ORFISH - Development of innovative, low-impact offshore fishing practices for small-scale vessels in outermost regions - MARE/2015/06

WP3 Developing and testing low impact fishing techniques

Task 3.5 Equipment through experimentation of a sample of small fishing vessels with GPS

Deliverable #45

Final report of the task 3.5

The ORFISH project

The ORFISH project aims at providing a platform for exchange of knowledge on low-impact offshore fishing techniques among fishers for the outermost regions with a view to developing and optimizing these techniques and with the principal objective of alleviating fishing pressure on coastal fish resources. The specific objectives of the project are the following:

- Raising awareness of the opportunities to develop innovative fishing techniques allowing to divert fishing effort away from coastal resources
- Developing and testing low impact fishing techniques adapted to the bio-geographical conditions of each outermost region
- Creating alternative fishing opportunities that will help to consolidate jobs in the fishing industry and ensure a steady supply of fisheries products to local markets
- Exchanging of best practice on low-impact offshore fishing techniques between ORs, which will also do good to overseas countries and territories and third countries
- Improving communication among outermost regions' fishing sectors as part of the good functioning of the Advisory Council on Outermost Regions

ORFISH website:
https://orfish.eu

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Our greatest thanks go to the six voluntary fishermen (Carmen, Adrian, Filipe, Eduardo, Felix and Isaac) who allowed this partnership action to be carried out.

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I. Objectives

In many European fisheries and particularly ORs, small-scale vessels are often multipurpose targeting different species using different gears. Given the narrow island shelves, vessels may develop their activity in coastal areas, on the edge of the continental shelf or offshore in deep-water or large pelagic fisheries but it is currently difficult to quantify the distribution of fishing effort between the different fishing gears and between the different areas.
As noted in the background of the call, it is an important issue to better quantify the fishing effort, its spatial and temporal distribution with the principal objective of alleviating fishing pressure on the coastal fishing resources.

The EU legislation requires that all coastal EU countries over 12 meters should set up a Vessel Monitoring System (VMS). Used by the fisheries authorities for real time fisheries controls, VMS data and more generally any geo-tracking devices can also be used for knowledge and scientific purposes, especially for the analysis of fishing effort distribution. Without such geo-tracking device for the smaller vessels, it is much more difficult to spatialize the activity of SSCF, strongly dependent of coastal limited territories and highly submitted to concurrent uses.

In this study, we propose to experiment the equipment a sample of voluntary fishing vessels with geo-tracking devices in different ORs, in order to follow the distribution of their fishing activity, only for knowledge purposes. The experiment will concern a maximum of 4 voluntary fishers by OR with a strong priority for the vessels involved in the experimental fishing trips (see previous tasks).

The WP3.5 benefits from the experience of Ifremer, which developed the Recopesca project in the early 2000s, to equip a high-frequency geolocation system for voluntary vessels, including small-scale coastal fishing vessels.
https://wwz.ifremer.fr/recopesca/Le-projet-RECOPESCA/Description-du-projet.

Deliverables:

- Fishermen reports: quarterly production of standard individual-vessel restitution.
- Interactive mapping tools will be accessible in the ORFISH web site with restricted access (individual login and password).
- Software application to report fishing trip experiments
- Contribution of task 3.5 to the intermediary report
- Contribution of task 3.5 to the final report

II. Geo-tracking equipments

Two geo-tracking equipments have been used in the ORFISH project: a GPS beacon installed permanently on board the fishing vessel and an Android tablet made available to the voluntary fishermen.

II.1 GPS beacons

Recopesca concentrator[1] (Figure 1a, b) is a device containing a GPS as well as a data transmission system on land. This box is able to communicate also with the environmental sensors when installed on the fishing gear (depth, temperature, salinity), retrieves their data and transmits on shore when it is within range of the telephone network (GPRS).

NAVLOC beacon is a simplified and less expensive version of the Recopesca concentrator since it only supports GPS data[2].

These two devices are still operated in French context. Installed permanently aboard fishing vessels, GPS beacon can automatically receive and send GPS information from the boat vessel at regular rates. Out of the maintenance of these GPS beacons, no operation is required for the crew to operate. GPS beacons measures and records speed, direction and GPS position of the boat at configurable rates. Once powered, they are fully autonomous. Time-stamped data are transmitted via GPRS to a management station. Rugged and waterproof box is made by high-pressure injection. A Li-Ion Internal battery recharged by the vessel ensures continuity of service, even in case of loss of the main power. Starting and remote configuration of NAVLOC beacon is feasible by text message or email, quick and easy set to up.

[1] Designed, specified and financed by Ifremer, the Recopesca concentrator was built by nke instrumentation. http://www.nke-instrumentation.com/products/networks/opportunity-ships/recopesca.html
[2] Specified by Ifremer and funded by the French Fisheries Directorate, the NAVLOC beacon was built by nke instrumentation. http://www.nke-instrumentation.com/products/multiparameter-probes/fishing-area/navloc-beacon.html

Figure 1a, b. Recopesca concentrator aboard a volunteer from La Désirade, Guadeloupe since 2015 (Turff project, Ifremer)

- Data storage: data are transmitted to the Ifremer Fisheries Information System and/or to data center of the ORs partners.
- Data processing: Ifremer use the Algopesca software and can provide it to other OR partners involved in the project.
- Data dissemination: based on the data collected, the project processes the different datasets, in order to provide each voluntary fisher a restitution including fishing trips and maps by trip at the convenient scale.

Deployment of beacons during the project ORFISH:

Recopesca concentrators and Navloc beacons have still been installed aboard some volunteers in Guadeloupe and la Réunion since a couple of years, through internal Ifremer's projects called Recopesca and Turff (Figure 2).

Two vessels from Guadeloupe participate at this WP3.5.

