Ifremer
Système d'Informations Halieutiques

NOTE

RECOPESCA PROJECT ASSESSMENT

CC BY SA

Julie DUCHENE[1] • Emilie LEBLOND[1] • Loïc QUEMENER[2] • Guillaume CHARRIA[3]

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[1] RBE-HISSEO Coordination and valorisation of fisheries monitoring Unit (*Coordination et valorisation de l'Observation Halieutique*)
[2] REM-RDT Technological Research and Development Unit (*Recherches et Développements Technologiques*)
[3] ODE-LOPS Laboratory for Ocean Physics and Satellite remote sensing (*Laboratoire d'Océanographie Physique et Spatiale*)

Contents

1. BACKGROUND

The purpose of this document is to outline the objectives and functioning of the RECOPESCA project, which has now come to an end, and to summarise its contributions to fisheries, physics and participatory science. The conclusions drawn over the course of the project, areas for improvement and outlook for the future are also presented.

2. THE RECOPESCA PROJECT IN BRIEF

The national multi-disciplinary RECOPESCA[1] project (2005–2022), led by Ifremer, was a collaboration between voluntarily participating fishers and scientists for the automated collection of geopositioned environmental physics and fisheries data from coastal areas, aimed at advancing knowledge of the ecosystem and fishing activity for the needs of coastal physical oceanography and fisheries.

From 2005, RECOPESCA allowed around 170 volunteer vessels on all coasts of mainland France and the French overseas territories, to be equipped with a geolocation system with a transmission frequency of between 1 and 15 minutes. Such systems allow fishing vessels to be located very precisely, which is essential for spatialising fishing activity and accurately assessing fishing effort. Over the course of the project, thanks to the active participation of professional fishers, around half of these vessels were also fitted with environmental probes installed on their fishing gears. These served to collect physical data on the entire water column (measurements of depth and temperature, sometimes salinity and more rarely turbidity) and to quantify fishing time.

These vessels, regularly working in areas little studied or inaccessible (see, for example, Akpinar *et al.*, 2018[2]) to other fixed or mobile instrumentation systems (e.g. Argo profilers, coastal fixed stations, FerryBox, satellites) played the role of platforms of opportunity. Local environmental conditions and their variability in exploited areas are rarely sampled by scientists, often because of their particular characteristics (notably shallow waters, tidal currents and heavy maritime traffic), which make these measuring devices vulnerable. So, even for basic parameters such as temperature and salinity, most of the measurements available today on the continental shelves come from oceanographic campaigns carried out by the French Oceanographic Fleet[3].

In addition to the environmental data collected during cruises and by other systems, the data acquired thanks to the RECOPESCA project, which were collected on a more regular basis and at high frequency due to the high activity levels of the vessels equipped, has fed the operational coastal oceanography databases (coastal component of Coriolis) and been used to implement the ecosystem approach to fisheries[4]. In this way, the project has addressed research issues (physics and fisheries), support for public policies (DCSMM, DCF, CMEMS) and Ifremer's innovation in the coastal sector[5].

[1] *https://sih.ifremer.fr/Debarquements-effort-de-peche/Geolocalisation-et-instrumentation*
[2] *https://www.atlantos-h2020.eu/download/deliverables/AtlantOS_D4.5.pdf*
[3] *https://www.flotteoceanographique.fr/*
[4] *https://www.coriolis.eu.org/*
[5] *Copernicus Marine Service*

3. FISHING VESSELS AS MESUREMENT PLATFORMS AT EUROPEAN AND INTERNATIONAL LEVELS

Other projects in Europe and worldwide use professional fishing vessels as platforms for collecting environmental data. These are run by public or private establishments (Fig. 1), such as the Italian National Research Centre and its Fishery & Oceanography Observing System (FOOS)[6].

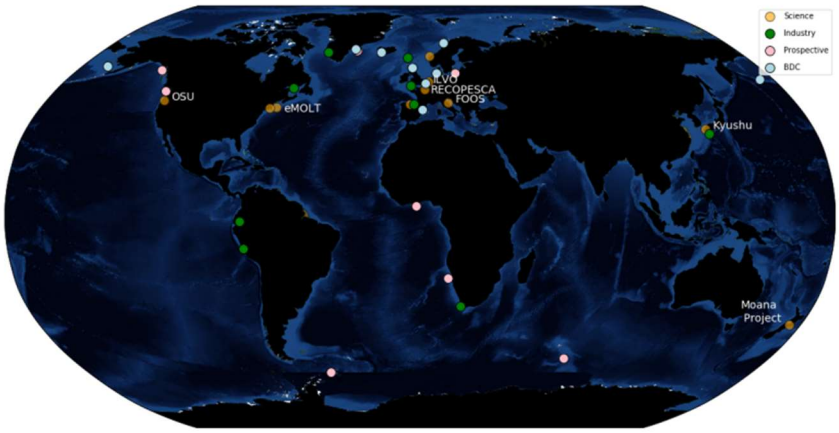


Figure 1. Scientific and industrial projects in collaboration with fishing vessels (source: https://berringdatacollective.com/data_management/)

There are currently a number of initiatives underway to bring people together and exchange ideas on this key issue, including the "fishing for data" workshop co-organised by EMODnet Physics and Berring Data Collective[7] (a private initiative that pays professionals for collecting data, unlike RECOPESCA, which is based on unpaid volunteers) to facilitate collaboration, work on pooling data and supply databases (EMODNET, COPERNICUS, etc.) according to metadata standards.

Several research projects involving Ifremer have confirmed that fishing vessels are an innovative tool for collecting environmental data, and the staff in charge of RECOPESCA have regularly been asked by foreign colleagues (e.g. CNR Italy, IMR Norway, MI Ireland, IEO Spain, etc.) to contribute their expertise and collaborate on projects aimed at developing or improving observation tools. Examples include EU-FP7 JERICO and H2020 JERICO-NEXT[8], EU-FP7 NEXOS[9], CPER PREVIMER, CPER ROEC, Interreg MyCOAST and, most recently, H2020 NAUTILOS[10], which aims to develop and test low-cost, robust and reliable dissolved oxygen and fluorescence probes.

