# AAC Recommendation on the Use of Satellite Data for Aquaculture

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## I. Background

The Copernicus programme is a complex satellite Earth observation initiative launched in 1998 by the European Commission in collaboration with several space agencies. It aims, based on satellite observations of the Earth and data collected in situ, to provide complete, free and open access to data and information about our planet and its environment. It is coordinated and managed by the European Commission and is approximately two-thirds funded by the EU budget, with the remaining costs supported by the European Space Agency (ESA) and other third parties.

The development of the observation infrastructure takes place under the auspices of the ESA for the space component, and the European Environment Agency and member states manage the in-situ component. A network of institutional agencies and private service providers, including Copernicus (CMEMs), EMODnet, EUSPA, Mercator Ocean and other partners, operates around the programme. For end users—in our case, aquaculture sector stakeholders—orienting themselves within this network of operators whose roles and services are often difficult to understand is currently problematic and time-consuming.

In addition to the complexity of the network described above, several other factors add to the challenge:

- Factors intrinsic to the nature of the data itself (mode of collection and recording, etc.)
- Factors linked to the nature of the activities carried out by end-users from different sectors operating in the same geographic area
- The diversity of the environments in which aquaculture activities take place (on land, in lakes, at sea or in intermediate areas such as estuaries, coastal lagoons and intertidal areas)
- The variety of production methods in aquaculture (land-based farms, pond aquaculture, off-bottom cultivation in intertidal areas, cages, long-lines, etc.)

This overall complexity and the proliferation of service offerings tailored to specific uses are the two main aspects underlying the still marginal use of satellite data in aquaculture.

## II. Justification

**Potential end users of satellite data and related needs**

Based on the various consultations conducted during the drafting of this document, a list of the needs of various aquaculture-sector stakeholders, organised according to their sector of activity and role, was prepared. This list is not exhaustive, but it provides a foundation to be expanded upon in the future.

*Needs in the Shellfish Industry*

The shellfish industry is the aquaculture sector most dependent on the surrounding environment, from which it draws nourishment, and is therefore the sector most likely to

benefit from the use of satellite data. Potential users include individual producers and producers' associations.

Relevant satellite data for the sector include the following:

- Temperatures, with a focus on critical thresholds for certain farmed species. Real-time data are of limited use, as products cannot be marketed or moved to other sites in the short term. Forecasts on a monthly scale based on historical data would be far more useful.
- Chlorophyll concentrations in water, understood as historical averages on a weekly or monthly basis. As with temperature, real-time data are of limited value and have no application.
- Photosynthetically active radiation (PAR), corresponding to light of wavelengths of 400–700 nm, which constitutes the portion of the spectrum utilised by plants for photosynthesis
- Sea currents
- Historical meteorological and marine data for a given production site (average and maximum wave height, average and maximum wind speed and direction and previously mentioned environmental parameters, etc). These data are necessary for licensing applications, environmental impact studies and operational planning.
- Dated and certified satellite images to document damage to facilities after exceptional events for insurance or institutions—for instance, orthophotos of structures installed in intertidal zones before and after the event.

Relevant models for analysing and extrapolating data of interest to the sector are as follows:

- Forecasting temperature and chlorophyll concentration trends over the following three- to six-month period, based on existing historical datasets (meteorological, satellite and in situ data).
- Assessing the risk of suspension of bivalve harvest and sales due to algal toxins, using historical chlorophyll and health-monitoring data.
- Extrapolating the thermal profile of the water along the water column based on surface temperatures, in situ measurements and seawater stratification models.

Other types of modelling systems proposed in past years that have not found practical application include these:

- Growth models for bivalve molluscs based on temperature and chlorophyll concentrations. These are of little benefit because farmers cannot influence environmental conditions and marketing must be carried out in periods conditioned by other factors, such as the reproductive cycle (meat rate).

- Early-warning systems for events such as freshwater flows, harmful algal blooms (HABs) or other damaging events, as producers typically cannot intervene in time to reduce damage

## Needs in the Fish Farming Sector

For land-based fish farming and sea cages, the use of satellite data is limited by the nature of the available data and the existence of technologically advanced and increasingly reliable in situ monitoring systems.

