Copernicus Marine) organized a joint event in Athens on September 24-25 2019. The objective was to explore the application possibilities of the available open-access satellite, model-based and in situ marine data for the aquaculture sector. This was done through the sharing of experiences and challenges representatives from the aquaculture sector are facing when managing aquaculture farms, followed by a demonstration of how Copernicus Marine might contribute to tackle these and possible future challenges.

After an announcement of the dates for the workshop, the agenda was published and registrations were opened in June 2019 through the web sites of EATiP and Copernicus Marine (see http://marine.copernicus.eu/copernicus-marine-for-the-aquaculture-sector/).

A large interest in the event was shown and a total of about 90 persons preregistered. Of those, 50 completed the on-line survey, 56% of which were representatives from the private sector. Figure 1 shows that 34% of the respondents had no or little experience with the use of the marine service, whereas 20% considered themselves as expert users.

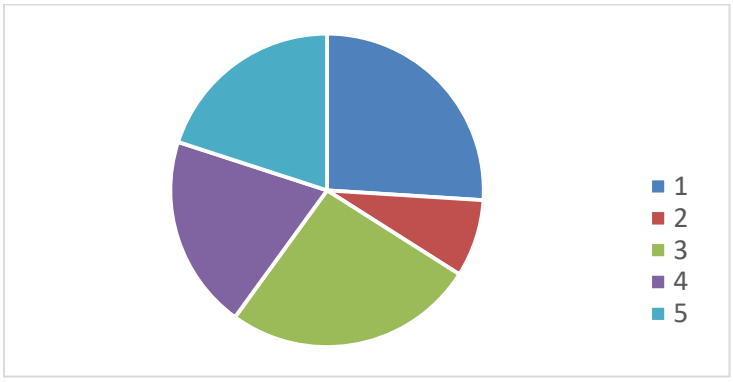

Figure 1: Ranking of Copernicus Marine user level (from 1 to 5 where 1 star means "never used Copernicus Marine data" to 5 stars which means "proficient user").

Leonidas Papaharisis from HETEPA welcomed the participants to the workshop (photo EATiP)

The monitoring of oxygen levels, pollution drift forecast, algal bloom monitoring and eutrophication was regarded of highest relevance (56% of respondents gave this the highest score), followed by the use of data for the management of environmental risks (52 % of respondents gave this a 5-score). Of almost equal value were the need for data to monitor climate change (40% score 5 and 26% score 4) and to plan new aquaculture locations (40% and 20% respectively). The lowest score was given to the optimisation of existing locations (24% and 24% respectively).

The local organisation of the workshop was led by HETEPA, the Hellenic EATiP Mirror Platform. In total, 80 persons joined the event. The type of audience was distributed among the categories as shown inFigure 1 Figure 22.

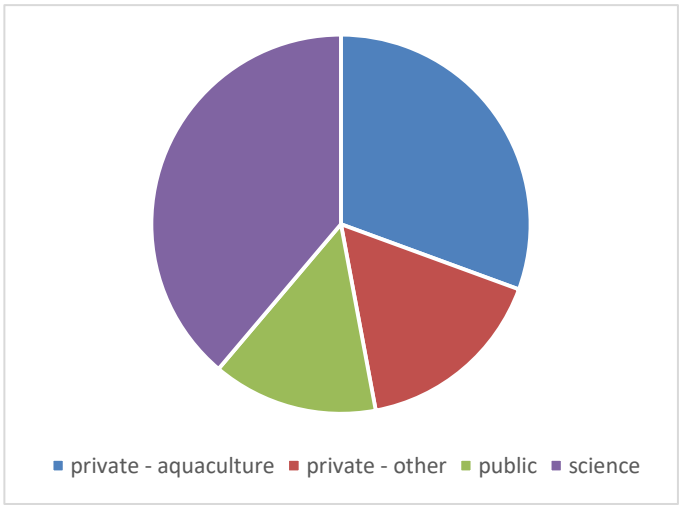

Figure 2: Type of organisation represented by the workshop attendants

Participants at Day1 of the workshop (photo EATiP)

In total, 45% of the attendants represented the private sector, and of those 60% were working in aquaculture. A total share of 40% worked in R&D organisations or universities.

Nikos Zampoukas from DG RTD (photo EATiP)

The participants learned about the sector's need for data when operating at sea and about how Copernicus Marine might contribute to tackling those needs. Nikos Zampoukas from DG RTD underlined the importance of marine data in the context of Horizon Europe and the new Mission on Healthy Oceans, Seas, Coastal and Inland Waters. From DG MARE, Dora Barreira-Ramos held a remote presentation on the main challenges European aquaculture is facing. She presented how the Farm-to-Fork policy and the revision of the Strategic Guidelines for Aquaculture Development in the EU are intended to support the sector's competitiveness and innovation level. The importance of satellite images for aquaculture production and governance is acknowledged in the Guidelines.