Collaborations have also been set up with other external partners such as marine protected areas (Iroise Natural Marine Park and Port Cros National Park) or scientific teams that explicitly use RECOPESCA equipment to acquire data in a specific area or on particular sub-fleets (as part of projects such as ORFISH, TURFF or ATLANTILES). The RECOPESCA operational data acquisition platform and its data transmission, database storage and processing infrastructure were made available to these partners, who financed the purchase of the equipment, and Ifremer for the reception and management of the data, which contributed to the overall maintenance of the system.

[6] *https://www.irbim.cnr.it/en/inf-dettagli/adrifoos/*
[7] *https://berringdatacollective.com/*
[8] *https://www.jerico-ri.eu/*
[9] *https://www.nexosproject.eu/*
[10] *https://www.nautilos-h2020.eu/*

4. RECOPESCA'S MODE OF OPERATION

Technology

The RECOPESCA system (Fig. 2) consisted of a probe installed on a vessel's fishing gear, which measured various physical data over the whole water column. When the gear was brought back on board, the data was transmitted by radio and stored in a central data acquisition unit, the "concentrator", equipped with a GPS to geolocate the vessel. Then, as soon as the vessel was within range of the GPRS (2G) network, the concentrator would automatically transfer all this data to Ifremer, for storage in the Harmonie database of the Fisheries Information System (FIS), with no need for any action from the crew[11]. After a series of processing operations, the geolocated physical data would then be sent to the French operational oceanography database Coriolis.

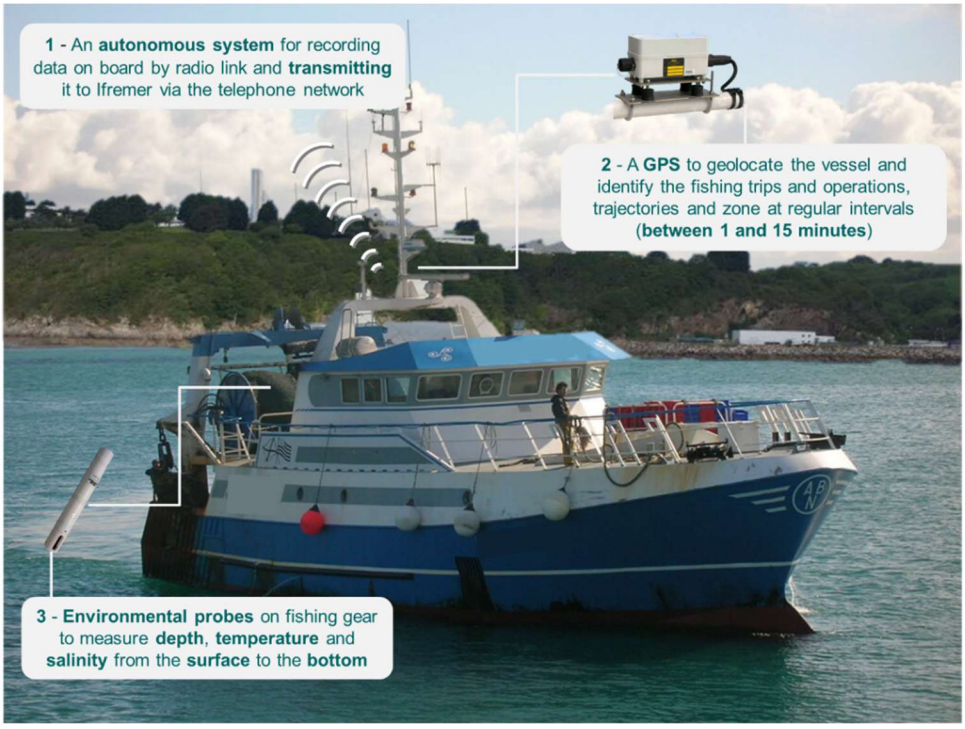


Figure 2. Schematic diagram of how the RECOPESCA system works

All the equipment was developed to Ifremer's specifications, working with NKE Instrumentation from 2001. Three essential and inseparable functions characterised the RECOPESCA system:

- Probe measurements were recorded at a different rate on the seabed from when the fishing gear was being lowered, when the rate was higher. This made it possible to detect sudden changes in parameter values (temperature, salinity) for the detection of strata such as the thermocline or halocline.
- Physical data were communicated from the probes to the concentrator when the gear was being raised.
- Transmission of data from the concentrator was autonomous when the vessel was within range of the network, without any intervention from the crew or external parties.

Although other geolocation systems and probes have been developed by manufacturers around the world, to our knowledge no similar system exists including these three features and offering an equivalent level of measurement accuracy.

[11] *https://sih.ifremer.fr/*

Skills used in the project

At Ifremer, a multidisciplinary team ensured that the project ran smoothly[12]:

- a fisheries engineer[13] for operational coordination of the project (general coordination, monitoring of equipment operation and feedback to professionals, management of the panel of vessels, relations with professionals and the service provider NKE, communication);
- an engineer[14] for a part of the technical aspects (metrology, installation of equipment, Fig. 3), with NKE being subcontracted for certain ports for technology monitoring, etc.;
- physical oceanography[15] and fisheries researchers and to define scientific needs and utilisation,
- technical support staff to monitor vessels on the different coasts,
- IT specialists[16] to receive, process and store data in the Harmonie and Coriolis information systems.