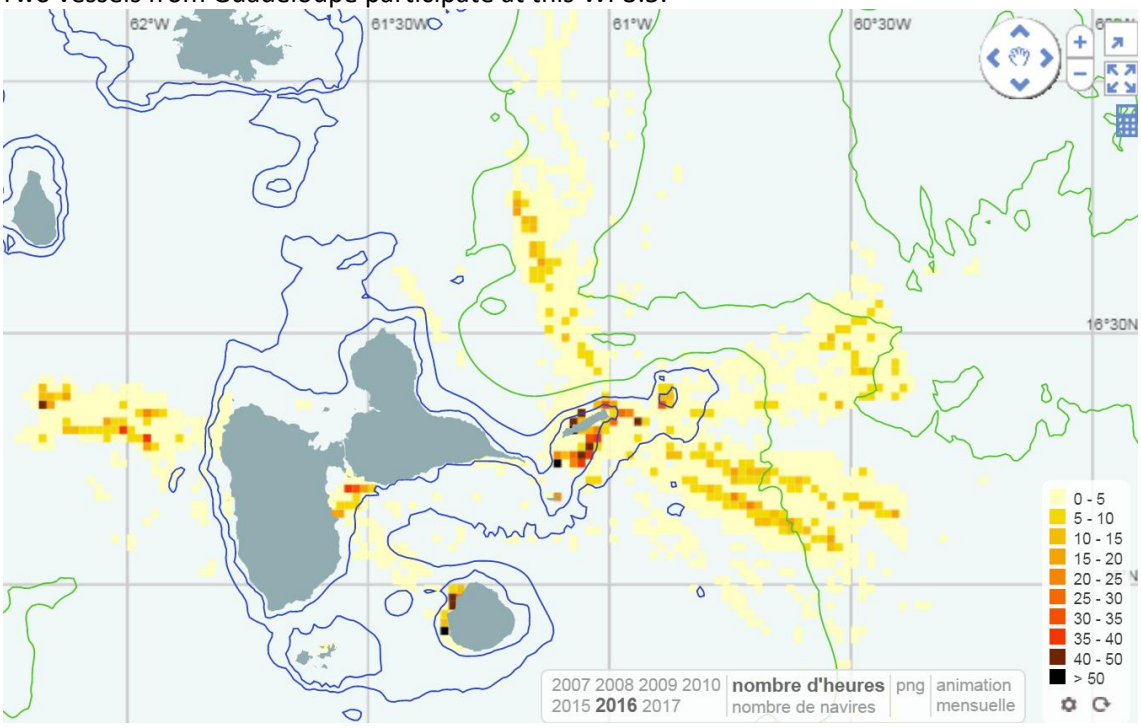


Figure 2. Annual synthesis of the cumulative pings In Guadeloupe from 6 volunteers involved in the Ifremer projects dedicated to geolocation (data 2016 from Turff project)

Three Navloc beacons has been transferred from France to Ponta Delgada (Azores) at the end of March 2018 for delivery to the 3.5 task's partners in charge of the installation on board three volunteers from Macaronesian islands (Figures 3 and 4). The GPS beacons were installed on board voluntary vessels from Canary, Madeira and Azores at the end of June and July.

Figure 3. The NAVLOC GPS beacon equipping three Macaronesian vessels.

The beacons are equipped with International Orange SIM cards.

N°Fabrication	Code CFR	N° IMEI	Adresse email	Mot de passe	Numéro carte SIM
2100480180034	ORFISH000001	354888042996629	002jerico@orange.fr	jerico002	2316401577521
2100480180035	ORFISH000002	354888042996660	004jerico@orange.fr	jerico004	2316401577539
2100480180036	ORFISH000003	354888042996645	005jerico@orange.fr	jerico005	2316401577547

Figure 4. Characteristics of the three NAVLOC beacons for Macaronesian volunteers.

The frequency of acquisition of spatial information has been set at 5 minutes.

II.2 Android tablets

Two applications have been developed by WeMake to provide fishermen an easy and innovative way of **monitoring and analyzing their fishing activity**: a GPS tracking application and a logbook application running on **cheap tablets** (samsung). For cost reasons, consumer tablets were chosen while hardened tablets were recommended by WeMake.

The applications work offline; once a connection is detected (e.g. WiFi), the data saved by the applications on the device are sent to the server. **No mobile subscription is required**.

Six tablets have been transferred from France to Ponta Delgada at the end of March 2018, for delivery to the 3.5 task's partners in charge of the search for volunteers from Macaronesian islands.

The key requirements of these developments are:

- easy to use applications
- cheap system
- lightweight process

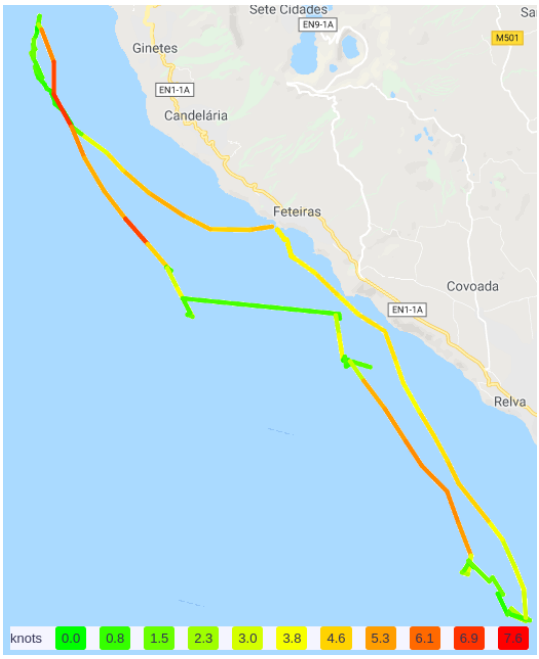
II.2.1 GPS tracking application

The GPS tracking application is **very easy to use**: once logged in, the fisherman only **has to start the GPS tracking at the beginning of the trip and stop it at the end**.

All the data is saved on the device, and sent to the server when a network connection is detected.

The fisherman **can immediately review** the GPS tracking in the ORFISH website (see the section Fisherman report).

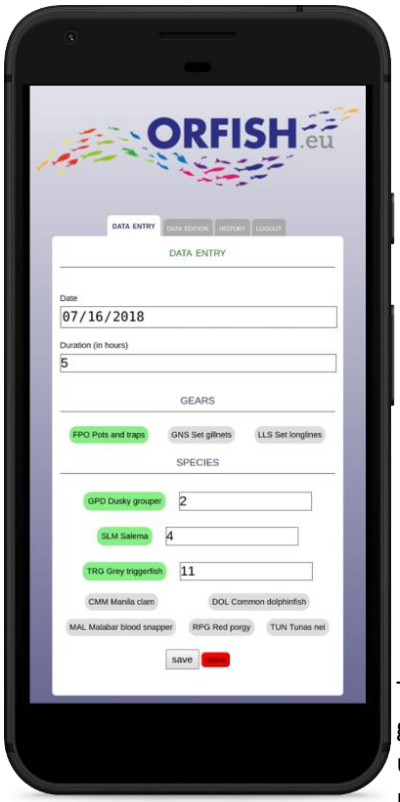
The application uses an adaptive tracking algorithm turning off the data acquisition when the boat is not active, and aggressively tracking the position where the boat is active. This will ensure the best tradeoff precision of the sampling/energy consumption.



II.2.2 The Logbook application

The ORFISH logbooks application allows fishermen (or scientific observers) to input their **fishing logbooks**. As the Geotracking application, this application works offline, and upload the data saved when the network is back: fishermen can input data at any time.