Discussion among the aquaculture stakeholders on the needs for ocean data, led by Alexandra Neyts from EATiP (photo EATiP)

The other talks of the first session were given by the European level aquaculture associations EATiP, the Federation of European Aquaculture Producers (FEAP) and the European Molluscs Producers Association (EMPA), the Aquaculture Advisory Council (AAC), the NGO European Bureau of Conservation and Development (EBCD), the fish farming company Salmar and the Norwegian Seafood Federation. They showed the requirements of the fish and shellfish farming sector for real-time monitoring, better predictive models and reduced uncertainties.

Laurence Crosnier from CMEMS introduced the services of Copernicus Marine to the audience (photo EATiP)

Fabrice Messal from CMEMS summing up the findings from Day 1 (photo EATiP)

The second part of the presentations consisted of an introduction to the Copernicus Marine Service and marine data (including satellite, model-based and in situ data) delivered by Copernicus Marine and by EMODnet, and of aquaculture related examples provided by different experienced users. These talks provided the attendants with a better understanding of the opportunities the Marine Service can provide.

During the hands-on technical training session, some of the existing examples and known solutions were put into practice. Copernicus Marine staff and experienced users advised on how to use marine data to develop customised products.

Special skills are required to operate with the data sets available through Copernicus.

Combining the problem-owners and problem-solvers in a joint workshop proved to be a useful concept. In addition to the exchange of ideas and knowledge processes, the event provided a networking platform across different stakeholder groups – people who usually would not meet.

2. Main findings

Based on global policy decisions, it is anticipated that national authorities will increase the demands for environmental monitoring in the years to come. The granting of production licenses is expected to be increasingly linked to a set of defined sustainability criteria, including those related to biodiversity conservation and climate change. It is therefore important for the sector to operate according to a precautionary, evidence- and ecosystem-based management. EATiP encourages the utilization of available satellite, model-based and in situ environmental and farm data for the development of appropriate decision-making models.

The aquaculture community was found to have a generally low knowledge about the possibilities of Copernicus Marine, and several participants expressed a need for more information and awareness. Free access to the data was mentioned as a key issue for the end users. Copernicus Marine service data are distributed free of charge.

Attendants commented that the Service is currently not sufficiently user-friendly to be taken up by aquaculture producers, technology or service suppliers. It was encouraged to adapt both the download interface and the product catalogue to stimulate its user-friendliness, and to use meaningful product and dataset names. The example of Planet OS was given as an illustration of a user friendly interface. The provision of an interpolation algorithm as a service was also mentioned as one of the many requirements. Annex1 is listing in details all the requirements gathered during the event.

A clearer documentation and information about parameter and quality control and about data units, as well as a need for standardization is important to be able to apply the data sets in governance models and monitoring schemes. The interoperability of the available sets was also said to be of great significance, in order to be able to compare data from different sources.

Whereas Copernicus Marine provides observations from satellite and in situ platform and model-based forecasts for a set of physical and biological marine parameters in the past (last 25 years) and for the next 10 days in forecast mode, EMODnet maintains a marine data set archive for bathymetry, biology, chemistry, geology, human activities, in situ based physics and seabed habitats. For the attendants, it was important to operate with an integrated data set, independent of data provider.

In the aquaculture sector, different types of datasets are valued to increase the overall predictability of the production. In particular, the following were highlighted:

- Homogenized bathymetry data along the coast (siting, optimization)
- Temperature, oxygen, nitrogen (siting of shellfish farms)

- Salinity and temperature (as indicators of the thermocline behavior, upwelling areas, global warming)
- Estuary data, river effluents and runoff from land (protection against pollution, eutrophication, pathogens)
- Distribution of organic matter, chemical compounds related to antifouling, medication, lice treatments in the vicinity of sea cages (environmental interactions, social acceptance)
- Chlorophyll-a, warnings for potential Harmful Algal Blooms (risk management)
- Phytoplankton identification (differentiation between useful and toxic algae)
- Real-time in situ observations of waves, temperature, salinity, currents, waves, dissolved oxygen, chlorophyll-a (planning of set-out of fish, planning and monitoring of daily operations, preparedness for extreme weather, fish welfare and growth optimisation)

The aquaculture sector is currently not using satellite data as part of its routines. However, satellite images can provide valuable information e.g. about shellfish production densities and disease or mortality progression, and about the spreading of Harmful Algae Blooms. They can also provide tools to demonstrate potential environmental benefits of shellfish farming. When it comes to satellite data, information about its uncertainties was regarded as crucial.