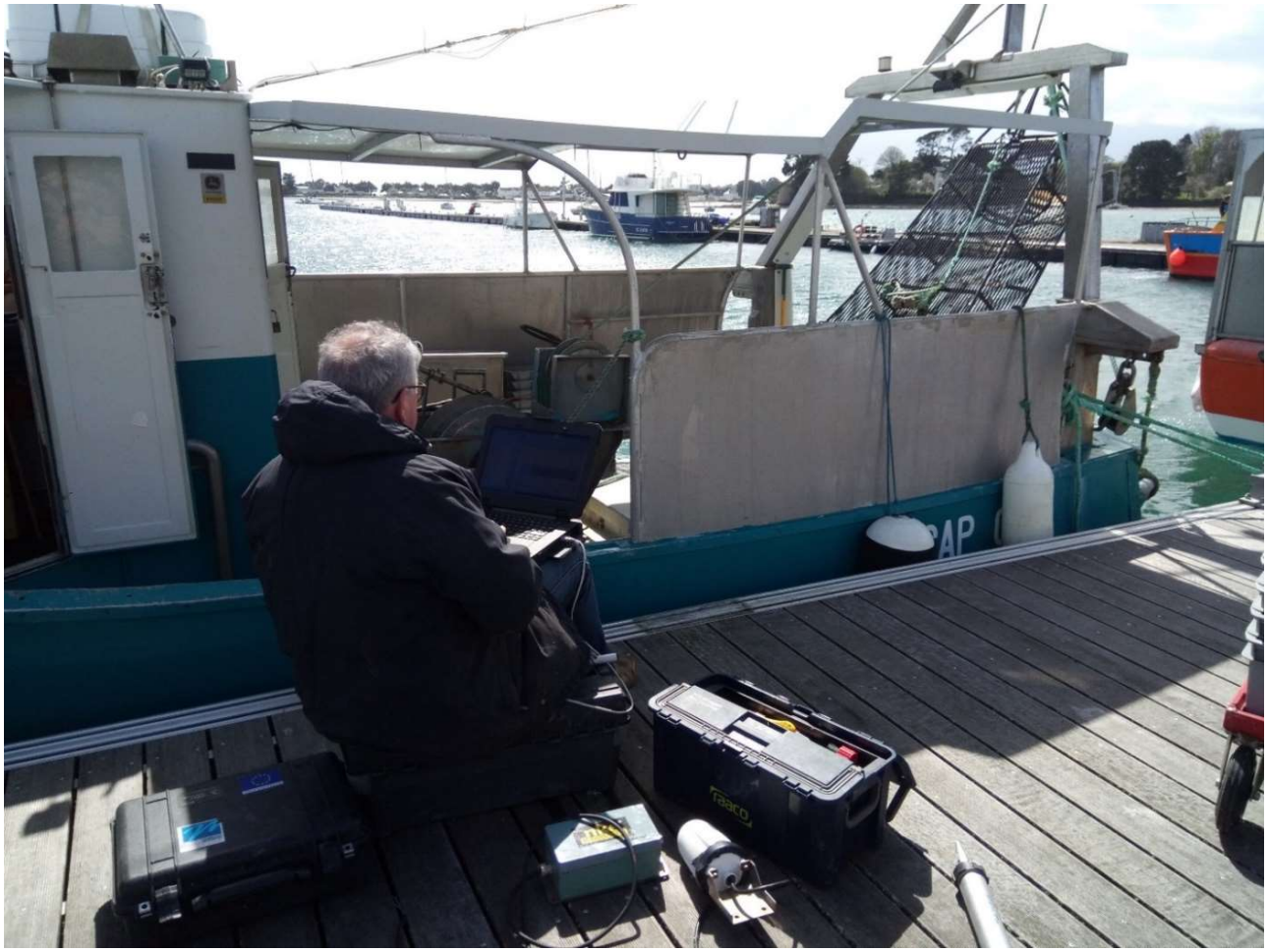


Figure 3: Installation and configuration of instruments on a professional fishing vessel

[12] *https://www.ifremer.fr/fr/scientifique-et-technique*
[13] *Department of Biological Resources and Environment (Ressources Biologiques et Environnement - RBE) https://en.ifremer.fr/Research-Technology/Scientific-departments/Department-of-Biological-Resources-and-Environment*
[14] *Department of Physical Resources and Deep-Sea Ecosystems (Ressources physiques et écosystèmes de fond de mer - REM) https://en.ifremer.fr/Research-Technology/Scientific-departments/Department-of-Physical-Resources-and-Deep-Sea-Ecosystems*
[15] *Department of Oceanography and Ecosystem Dynamics (*Océanographie et Dynamiques des Ecosystèmes - *ODE) https://en.ifremer.fr/Research-Technology/Scientific-departments/Department-of-Oceanography-and-Ecosystem-Dynamics*
[16] *Department of Marine and Digital Infrastructures (Infrastructures Marines et Numériques - IMN) https://en.ifremer.fr/Research-Technology/Scientific-departments/Department-of-Marine-and-Digital-Infrastructures*

5. CONTRIBUTIONS OF THE RECOPESCA PROJECT

For Ifremer's missions

This project offered **a unique data acquisition method for coastal physical oceanography** to supply the various national and European databases dedicated to research and operational physical oceanography (e.g. BD Coriolis, European CMEMS Service and other European projects). The vertical profiles collected were used to observe hydrological evolutions for continental slope and shelf areas (thus filling a "gap" between offshore observation systems of the same nature - i.e. TGIR ARGO - and more littoral observations - i.e. IR ILICO - Akpinar *et al.*, 2018). These observations were therefore used to assess the variability of coastal waters (particularly the deep waters of the regions sampled) and, more generally, to validate physics models (research and operational). Environmental data on temperature and salinity fed into the DCSMM monitoring project.

Using the instruments installed on board, the RECOPESCA system also provided **precise data on fishing activity and effort**, which the regulatory framework (declarations by professionals or compulsory geolocation by VMS of fishing vessels over 12 metres operating in European waters at a frequency of 1 hour) does not allow us to obtain: precise fishing time for gears, speed and trajectory while fishing/steaming, duration of operations, etc. Although the new European regulation on fisheries control currently in the process of being adopted[17] refers to the geolocation of all fishing vessels in Community waters, including those under 12 metres, a Member State can, until 31/12/29, dispense EU fishing vessels under 9 metres in total length and flying its flag from the obligation to be equipped with a vessel monitoring system if they:

(a) use only passive gears;

(b) operate exclusively in waters within six nautical miles of the baselines under the sovereignty and jurisdiction of the flag Member State;

(c) never spend more than twenty-four hours at sea, calculated from the time of departure from port to the time of return to port; and

(d) are not subject to restrictions applicable in the restricted fishing areas in which they operate.