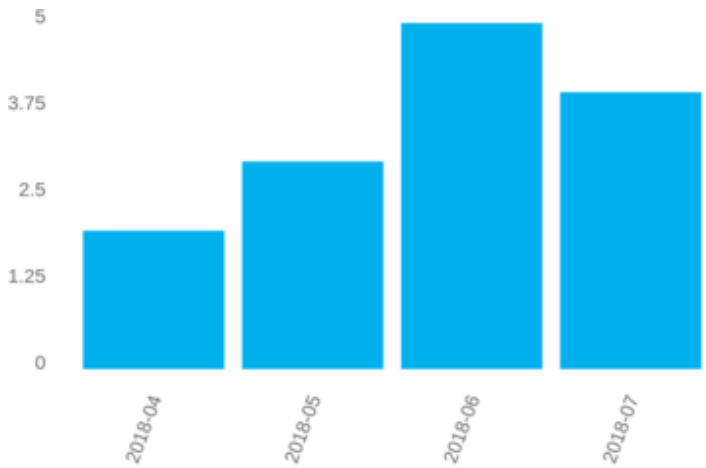
The application can be used on smartphones, tablets and computers.



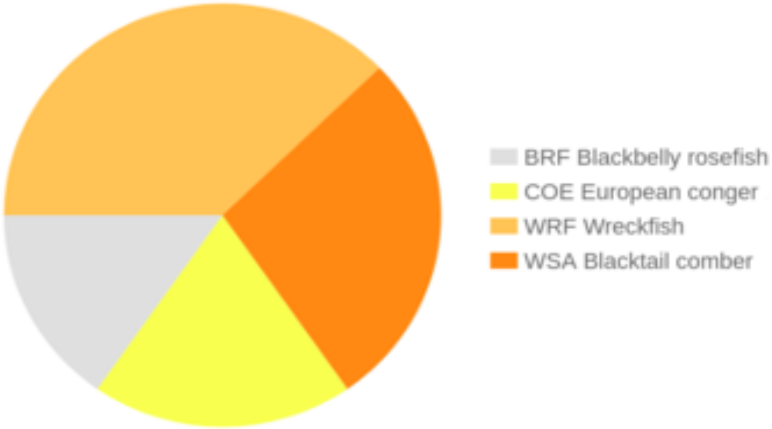
The data is entered day by day, gear by gear. For each gear, the user specifies the date, the number of hours, optionally the fishing zones, and, for each species, the capture made with this gear.

The fisherman can access directly in the application to a **basic report** (number of logbooks per month, landings per month, quantity by species…) updated in real time.

The fisherman **can immediately review** the GPS tracking in the ORFISH website (see the section Fisherman report).



Number of logbooks received per month



Quantity by species

III. Data storage and data processing

III.1 Data storage

GPS data from NAVLOC beacons, equipping the five volunteers, are automatically transmitted each day by email to the Ifremer Fisheries Information System and store in Harmonie (Oracle database of the SIH of Ifremer). Data from Azores, Madeira or Canaries are or can be redirected to the data center of the ORs partners.

GPS data from Android tablets, used by four volunteers, are directly managed by WeMake. A bulk shipment of these GPS data was made once from Wemake to Ifremer, in order to obtain a standardized GPS data treatment and prepare the individual feed backs to fishers.

Logbook data, from Android tablets, used by four Macaronesian volunteers, are directly managed by WeMake.

III.2 GPS data processing

Ifremer has developed a software package to reconstruct first the outings of the fishing vessel at sea and then estimate the daily fishing effort. The AlgoPesca Software Package is dedicated to the treatment of geolocated data (VMS and GPS) [reference in the IDDN's directory of the Agence pour la Protection des Programmes (APP), since the 18/11/2013: IDDN.FR.001.470003.000.R.P.2013.000.30300]. It includes:

1- Calculation of straight-line average speed between two pings, which is the key criteria, in order to determine if the vessel is fishing, steaming, or in a harbour. Behind a threshold of 4,5 knots, the vessel is considered as fishing. **All periods where the speed is below the threshold are considered as fishing time: it therefore includes mainly the actions of handling fishing gear in the water but also the preparation of the gear, the drifting, going for bait...**This threshold is a parameter: it will have to be modulated in the future according to the gear used but also the fishing practice of the vessel: it will have to be reduced for the liners operating in the context of the Azores (3 knots) and increased for the liners around the MFADs in Guadeloupe (7 knots);

2- Detection of the fixed positions of the vessels during more than 5 hours, as an indication of a potential port or a shelter not yet registered;

3- Visualisation of these fixed positions and the harbours and shelters still registered in the Harbours data base. Then the expert confirms the new ports to be included in the data base needed in the following modules of characterisation of the fishing trips;

4- Reconstitution of the dates and hours of start and end of each fishing trip per vessel;

5- Reconstitution of the fishing sequences per vessel, per day and fishing area (ICES rectangles, grid cell of x' of latitude by x' of longitude), including potentially other layers (EEZ, MPAs, …);

6- Visualisation per vessel of the fishing trips calculated and speed profiles.

The results of the vessel treatment consist in a summary list of the detected trips, daily sequences and fishing effort estimates in hours per sequence. They are integrated into the restitutions by vessel.

IV. Data dissemination

IV.1 Individual feedback to the individual fisherman

Using the experience of Ifremer through its project called RECOPESCA, individual feedbacks have been organized in this Task 3.5. A translation in Spanish and Portuguese has been done. The figures 5 and 6 are extracted from examples of individual feedback.
They are currently produced in deferred time.

The individual synthesis presents:

- a general view of the monthly activity of the vessel;

Estatísticas

Período	Número de marés	Número de dias no mar	Número de dias de pesca
Julho 2018	3	3	3
Agosto 2018	10	12	12
Setembro 2018	19	21	21
Outubro 2018	16	10	10
Novembro 2018	6	6	6
Dezembro 2018	10	14	14
Janeiro 2019	1	1	1
Fevereiro 2019	9	13	13

Indicadores	Mínimo	Média	Máximo
Número de dias no mar por maré	1	1,4	3
Número de dias de pesca por maré	0	1,2	3