Copernicus Marine emphasized the need to supplement their ocean data sets with coastal data provided on a national or locals scale. Copernicus data should be regarded as a backbone, supported by other types of measurements and by local expertise. The totality of data, especially on temperature, currents, waves, dissolved oxygen, contributes to the development of predictive and monitoring models with global or basin scale coverage, and hence may improve aquaculture planning and preparedness practices. Examples of their use for the building of marine spatial planning services at different scales – from global to local – were shown. Other products demonstrated are anomalies of different parameters over a period of 25 years, and models showing 10 days of forecasts in selected regions. The latter are based on regional and global models, developed by regional and global experts respectively. Here, Copernicus data provide boundary conditions for more detailed local coastal models with higher resolution.

Coastal models exist in most countries and information about aquaculture use cases in different regions is available on the Copernicus Marine web site and case book for aquaculture. Current coastal models are often felt to be too coarse, not providing the necessary level of detail. Attendants from the aquaculture sector required high resolution coastal data sets (100 m – 1 m) and a short delivery time. Some may already exist in certain regions, and it was proposed to set up a list of the existing coastal models in Europe, and whether they were downscaled from Copernicus boundary conditions, as a basis for potential use by the aquaculture industry. A contact list of model providers at regional scale was also expressed to be of interest. CMEMS informed about the development of a coastal roadmap strategy in Europe, but commented that this is an ongoing process needing approval of the national authorities.

3. Way forward

Collaboration between EATiP, Copernicus Marine and the providers of intermediate services was regarded as necessary to fully exploit the opportunities of the available data sets and models. A number of Copernicus User Uptake funding opportunities were mentioned, such as FPA, Caroline Hirscher, Copernicus relays/academy, CMEMS User Uptake, Copernicus accelerator, Copernicus masters, h2020 call where the use of Copernicus data is enforced, etc… A series of User Uptake pilot projects, running parallel in different regions, were proposed as a joint action between CMEMS, EATIP and EMODnet.

In situ data are scarce, but highly needed to calibrate existing models. Aquaculture companies are monitoring multiple parameters on site on a continuous basis. The producers and producer

associations present at the workshop expressed their interest to share those in order to develop better predictive and monitoring models. However, it was emphasized that the data providers should keep full ownership and control of the data they deliver. Also, Copernicus Marine was asked to provide an in situ data ingestion protocol (available here: http://www.marineinsitu.eu/submit-data/), providing the aquaculture stakeholders with clear guidelines on who to contact, which data standards to follow, which file format to use, how to upload etc. Educational programmes are needed to have a correct interpretation of the data, leading to the right decision-making. Intermediate users, making the connection between end users and data providers were regarded as crucial in this process.

EATiP can be used as platform to coordinate the establishment of a data highway in Europe, where interested aquaculture stakeholders share their monitoring data with Copernicus Marine.

4. Evaluation

The Copernicus Marine - EATiP partnership resulted in a successful event enabling the identification of the most critical marine data needs and most promising data-based opportunities in the aquaculture sector. Through the training session and plenary discussions, awareness was raised, and different types of stakeholders connected.

An invitation to evaluate the workshop through an on-line survey was sent out to all participants. In total 15 responses were collected. 53% of those gave day 1 of the event the highest score (5), the remaining 47% gave it a score of 4. For day to, the results were 20% and 40% respectively. Here, 33% gave the session a mediocre score of 3, whereas 1 respondent gave it the lowest score. We believe this was due to its strong technical focus. The impact of the training session might be improved by splitting the participants into two groups, i.e. the inexperienced aquaculture end users and the experienced intermediate users. However, 86% of the respondents replied that the workshop answered to their expectancies, and all of them found the presentations relevant for their business. Additionally, almost all (93%) experienced good interactions with the speakers and other participants.

October 2019.

EATiP Secretariat

Annex1: list of detailed aquaculture sector requirements for marine data

Need for information/awareness about Copernicus Marine

- Need to learn more about the Copernicus Marine possibility

Need for free data

- Need for free data

Need for user friendly interface/clearer product metadata/toolbox

- Need for a more user friendly interface
- Need to have a Copernicus Marine data download and visualization interface equivalent to the PlanetOS tool with APIs ; need to have immediately a test URL for each parameter as done in PlanetOS
- Need for more user friendly download interface and catalogue; currently not easy to download data; the catalogue is not clear;
- Need to have meaningful product and dataset names as it is currently impossible to understand which parameter is stored in which product and dataset
- Need interpolation algorithm to be provided as a service