In addition, the transmission frequency will remain at one hour and Member States will have four years after the entry into force of the rules to equip vessels with the new technologies required, particularly mobile equipment for vessels under 12 m (which would pose a problem if this was forgotten and left behind). The advantage of the RECOPESCA equipment was its autonomy, the fact that professionals didn't have to take care of it or handle it, and the possibility it offered of recording data at higher frequencies.

The development, validation and maintenance of software for processing VMS data (in particular the FIS[18] ALGOPESCA algorithm), used to reconstruct the activity of French and foreign vessels working in French waters and to respond to regular official demands from the DPMA (e.g. in the context of bycatch or Brexit issues) or calls for data ICES working groups (e.g. WGSFD on spatial fisheries data) or from the STECF, require this detailed knowledge of fishing practices, and therefore use high-frequency data from RECOPESCA.

[17] *https://www.europarl.europa.eu/legislative-train/spotlight-JD21/file-revision-of-the-fisheries-control-system*

[18] *Ifremer. Système d'Informations Halieutiques [Fisheries Information System] (2021). ALGOPESCA geolocation data processing algorithm. Synthesis note. https://archimer.ifremer.fr/doc/00682/79405/*

For example, this tool has been used for methodological or scientific developments such as:

- improving the use of geolocation data to assess fishing times, to better calculate vessel fishing times for certain metiers in particular, and to understand gear fishing time ;
- the recognition of fishing gears by artificial intelligence (ongoing IAPESCA[19] research project) as a prerequisite for the functional implementation of speed thresholds per gear[20] ;
- identification of fishing operations using machine-learning methods (work has been carried out on active gears and is in progress for passive gears, testing alternatives for evaluating vessel fishing time and preliminary work on identifying passive gears);
- validation of the calculation of fishing time: comparison of different existing algorithms for evaluating fishing time: ALGOPESCA / VMStools[21] / Gear speed thresholds using RECOPESCA probes as a metric of vessel fishing time;
- assessment of passive gear fishing effort (DELMOGES[22] and Cibbrina Life[23] projects) to improve the calculation of vessel fishing time, calculate gear fishing time and acquire effort variables such as net length, number of pots and immersion time;
- knowledge of small-scale fisheries (SSF): RECOPESCA is being used in pilot phases to acquire the knowledge necessary for estimating effort variables for certain small-scale fisheries (ICES-WKSSFGEO[24,25]).

Detailed vessel activity data coupled with local physical data is also useful for the ecosystemic study of certain fisheries (e.g. monitoring and management of kelp resources and the kelp-harvesting sub-fleet, assessment of the lobster fishery in the Bay of St-Brieuc or St-Pierre et Miquelon, etc.) (Fig. 4).

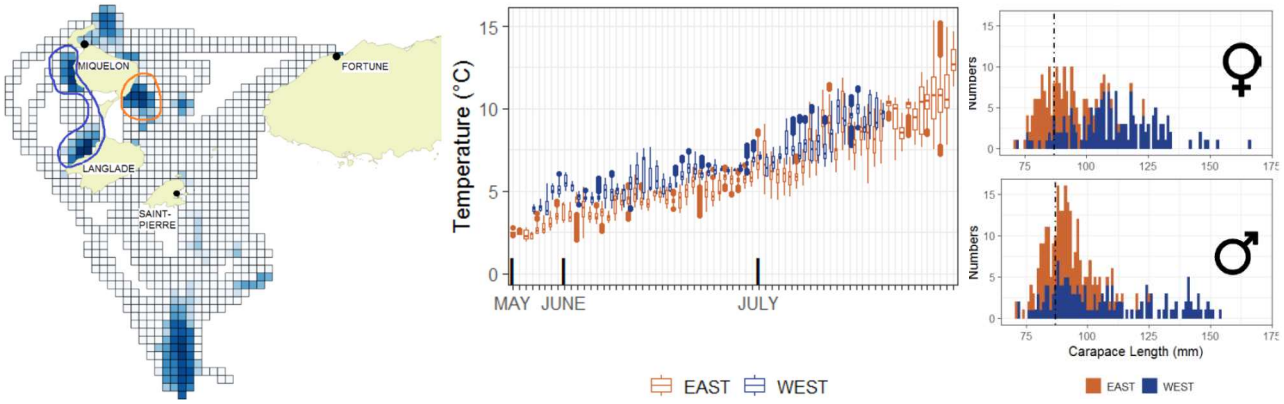


Figure 4. RECOPESCA and its application to the lobster fishery in St-Pierre and Miquelon. Distribution of fishing effort of pot vessels and daily variations in temperature acquired by RECOPESCA instruments, in relation to the size structure of the lobsters sampled (Source: Anaïs Roussel M2 internship - 10/10/2019 - ATLANTILES project)

[19] *Rodriguez Julien (2023). iapesca, a R-package for manipulating and interpretating high resolution geospatial data from fishing vessels. R tutorial. https://doi.org/10.13155/93094*

[20] *Submitted article: DANHIEZ F.P., WEISS J, RODRIGUEZ J., WOILLEZ M. Machine learning for inter-regional fishing gear identification from vessel behavior retrieved from trajectory data.*
presentation of results from WKSSFGEO ICES (2022). Workshop on Geo-Spatial Data for Small-Scale Fisheries (WKSSFGEO). Open Access version: https://archimer.ifremer.fr/doc/00748/86016/)

[21] *http://nielshintzen.github.io/vmstools/*

[22] *https://delmoges.recherche.univ-lr.fr/*

[23] *https://www.ascobans.org/sites/default/files/document/ascobans_ac26_pres6.1c_cibbrina-bycatch-project_svoboda.pdf*

[24] *ICES. 2022. Workshop on Geo-Spatial Data for Small-Scale Fisheries (WKSSFGEO). ICES Scientific Reports. 4:10. 60 pp. http://doi.org/10.17895/ices.pub.10032*

[25] *https://www.sciencedirect.com/science/article/pii/S1470160X23009640#s0075*

Since 2005, RECOPESCA has been an efficient and sustainable example of collaboration between fishers and scientists and **a participatory science project** in its own right. In fact, the professional fishers who volunteered got involved so they could improve their knowledge about the environment in which they operate and its interaction with the resources they exploit, and about their fishing activity. The frequent exchanges with the these fishers contributed to good relations between Ifremer and the profession, and enabled us to discuss various topical subjects relating to fishing and resource management, encouraging greater acceptance of the messages communicated by Ifremer.