Calendário das saídas

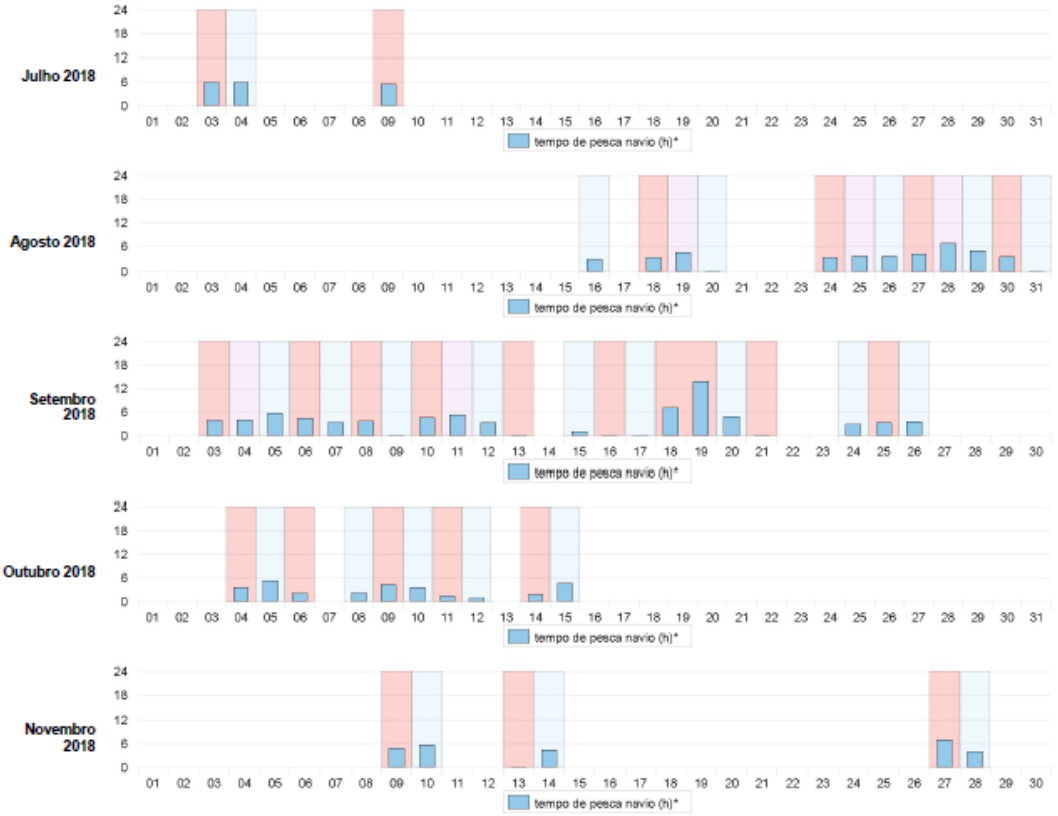
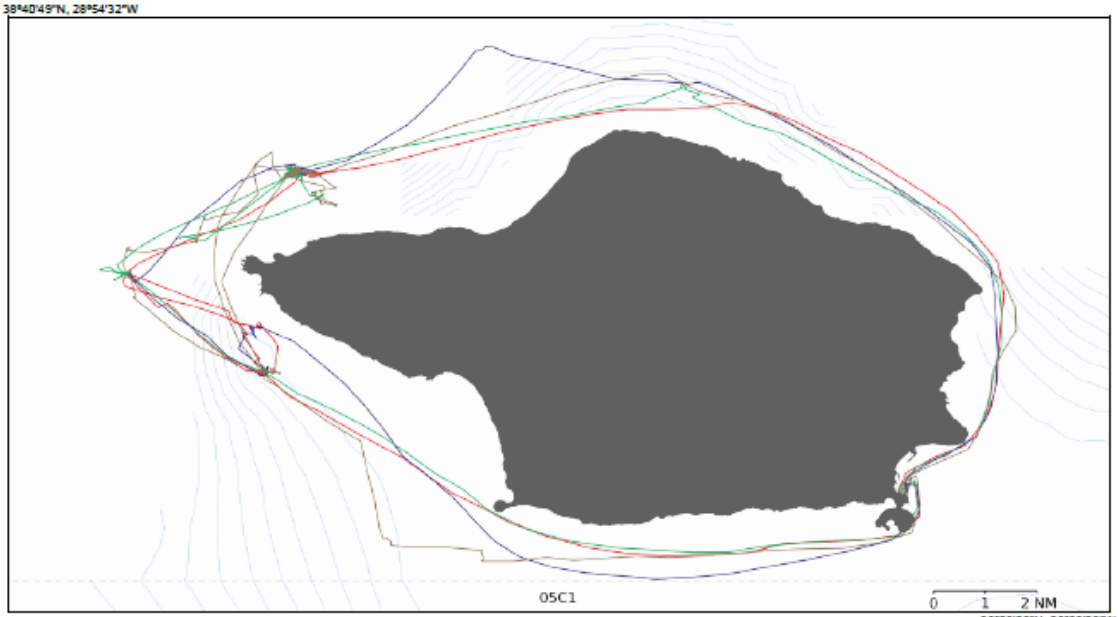


Figure 5: Example of an individual synthesis(source Ifremer).

- a comprehensive and detailed view of all the fishing trips of the vessel during each month (figure 6), presenting the monthly calendar of fishing trip, a map of each fishing trip and the characteristics of each trip and daily sequences (date, area, sequence duration and fishing effort estimation). Some sequences do not present any fishing effort: they correspond to transit periods to the fishing grounds or to a port.

Mapa das marés do mês

38°40'49"N, 28°54'32"W



38°29'26"N, 28°33'29"W

Mapas baseados em dados de SHOM ©, NOAA / NGDC © (litoral) y GEBCO © (batimetria)