However, several cases are worth mentioning:

- Historical meteorological and marine data for an offshore production site (average and maximum wave height, average and maximum wind speed and direction, and related environmental parameters) are necessary for licensing and environmental impact studies.
- Real-time data in land-based pond aquaculture could become one of the most valuable tools for achieving smart nutrient management and sensor-based solutions.
- In the case of exceptional events, dated and certified satellite images are useful for documenting damage, such as orthophotos of open-sea cages, for insurance companies or institutions before and after an incident.

## Research Needs

Today, numerous scientific studies have made use of satellite data. Unfortunately, the data-processing models are not standardised, thus making the results difficult to compare. Furthermore, access to data and related services is often funded through research projects; when these projects end, the software programmes that have been developed are discontinued and their content is lost.

## Needs of Institutions and Decision Makers at all Levels

At the institutional level, satellite data can be applied in many fields, including the following:

- Marine spatial planning and aquaculture activity mapping
- Licensing and aquaculture enterprise mapping
- Evaluation of environmental performance in aquaculture
- Monitoring climate change

- Evaluation of Marine Strategy Framework Directive (MSFD) and Water Framework Directive (WFD) results
- Monitoring algal toxins and HABs
- Monitoring water treatment and discharge

Dedicated digital platforms, either permanent or part of ongoing projects, already exist at both the EU and member state levels, often run by relevant ministries or specialised research institutes. However, their state of progress varies widely among countries, making it difficult and inefficient to exchange data with the European Commission and between member states. Furthermore, when provided, end-user access is often difficult.

In countries with reliable monitoring and advanced data-sharing systems, private individuals or producer associations have promoted the development of user-friendly platforms accessible from smartphones and computers. In the absence of preexisting databases, such initiatives would not have been possible.

*Mismatch between supplied services and sector needs*

As part of the consultations and analyses carried out in preparing this recommendation, efforts have been made to understand why the use of satellite data has remained so limited despite numerous projects and initiatives designed to address the issue.

The unsuccessful outcomes of many initiatives aimed at the shellfish sector are probably due to a top-down approach. This approach was determined, on the one hand, by the availability of satellite data from the Copernicus programme and, on the other, by strategies pursued by universities and service providers whose offerings did not meet the sector's needs.

Several reasons explain this lack of success:

- The sector's real needs were never clearly identified.
- Proposers still struggle to understand producers' actual needs and the socioeconomic context in which they operate.
- Universities operate in an academic logic, prioritising publishable, cutting-edge results that are difficult to apply in a sector that is still very traditional and composed mainly of microenterprises and SMEs.
- Many service providers target well-structured companies, perhaps with Research and Development departments (e.g., in the salmon industry), which does not reflect the reality of sectors that could benefit most from the use of satellite data, such as the shellfish farming sector.

- Many stand-alone proposals based on satellite data focus on a particular aspect or a narrow niche of end users, resulting in economies of scale that are too limited to be profitable.
- Producers are generally unaware of the advantages and limitations of satellite data.
- Producers and end users often lack the time to explore the use of satellite data and do not see them as a necessity or priority.
- Many of the proposed services have shown an unfavourable cost–benefit ratio.
- Numerous initiatives took place within projects that ended without follow-up.
- Coordination has been weak at both the national and EU levels.

These findings raise the question of what role producers' associations should play as intermediaries between producers, academia and service providers.

*Data availability, use and reliability*

In aquaculture sectors where satellite data would be most relevant—such as shellfish farming and pond aquaculture — several factors have contributed to their still marginal use.

- Limited computer skills among end users, combined with inadequate hardware and complicated and time-consuming access procedures (e.g., to restricted areas), often discourage potential users.
- Using satellite data requires specific knowledge that many producers do not have; therefore, service provision must include training.
- Data reliability is poor in the intertidal zone (the area between land and sea affected by tides), where most European production occurs.
- The need for in situ measurements to confirm satellite data or enable processing and extrapolation (e.g., modelling water column temperature profiles based on surface and current measurement data). With regard to in situ measurements, it would also be advisable to define guidelines specifying which parameters should be collected, how they should be expressed and digitised for sharing and recording and which systems are most reliable and least expensive in installation and maintenance.