This project was fully in line with the following orientations and aims of the Institute:

- understanding the dynamics and impacts of changes in the physical ocean by 2100,
- understanding climatological and geological events using a multi-scale approach and multi-source data,
- sustainable management of marine resources ("an ocean of solutions"),
- share marine data and information ("an ocean of data and services"),

and has contributed to the achievement of the Sustainable Development Goals n° 13: "Climate action" (Taking urgent action to combat climate change and its impacts) and n° 14 "Life below water" (Conserving and sustainably using oceans, seas and marine resources for sustainable development).

For society

The willingness of professional fishers to get involved for the benefit of science and a transparent approach are very positive for the image of the profession. The fishing professionals involved received individual feedback on their activity data after processing (Fig. 5). In particular, this data has recently enabled some of them to assert their fishing rights in Jersey waters in the context of Brexit. In addition, several volunteers expressed an interest in having access to the physical data in order to adjust their fishing strategy. This is why an interactive mapping website was developed in 2021 to give them access to the trajectories and environmental data they collected (Fig. 6).

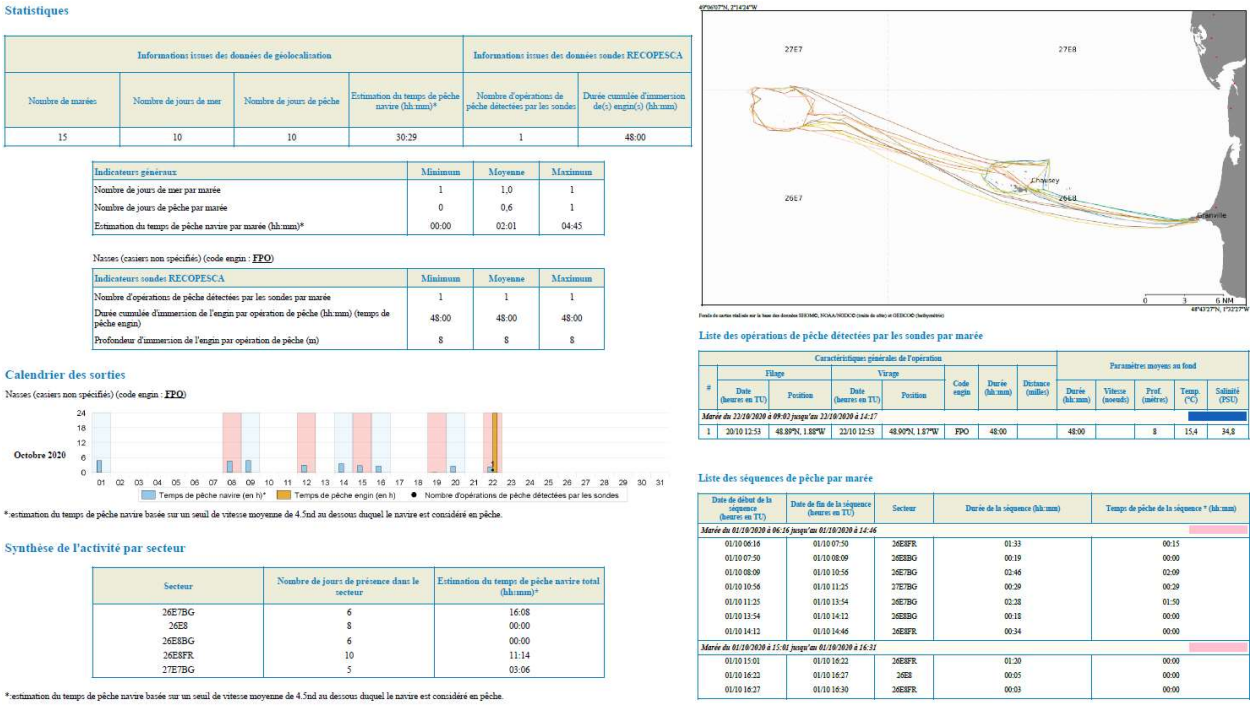
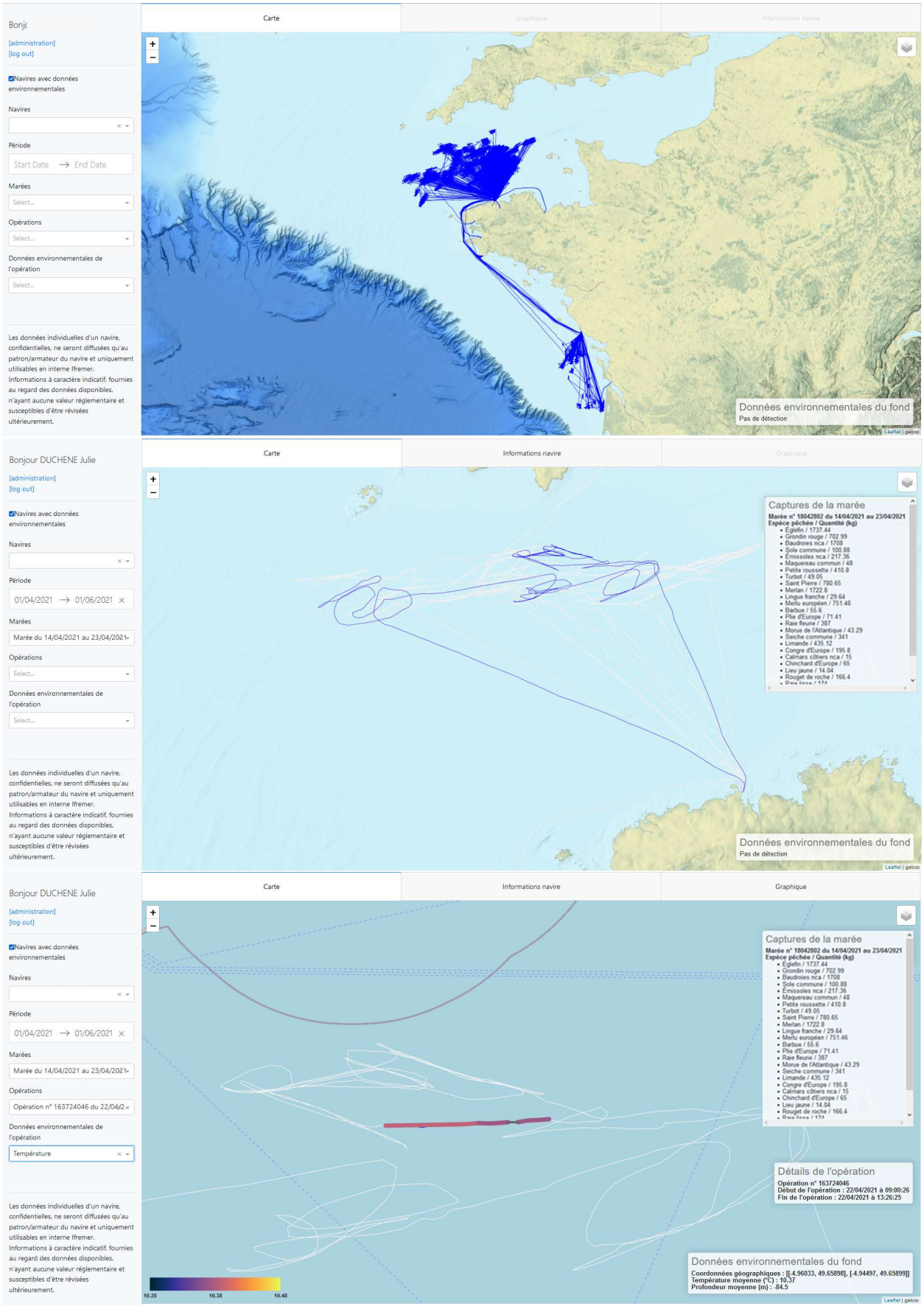