Lista de sequências de pesca por maré

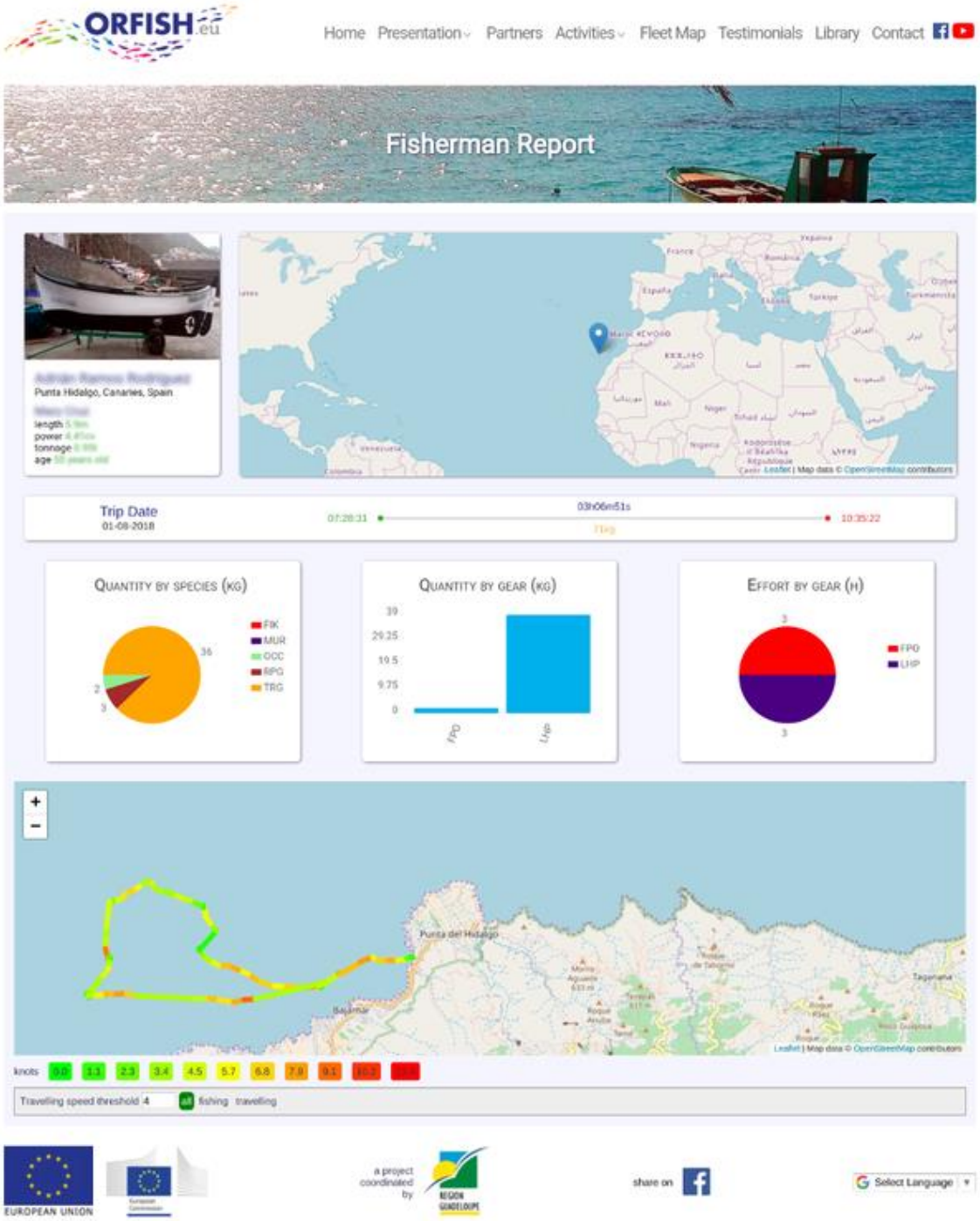
Data de início da sequência (horas em UT)	Data de fim da sequência (horas em UT)	Setor	Duração da sequência (hh:mm)	Tempo de pesca da sequência * (hh:mm)
Maré do 03/07/2018 às 09:22 até o 04/07/2018 às 20:41				
03/07 09:22	03/07 23:59	06C1	14:37	12:00
04/07 00:00	04/07 20:41	06C1	20:41	17:43
Maré do 09/07/2018 às 09:07 até o 12/07/2018 às 09:22				
09/07 09:07	09/07 23:59	06C1	14:52	12:05
10/07 00:00	10/07 23:59	06C1	23:59	22:50
11/07 00:00	11/07 23:59	06C1	23:59	17:44
12/07 00:00	12/07 09:22	06C1	09:22	03:12
Maré do 16/07/2018 às 08:07 até o 18/07/2018 às 09:15				
16/07 08:07	16/07 23:59	06C1	15:52	12:32
17/07 00:00	17/07 23:59	06C1	23:59	21:10
18/07 00:00	18/07 09:15	06C1	09:15	07:34
Maré do 26/07/2018 às 03:38 até o 26/07/2018 às 19:20				
26/07 03:38	26/07 19:20	06C1	15:42	10:18

Figure 6: Example of an individual monthly synthesis (source Ifremer).

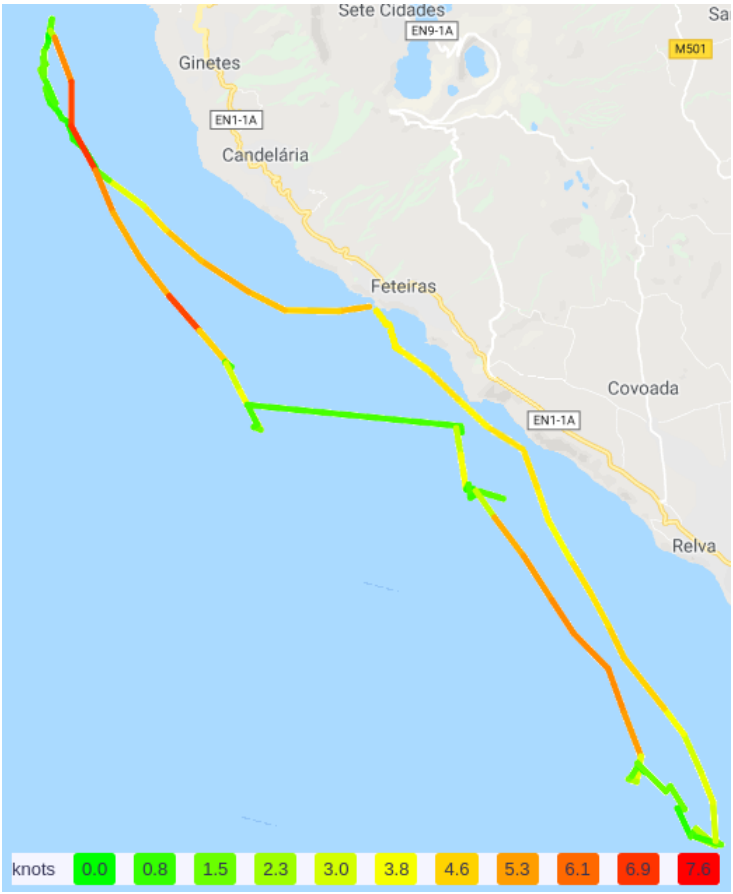
The six volunteers, equipped with either a Recopesca concentrator or a NAVLOC beacon or the GPS application on Android tablet, still receive or will receive by the beginning of April 2019, the standardized summary of their activity since the beginning of the operational phase of WP3.5.

IV.2 Digital Fisherman Report

The ORFISH website also embeds an individual Fisherman Report, developped by WeMake, where each fisherman can access and analyse all his data. Each trip report **synthesizes the GPS tracking data** and **the logbooks** able to deliver a complete view of the spatial distribution and the landings of the trip in which, one can discriminate the travelling and fishing segments based on a speed threshold, etc...