Need for data

Data documentation

- Need clearer documentation about data: clear information about parameter and quality control. Need to know which North/South conventions are used for wind/currents/wave data

Data format

- standardization is important
- need data in ATRS84 format (for excel file)
- need to be fully inspire compliant; it is not the case yet which results in a non-fully interoperable CMEMS dataset

Data units

- Need to have clearer information about data units, and how they differ from in situ / satellite / model parameters which could be proxys

Data Uncertainties

- Need to know the uncertainties on satellite data. It is important to convince the conservative communities (e.g. working on MSFD), only believing in in situ data, that satellite observation can be of great value

In situ/model/satellite

- Need for intercomparison of data from different sources
- Need for homogenized bathymetry data along European coast

- Need for temperature, oxygen, nitrogen data to look for new locations for shellfish production
- Need data from rivers to protect aquaculture/shellfish farm from run-off and land-based pollution (e.g. containing viruses, E-Coli)
- Need for river and estuary data; what will be available from SWOT?
- Need for model including forecast and satellite data (on chlorophyll-a and other parameters) to warn for potential HAB
- Need for data about accumulation of organic matter, chemicals, antifouling compounds , medicines and alike
- Need for salinity data and temperature connected to parasite (e.g. sea lice) control and management
- Need for real time observations to optimize daily operations

IN SITU

- Need for wave data from buoys in existing international programs
- Need for temperature, salinity, currents, waves, dissolved oxygen data
- Need real time observations

SATELLITE

- Need for ocean Color sentinel-2 data
- Need for aerial or satellite photo of shellfish production farms (photo of tables where shellfish sockets are attached in the water) at different times (twice a month) to be able to follow how many tons of shellfish will be produced (i.e. photo will allow to follow how the shellfish grow: the bigger the shell, the darker the photo). According to the color of the shellfish socket, the produced tonnage can be deducted. Also dead shells can be detected.
- Need for satellite data about Harmful Algae Blooms, offshore and at the coast (S-2 and/or S-3)

MODEL

- Need for model data with global coverage or basin scale coverage to know about general ocean circulation conditions;
- Need for models on temperature, currents, waves, dissolved oxygen

INDICATOR

- Need to know about thermocline behavior, upwelling presence, potential HAB occurrence, Global warming trends in coastal areas
- Need data to reduce the risk in aquaculture industry, to increase predictability, allow better planning, and support strategic decision against global warming
- The aquaculture sector needs the help of Copernicus and its data to show to the general public that the aquaculture industry is environmentally sustainable and compliant with environmental policies;
- A tool is needed to enforce social acceptance of aquaculture using space observation to evaluate aquaculture farm impact on the environment;

Need for higher resolution data/ clearer Copernicus coastal roadmap portfolio

- Need for a high resolution coastal model (10 meter resolution)
- Need to have the list of all the existing coastal models in Europe (from national initiatives or private companies or CMEMS intermediate users) that can share their coastal model outputs with the aquaculture industry. Need to know whether those coastal models are downscaled from Copernicus boundary conditions or not, and if the coastal data are open source or not (the example of SAMPA in Spain was given, but it is not clear where to access it)
- Need for very high resolution coastal data including all Lagunas for shellfish farm planning
- Data of higher resolution is needed to cope with local needs; 100 meter resolution needed and even 1 meter for some parameters; need data at high resolution, for free;

Need for a clear common Copernicus Marine/EMODnet offer

- Need for a clear combined Copernicus Marine/EMODnet offer, gathered in the same place from the same single portal

Collaboration/ User Uptake funding opportunities

- There are a lot of Copernicus User Uptake funding opportunities; there is a need to list them somewhere (FPA, Caroline Escher, Copernicus relays/academy, CMEMS UU, CAMS UU, C3S UU, Copernicus accelerator, Copernicus masters, H2020 call where the use of Copernicus data is enforced, etc…)
- Copernicus/aquaculture projects cooperation: Can Copernicus work together with on-going aquaculture projects related to climate change, i.e. ClimeFish and CERES?
- Would like to see a User Uptake pilot project developed between CMEMS and EATIP for the aquaculture industry

Need for a Data Ingestion protocol for ingestion of aquaculture sites in situ data into Copernicus Marine in situ TAC

- Copernicus/EMODnet needs to define and publish their common in situ data sharing protocol for the aquaculture. It is necessary to know who to contact, which data standards to follow, which file format to use etc… The protocol is available at: http://www.marineinsitu.eu/submit-data/
- The aquaculture sector expressed its intention to share its in situ monitoring (a set of different parameters) data with Copernicus. Need for a protocol to be described on how to do it.