Figure 5. Example of fishing activity data for October 2020 released to professionals.



<u>Figure 6</u>. Extracts from the cartographic data display website

The physical data collected has been made public after processing and anonymisation and can be downloaded from the Coriolis coastal physical data display site http://data.coriolis-cotier.org) (Fig. 7). This means that anyone, from scientists to individual members of the public, can access it for different projects (see Fig. 8 for its use in the PREVIMER project, for example).

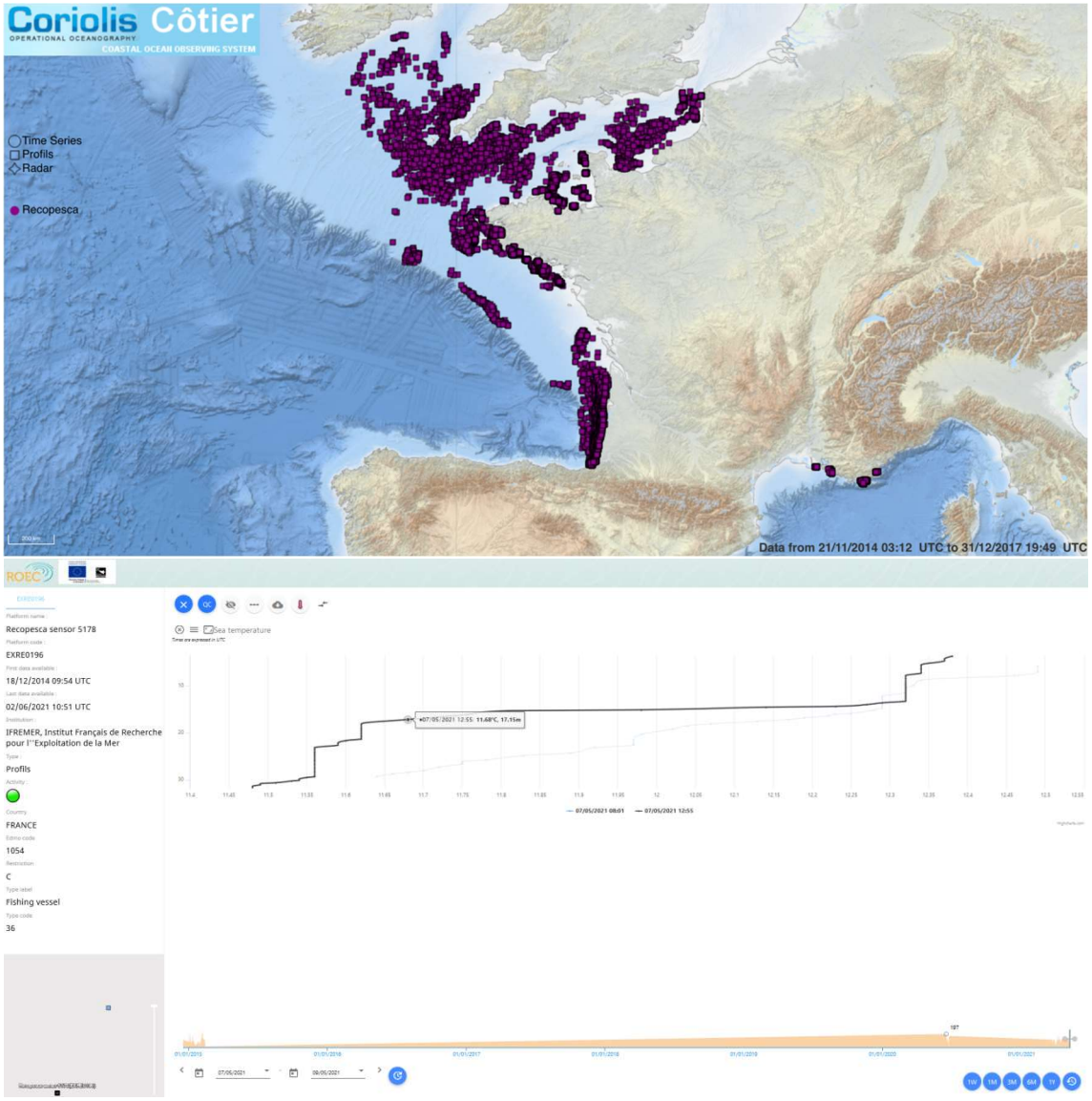


Figure 7. Profiles available from 21/11/2014 to 31/12/2017. An example that can be viewed on the website of physical data acquired by a vessel in the RECOPESCA project

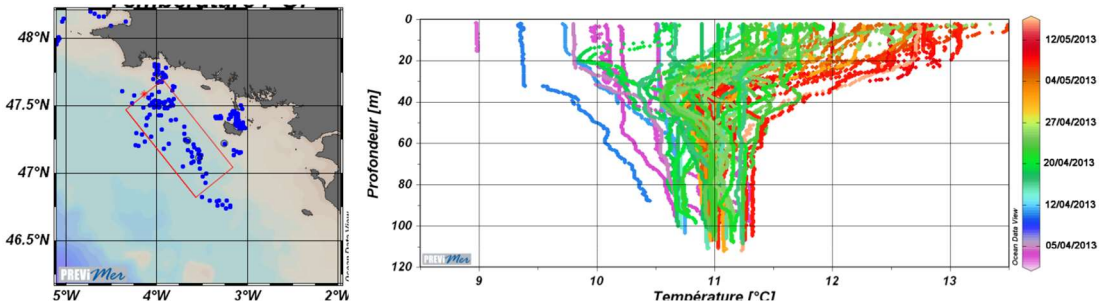


Figure 8. Example of the use of physical data by the PREVIMER project team (vertical temperature profiles on the grande vasière between the beginning of March and the end of June 2013 - Source: PREVIMER Newsletter. Informations et analyses des eaux côtières. April May June 2013 - nº 20)

6. LESSONS LEARNED AND AVENUES FOR IMPROVEMENT

Materials

All the actors involved in RECOPESCA agree that equipment reliability is crucial to the success of such a project. However, the performance of the equipment used since the start of the project, both the probes and the concentrators, was compromised in its final years, due to:

- the cessation of production of certain electronic components;
- the threat of the phasing out from January 2021 of the GPRS (2G) network used for the automatic transmission of data from the vessels to the onshore database;
- the cessation of equipment maintenance by NKE from 1 January 2022;
- the reinforcement of Ifremer's IT security systems in autumn 2022, which blocked data reception.

As a result, data acquisition, quality and automatic transmission and reception became subject to uncertainty.

A search for instruments of at least equivalent accuracy and function was launched in 2019. A new WiSens probe from NKE was evaluated in the RDT Unit's metrology laboratory and tested on board THALASSA during the EVHOE 2020 fishing campaign. The performance of this probe was not compatible with the specifications required for the RECOPESCA project (it had a single acquisition rate instead of two, unstable measurement frequency, a long temperature probe response time, low battery life and Wi-Fi connection problems). A second, more suitable version, in addition to a concentrator known as a "hub", a multifunction box that automatically collects and sends data from the WiSens and GPS to shore (Fig. 9), could be available in 2024.

Figure 9. NKE's WiSens system tested as part of the NAUTILOS project (left: hub; right: probe)