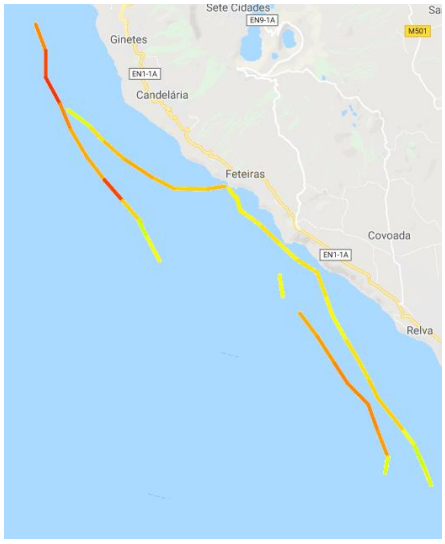


Example of Fisherman Report (based on fake data)



Trip (fake data)

Trips fishing zones



Trip travelling

The access to the report, managed by WeMake, is protected: only the fisherman and the ORFISH partner of the region has permission to access the report.

One trip on the Azores MFAD is publicly accessible at ORFISH website.

The fisherman reports includes also the NAVLOC beacons data.

V. Results

V.1 Operation of devices and applications

V.1.1 Navloc beacons

Five volunteers use GPS beacons (1 in Azores, 1 in Madeira, 1 in Canaries, 2 in Guadeloupe).

GPS beacons require a good installation on board the vessel especially from the electrical point of view.

Thus, the beacon installed for the first time in July 2018 in the Canary Islands had to be reinstalled in January 2019 because the electrical installation on board had not been in conformity with the specifications. The beacon is now working perfectly like the two others installed in the Azores and Madeira whose installation had been correctly done. The same type of electrical connection problem seems to be the case of the stop of emission of GPS data for one of the two vessels of Guadeloupe.

Insofar as the beacon is connected to the battery of the vessel, there is no problem of autonomy and the fisherman has no intervention to do at the beginning or end of the tide. The determination of the beginning and the end of the trips results solely from the processing of the GPS data received automatically by email. The identification of transit trips also results from the processing of the data. The feedback to fishermen is not made in real time, which can be a disadvantage.

From July 2018 to March 26, 2019, 255 trips at sea were reconstructed from GPS data received at Ifremer from the two Recopesca concentrators and the three NAVLOC beacons. These 255 trips at sea correspond to 284 days at sea and 281 days of fishing.

V.1.2 Android tablets

Four fishers use the Android tablet (1 in Azores, 1 in Madeira, 2 in Canaries).

Android tablets works well. Its operation obviously depends on the charging of the battery, which seems to have posed overall little problem during this experimentation. Is complicated to manage in small vessels without cabin, were you don't have space to connect to the electric current, each time the fishermen go to fishing they should had charged it before.

The GPS application works very well from technical point of view: the fisherman only has to start the GPS tracking at the beginning of the trip, and stop it at the end. The fishers involved consider that this application is easy to use it, and economic way of geolocation instead of the green box

(VMS), commonly used is Europe for the control of the navigation (the transmission costs are borne by the fisherman.

With this GPS application, the fisher has also the advantage of being able to immediately obtain a feedback and review the GPS tracking in the ORFISH website.

This first version of the fishing logbooks application works very well from technical point of view. The four fishers who used the tablets were able to successfully transmit data on the characteristics of the fishing carried out during the fishing trip. At least one fisher had problems with the logbook software and just few times was possible to record the data.

GPS and logbooks apps on Android tablets require the active behavior of the fisherman to activate them at the beginning and end of the trip. The results of the experiment show that the fisherman can forget to launch one or the other application sometimes both.

From July 2018 to March 26, data from 90 fishing trips (112 days at sea) were transmitted via the GPS application and 36 fishing trips were described using the logbooks application by the four vessels using Android tablets.

Tablet applications were mainly used at the beginning of the experimental phase of the project (during the first six months). This leads to the recommendation that local project correspondents should make a special effort to sensitize fishermen to the launch of the GPS application from the beginning and to close it at the end of the voyage aboard the vessel. For some fishers, it would be nice a waterproof tablet that work with wet hands, in small boats this is really important.

Tablets and smartphones applications will be the only means of accessing spatial information and data from paperless logbooks for small scale vessels without electrical energy on board.

V.2 Synthesis of data per OR

This section gives a description of the results obtained during the experiments by ORs and then tries to identify the common elements concerning the small scale fleets in EU outermost regions.

V.2.1 Guadeloupe

The two vessels involved in the WP3.5 have been equipped with Recopesca concentrators since a couple of years. they don't use Androis tablets.

The two vessels are small-scale vessels using hooks and line for the targetting of mainly large pelagics around moored fishing aggregating devices. Each set of anchored FADs is positioned along a line corresponding to a defined line assigned to each fisherman. MFADs furthest away from the coast are located about 40 nautical miles from the coast. During each fishing trip on MFADs, the fisherman moves from one MFAD to another in search of the fish, mainly dolphinfish (*Coryphena hippurus*) (figure 7).

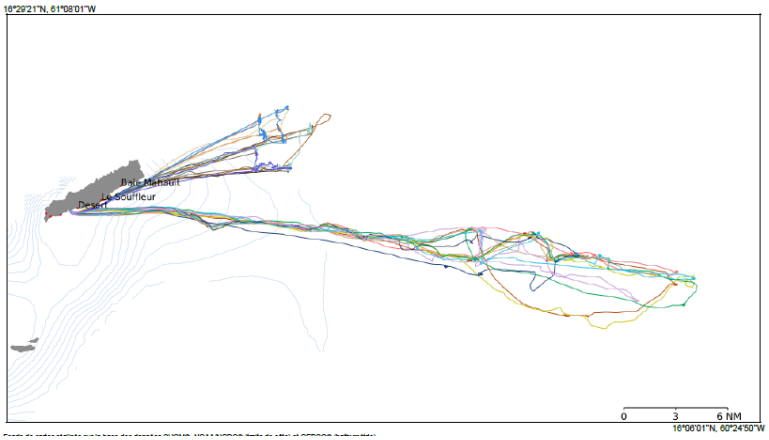


Figure 7: Example of an individual monthly synthesis (source: individual feedback of fishing trips, Ifremer).

One of the two vessels regularly practice a second activity, the snapper longline, in particular areas closer to the coast (figure7).

During the period July 2018 to February 2019, from the transmitted data it was possible to reconstitute 133 trips at sea for the two vessels (98 and 35), including 116 fishing trips. Other trips at sea are transits to another port for market considerations and purchase of supplies.