Regarding these points, the potential role of producer associations as intermediaries in managing certain services and in the training process should also be explored.

At the institutional level, there is also a need to address the issue of data standardisation, harmonisation and management. An evaluation of the MSFD[1] concluded, "The MSFD has paved the way for broad-scale marine data collection and knowledge building. However, the data collected are not fully harmonised and often lack sufficient quality. This leaves major knowledge gaps, while the significant potential of digitalisation, data sharing and earth observations is largely untapped".

*Conclusion*

The analysis conducted so far has highlighted the following:

- The aquaculture sector is complex, depending on species and production techniques.
- Satellite data can be valuable, but there is a need for historical rather than real-time data in offshore production sites and for real-time data in pond aquaculture management
- The use of satellite data in the fish-farming sector is likely to remain limited.
- The shellfish farming sector shows potential for the use of satellite data.
- The prevailing top-down logic for service provision does not meet the sector's needs.
- Stand-alone services typically offer an unfavourable cost–benefit ratio.
- There remains a lack of standardised, harmonised and high-quality data for effectively evaluating and monitoring European strategies and regulatory frameworks.
- Producers' associations could play intermediary roles.

In addition to these points, the sector requires access to several other data types:

- In situ environmental monitoring data
- Legally required health monitoring data (e.g., microbiological and algal toxin data, harvest suspension periods)
- Data from urban and industrial water treatment and discharge activities

[1] SWD(2025) 51 final – Commission Staff Working Document – Executive Summary of the Evaluation of Directive 2008/56/EC of the European Parliament and of the Council of 17 June 2008 Establishing a Framework for Community Action in the Field of Marine Environmental Policy (Marine Strategy Framework Directive) SWD(2025) 50 final https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/12898-Protecting-the-marine-environment-review-of-EU-rules_en

These and satellite data are interconnected and constitute fundamental elements for understanding and analysing historical trends, planning production and making decisions based on certified, up-to-date information.

Accordingly, the Ocean Pact[2] states the following:

- 'Ocean observation is the foundation of all marine knowledge. It provides critical data for weather forecasting, climate change mitigation and adaptation strategies, extreme events monitoring, civil security, maritime shipping, offshore energy, fisheries and aquaculture, and increasingly defence and security'.
- 'The Ocean Pact proposes to step up European efforts by launching an ambitious ocean observation initiative, including for the coastal and deep sea, covering the entire knowledge value chain, and taking a leading international role, to deliver critical information to all marine actors and sectors'.
- 'The initiative builds on the EU existing contribution to operational marine knowledge. As part of it, the Commission will further develop and integrate the two EU flagship data services EMODnet and the Copernicus Marine Service'.

Except for its emphasis on the "Ocean" component, which is inconsistent with several objectives related to freshwater aquaculture and the Mediterranean, the AAC supports the document's overall approach.

It is therefore recommended that all available data be integrated through a holistic approach operating at a large-scale and including the following:

- Coordination at the European level with shared strategies and standardised, harmonised tools and procedures
- Integration, processing and management of data at national or basin scales
- Creation of multiuser, multiservice platforms

## III. Recommendations

### AAC recommendations:

### To the European Commission

- Implement strategies to make the best possible use of the available data and tools (Copernicus programme and related services) and to provide stakeholders with integrated, easy-access data, as proposed in the Ocean Pact.
- Treat satellite data as one element of integrated data systems within multiuser and

[2] COM(2025)281 final Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions - The European Ocean Pact https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52025DC0281

multiservice platforms, which will be fundamental for analysing, understanding and managing the complexity of aquaculture activities amid environmental and economic changes.

- Adopt a bottom-up approach that reflects the needs of the sector.
- Define more precisely the sector's needs based on the satellite data potentially available.
- Continue supporting research aimed at improving the reliability of collected data and developing models that expand the range of available services.
- Support projects for the creation and subsequent management of multifunction, multiuser platforms, considering the roles of institutions and producer associations in this integration process.
- Promote standardisation and harmonization of parameters used, in situ measurement protocols and data collecting and management procedures.
- Develop guideline documents on standardised instrumentation for in situ measurements.

### To the EU Member States

- Create and manage sector-specific multiuser platforms.
- Facilitate access for end users to the data managed by institutions.


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