A complete system from New Zealand is also commercially available. This is similar in principle and includes a multifunction box powered autonomously by solar batteries (Fig. 10). Although it only has depth and temperature probes, it could be partly adapted to Ifremer specifications with funding. A basic set of instruments was tested and validated as part of the DELMOGES project with a view to deployment on around twenty vessels to gather detailed activity and effort data to improve our knowledge of interactions between fishing and dolphins.

Figure 10. MOANA system from ZebraTech tested as part of the DELMOGES project (left: multi-function box, right: probe)

Deployment

Such a project involves a whole network of equipment requiring installation, monitoring and maintenance. The wider the range of vessels equipped and the more geographically dispersed they are, the more complicated it is to ensure that the system is working properly, necessitating considerable human effort.

The main points requiring vigilance are:

- As the probes alone are not geolocated, the position of the data they collect is determined by computer processing that matches the GPS position of the vessel carrying them. It must therefore be possible to identify the vessel and its gear in all cases, and the positions must be recorded at a sufficiently high frequency (between 1 second and 15 minutes maximum).
- Data from the probes must be automatically retrieved (and matched with the vessel's position) via a multifunction box that geolocates, receives the probe data and automatically transmits it to shore together with the GPS data (e.g. NKE hub currently under development, or a ZebraTech box). It can also be carried out manually, at a maximum frequency to be adapted according to the storage capacity of the probe (generally several months), but this requires the availability of professional fishers and people authorised to carry out this task.
- The instruments deployed may require regular calibration, depending on their type (manufacturer, parameter measured by the probe, etc.) and, therefore, a certain amount of organisation for their collection from the vessels, shipment and metrological verification, which must be arranged with the manufacturer.
- Maintaining good relations with fisheries professionals is essential, to encourage them to volunteer to have their vessels equipped, and to be available for installation, repairs and calibration of instruments. This support is never guaranteed and can vary over time, depending on the situation in which the sector finds itself (e.g. difficulties in recruiting volunteers in the context of the action plan to combat accidental dolphin captures).
- The risk of loss/breakage of equipment must be taken into account and means that spare equipment and its maintenance must be foreseen during the setting up of the project.