One vessel has an average activity of 10,5 fishing days per month and the other of 16 days on average in July and August.

Fishing trips are carried out by the day and last up to a dozen hours.

V.2.2 Azores

Only one vessel participated at the WP3.5 as well as the others actions of WP3. This vessel was equipped with a NAVLOC beacon and the fisherman received a tablet that he used both to transmit GPS data and logbooks information.

His fishing activities are hand line and surface trawling.

From July 2018 to the 26th of March 2019, GPS data transmitted by the NAVLOC beacon made it possible to reconstruct 34 trips at sea (3,8 trips per month on average), for 74 days at sea and 72 fishing days (8 fishing days on average per month).

The average duration of the fishing trips is estimated at 34 hours and 29 hours of fishing.

The activity of the vessel is very coastal and knows little seasonal variation (figure 8).

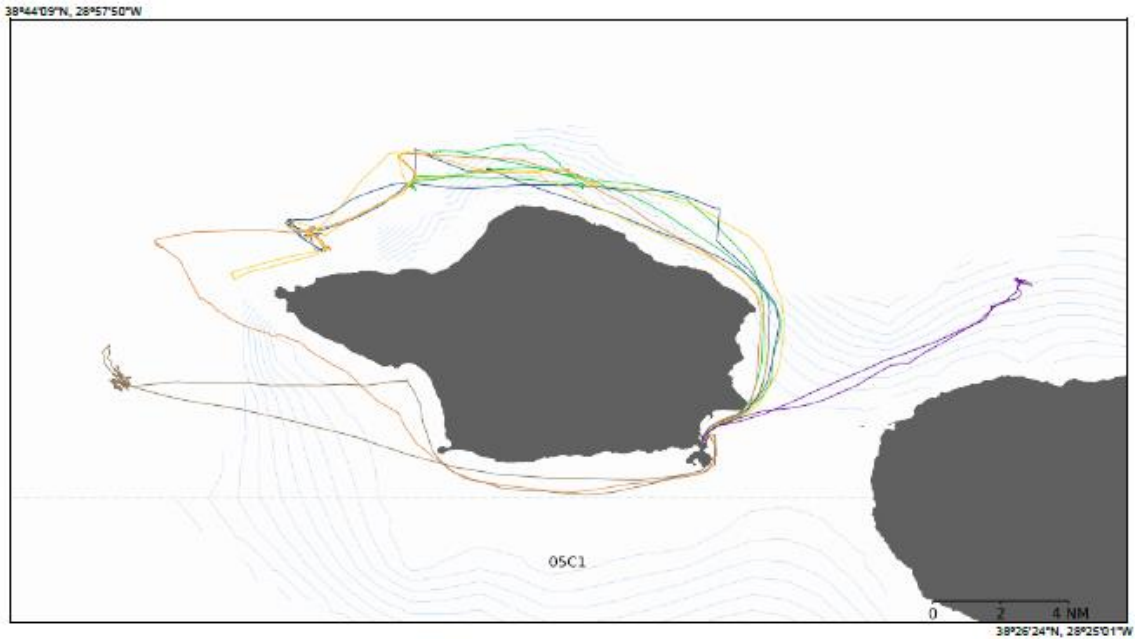


Figure 8: Example of an individual monthly synthesis (source: individual feedback of fishing trips, Ifremer).

During this period, the crew used 20 times the GPS application of the Android tablet (representing 41 days at sea and 59% of the days calculated with GPS beacon data) and data for one trip was received through the logbook application.

V.2.3 Madeira

Only one vessel participated at the WP3.5.
This vessel was equipped with a NAVLOC beacon and the fisherman received a tablet that he used both to transmit GPS data and logbooks information.

His fishing activities are hand line, bottom longline and drifting longline.

From July 2018 to the 26th of March 2019, GPS data transmitted by the NAVLOC beacon made it possible to reconstruct 77 trips at sea (8,6 trips per month on average), for 83 fishing days (9,2 fishing days on average per month).

The average duration of the fishing trips is estimated at 9 hours 14' and 6 hours 05' of fishing, but with strong variability (the longest fishing trip lasted 54 hours 45' including 45 hours of fishing).

The activity of the vessel is very coastal and knows little seasonal variation (figure 9).

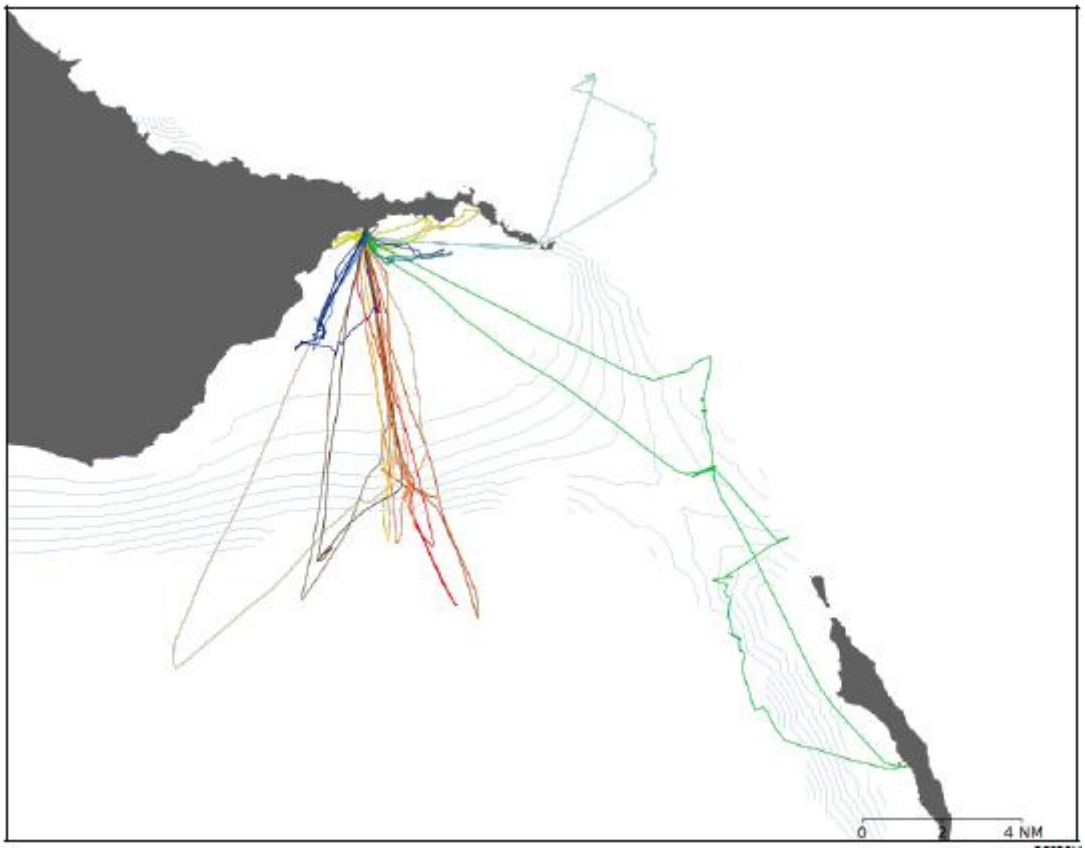


Figure 9: Example of an individual monthly synthesis (source: individual feedback of fishing trips, Ifremer).

During this period, the fisher used 50 times the GPS application of the Android tablet (representing 51 days at sea and 65% of the days calculated with GPS beacon data) and 25 times the logbook application.

V.2.4 Canary

Two vessels participatde at the WP3.5.

One vessel was equipped with a NAVLOC beacon and the fisherman received a tablet that he used both to transmit GPS data and logbooks information. This vessel is mainly potting and lining.

Due to a first bad electrical installation in July 2018, the first data was received from NAVLOC beacon only in January 2019. Only five daily fishing trips (2,5 fishing trips on average per month) have been reconstructed in January and February from the beacon data received from the GPS beacon, which marks a rather small activity compared to previous boats. This fisher didn´t went to fishing too much and he leave his boat for go to work to another tuna vessel.

The fishing trips are very short (2 hours 47' on average) as well as the fishing time (1 hour 44' on average) and the activity is very coastal close to the harbour (less than 2 nautical miles).

14 fishing trips were provided from July to February 2019 using the android tablet's GPS application (1,8 fishing trips per month on average). Five logbooks were provided over the period.

The second volunteer fisherman received a tablet that he used both to transmit GPS data and logbooks. Their fishing gears are longlines, pots and driftnets.

Only six fishing trips were reported from July to September (0,7 fishing trip per month on average from July to February). The fisher has almost always forgotten to start GPS tracking at the start. Five log books from July to November were reported by using Logbook's application. Its activity is very coastal entirely inscribed within 2 nautical miles of the coast (Figure 10).

Figure 10: Example of an individual daily synthesis for this vessel (source: Digital Fisherman Report, developesd by WeMake: segments with lowest speed in green correspond to fishing areas).

VI. Conclusions and perspectives

Equipment of fishing vessels with high frequency geolocation devices and Logbook application is certainly the simpleast and less expensive way to produce, in a reliable, homogeneous and long-term manner, spatialized information on vessel activity, including for small scale fishing vessels (not subject to the VMS at the moment).

This was the goal of the WP3.5 to test equipements in the case of ORs. The task was based on a partnership between Orfish and fishermen, volunteers for the installation of an equipment aboard their fishing vessel. The delay in starting up the ORFISH project and the resulting budgetary restrictions affected the lauching of this WP 3.5.

However, six fishermen accepted to providing their spatialized fishing activity data through a GPS beacon, installed permanently on board the fishing vessel, for five of them (1 in Azores, 1 in Madeira, 1 in Canaries, 2 in Guadeloupe). Android tablets, with two specific applications developed as part of this project were provided for four of them (1 in Azores, 1 in Madeira, 2 in Canaries).

The conclusions are the following:

GPS beacons: Once the GPS beacon is correctly installed on board the vessel, the automatic transmission mode of the geolocation data guarantees a completeness of the spatial information and fully describe the activity of the vessel without any intervention of the fisherman. Such GPS beacon has a purchase and installation cost of around € 1000 (This cost may decrease with the number installed). It also requires an electrical source on board the vessel.

Tablets: The implementation of the tablet and the two applications, GPS on one hand and logbooks on the other hand, have shown their effectiveness from a technical point of view. Almost 90 GPS trips (112 fishing days) and 36 logbooks have been filled by fishermen using this innovative way. It's in itself a success because many people thought that fishermen wouldn't use it due to its supposed complexity. However, the manual intervention of the fisherman to launch the application GPS then the application Logbook constitutes a source of incompleteness of the information. The comparison with the data from GPS beacon shows that the completeness is variable according to the vessels. The data obtained constitute at this stage a more or less wide sample of the activity according to the vessels. The first lesson is that GPS beacons are more efficient than tablets devices from this perspective.

Tablets and smartphones applications will be the only means of accessing spatial information and data from paperless logbooks for small scale vessels without electrical energy on board.

The second lesson is that with non-hardened and cheap tablets devices (less than 200€), it is possible to provide robust technical solutions for the tracking vessel positions for a long time, working offline and without mobile subscription. Tablet devices are also interesting as they give the possibility to fishermen to access to their own data on a specific website which is also interesting for the involvment of fishermen in such type of project. Some technical improvements could also be expected for future development by: using a more robust and waterproof tablets with a smaller screen to improve autonomy. On the software side, the ergonomics of the logbook application may be improved through the use of "species icons" rather than code names, by using vocal recognition to fill in the data instead of typing; by using a map to fill the fishing zone.

Fishermen believe that individual feedbacks are useful and necessary, but in the present state they provide little for their own knowledge.

The real-time feedback offered by Android applications, developed by Wemake, is a real advantage compared to the multi-monthly synthesis, thus in deferred time, developed for the moment by Ifremer.

Fishers consider that these feedbacks do not yet allow decision-making to optimize their fishing effort. These syntheses could be a more useful tool if mapping and analysis go hand in hand with landings data, making them useful to fishermen and not just for scientific purposes. Others would like to see the integration of gasoline consumption. Improve individual feedback by spatialising species production in their fishing areas every month or every week. it is a priority for future developments.

Based on this experience, it is clear that such type of devices improves kwowledge on fishing activity and effort allocation between the fishing gear, fisheries and ecosystem. Obtaining spatial information through a measurement system offers many advantages in terms of completeness of information, reduction of bias, mobilization of fishermen and cost compared to a method based on interviews. Experimentations on more large scale basis or extension of application to all population of vessels under 12 m should be encouraged for the monitoring of small-scale fisheries and also the traceability of small-scale fishing products

Thematically, data obtained in this WP3.5 provides valuable information on the activity of coastal vessels in the outermost regions. First of all, they show that the working rhythms are very variable from one vessel to another and according to the seasons. They are generally not very high and rarely exceed 10 days per month on average over the year. In addition, spatialization data underline the very coastal nature of SSCF activity in the Outermost regions, with the notable exception of hook and line vessels working on moored fishing aggregating devices in Guadeloupe. Based on adequate data processing, we can expect estimating effort per fishery and ecosystems. Finally, the very small spatial footprint of these vessels must also be emphasized.