Data

The flow of position data from vessels and environmental probes represents a large volume of data that requires an appropriate processing and database workflow. This depends on the choice of the adjustable configurations set in the instruments (position acquisition frequency and probe recording rates).

Then, making qualified data available to users (scientists, external partners and civil society, for example) requires a prior effort by qualified operators to validate the data, which is a substantial task.

Finally, feedback to professionals is essential if they are to support the project and remain involved over the long term. This feedback is therefore key. With the IT tools currently available, the minimum is to provide them with secure individual access to the data they collect via interactive environments, such as mapping their trajectories, and locating their fishing operations with temperature information. The final output, for which there is strong demand, is the ability to view the data in near-real time – as soon as the gear is back on board – on-screen on the bridge of the vessel. This is an area for improvement to be suggested to manufacturers.

7. END OF THE RECOPESCA PROJECT AND FUTURE PROSPECTS

At the start of 2020, work on optimising the panel of vessels was carried out in consultation with the physicists and hydrogeologists using these data, as well as the technicians and engineers who had a good knowledge of the vessels. A selection was made from among the vessels that had been equipped in order to keep only active vessels providing regular environmental data in sectors of interest. This was to avoid redundant measurements in sectors already covered by other instrumentation systems (particularly in the Mediterranean), to ensure the minimum maintenance required for the equipment (probe calibration once or twice a year, breakdowns or various updates), and to exclude certain vessels using gears where the risk of loss or breakage of probes was too great (net, line & longline in particular). The panel of vessels selected was made up of around 25 trawlers, pot vessels and dredgers working in the Channel and Bay of Biscay, as well as 7 pot vessels in St-Pierre and Miquelon as part of the ATLANTILES project.

Finally, the RECOPESCA project was faced with the obsolescence of its equipment that was almost 20 years old. This led to the end of the project in its initial form, which consisted of equipping vessels on a continuous basis for an indefinite period. Nevertheless, there are geographical sectors and specific issues where there is still a lack of fine-scale data, either on physical parameters or fishing activity. So equipping vessels for new scientific projects/collaborations on specific questions, rather than on a routine basis as has been the case until now, is not only possible, but essential.

Concerning the ocean physics aspect, data requirements today mainly concern the geographical sectors of the English Channel and Bay of Biscay (from the coast towards the continental slope) or, for example, the Iroise Sea, where these measurements serve to help us understand the dynamics of the arrival of the Ushant front (a request from the French Office for Biodiversity) and the Bay of St-Brieuc for different projects of the local Fisheries Committee (study of crustaceans, scallops, problems of the offshore wind farm, etc.). As for the needs of fisheries scientists, these mainly involve improving knowledge of the precise fishing effort of vessels (via high-frequency GPS position and an algorithm to detect according to its speed whether the vessel is stationary, steaming or fishing), but also of gears (paying out-fishing-hauling via a pressure change probe on the gear) and possibly environmental parameters such as temperature, salinity, chlorophyll A, dissolved oxygen, etc.

Finally, it is worth noting the interest in collaborating with foreign colleagues working on similar initiatives to build a network of coastal observatories based on fishing vessels – for example the Fishing Vessel Ocean

Observing Network FVON initiative – for which RECOPESCA's experience and Ifremer's expertise are called upon (particularly for definition of specifications and inter-comparison of systems) [26].

Latest-generation equipment can now be deployed, as new technological opportunities make it possible to develop more reliable and less costly probes and data transmission systems. Its purchase and implementation will need to be foreseen when projects are set up. The existing IT architecture and developments carried out for the RECOPESCA network (data flow management, storage in a database, data exploitation and dissemination) remain available and can continue to be used for projects currently underway (e.g. DELMOGES, NAUTILOS) or for those to come. Requests for vessel equipment may be made directly to the HISSEO Unit, internally by the fisheries scientists and physicists informed about the availability of the equipment, or may be the subject of agreements with external partners.

8. CONCLUSION

The RECOPESCA participatory science project involving volunteer professional fishermen allowed the deployment of geolocation boxes to collect the GPS positions of vessels at high frequency (between every 1 and 15 minutes), as well as collection of data from pressure/temperature/salinity probes attached to fishing gears, with automatic transmission of all the data to Ifremer.

RECOPESCA was an original, transdisciplinary project indispensable for the regular and cost-effective collection of detailed data on fishing effort and operations. These data were needed to validate models and algorithms for processing geolocation data used routinely in the Fisheries Partnership Agreement (FPA) and in emerging projects. RECOPESCA also collected basic yet fundamental environmental parameters of the water column and coastal seabed to validate physical models. It demonstrated the technical feasibility of automated data collection on fishing and the ecosystem, and the importance of partnership between fishers and scientists.

Over the last few years, the team has significantly reduced the panel of vessels volunteering its services and has endeavoured to find solutions to the problem of equipment obsolescence, a necessary step for new collaborations, appropriation of data by users and communication. However, as the equipment used for almost 20 years was obsolete, and in particular no longer allowed data to be received automatically at Ifremer, the project in its initial form was brought to an end. Nevertheless, the data collected throughout the project has provided input for research projects in fisheries and oceanography, as well as allowing significant advances in estimating the fishing effort of vessels. In addition, the existing low-cost infrastructure for receiving, databasing and processing data remains available for future projects. It could therefore be used to collect data for which there is no alternative (e.g. position and effort of vessels < 12 m) and/or which would require large budgets for occasional acquisitions (e.g. study of changes in deep water masses at the bottom of the Bay of Biscay).

RECOPESCA has therefore been an evolving project, driven by the data needs of different users. In the future, these needs will be met by the latest generation of instruments recently brought onto the market or under development, which will now need to be acquired for specific projects. RECOPESCA, a pioneering project for the collection and acquisition of fisheries and environmental data from professional fishing vessels, has become an international benchmark and the experience gained is recognised and regularly called upon.

[26] *https://fvon.org/*