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

WP2 Raising awareness of the opportunities to develop innovative fishing techniques

Task 2.2 Desktop study to collate of existing technical information on experimental fishing

Deliverable #10

Final report of the task 2.2 (main findings of the desktop study)

(Provisional version)

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:
http://orfish.eu

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I. Introduction

Marine resources in all outermost regions of Europe (ORs) make an important contribution to employment, livelihoods and food supply but fishing grounds are usually limited and scattered on the island slopes and seamounts (with the exception of French Guyana). Most fisheries are dominated by small-scale artisanal fishing fleets and therefore concentrated on the coastal fishing grounds which may have contributed to local overexploitation and biodiversity loss. During the last decades, experimental fisheries projects have been implemented in ORs to promote the diversification and the geographical expansion of local fisheries. However, most of the results are dispersed and difficult to gather and one of the objectives of this project is to collate existing technical information on experimental fishing. The objective is to raise awareness of the opportunities to develop innovative fishing techniques allowing the redirection of fishing effort away from coastal resources. This report presents the main findings of the experimental fishing highlighting the lessons learned and pointing ways forward to be shared

- The content of this deliverable is based on a work in progress and the results are preliminary and subject to revisions. A synthesis workshop (#2) is organized in Azores at the end of March 2018 to improve and consolidate the following deliverable. These preliminary results of this task have been shared between the contributors and disseminated within the project to get feedback and improvements from the partners.

II. Objectives

The specific objectives of this task are:

- Collect data on existing technical information on experimental fishing in each OR over a period covering the last 30 years.
- Build a collection of reports and database compiling the existing information.
- Analyse the main findings of the experimental fishing highlighting the lessons learned and pointing ways forward.
- Exchange and share the information among partners and stakeholders from different ORs.

III. Material and methods

As mentioned before, experimental fisheries projects have been implemented in ORs during the last decades to promote the diversification and the geographical expansion of local fisheries but the results are dispersed and difficult to gather. To overcome this issue, ORFISH partners collected published articles but also grey literature in different format (paper or numeric) in each OR. The period convered is the last thirty years.

3.1 Literature review

A systematic literature review consisting in three steps has been conducted in each OR according to the following common approach:

(1) Article/document/report selection,
(2) Abstract screening
(3) Review of relevant articles/documents/reports.

3.2 Lessons learnt and identification of future needs

For each OR, a global synthesis of all the information collected has been made, answering these 4 following questions:

1) Lessons learnt from successes and failures
2) Main identified opportunity
3) Main underlined obstacles
4) Needs in research and development

3.3 Synthesis of information

In order to provide a synthesis of experimental fishing, a skype meeting has been organized to define a common framework to gather data from the different partners. Considering that the level of information per case study may be heterogeneous, the objective was to identify a common set of variables that could be informed by the partners in a homogeneous way. The metadata file is organized as follows (see table 1).

Table 1. Metadata file providing information about experimental fishing in each OR

Variable Number	Variable	Variable format
1	OR	Text
2	Main body that financed the project (most important %)	Text
3	Co-funded project	Text
4	Coord./leader of the project (institution)	Text
5	Total cost (k€)	Numeric
6	Fishers or fishers organisation involved	Yes/No/Na
7	Beginning Year of the trial	Numeric
8	Ending Year of the trial	Numeric
9	duration in months	[1-N[
10	Main aims of the project	Text
11	What was mainly tested	Text
12	Depth of operation	Text (see depth references)*
13	Gears type used	FAO gear codification / MFAD
14	Vessel size for the trials (in meters)	< 6 m, [6-8[m, [8-10[m, [10-12[m, [12-15[m, [15-18[m, [18-24[m, [24-40[m
15	Dimension (length, number of hooks, traps, …)	Numeric
16	material	Text
17	Mesh size	Numeric
18	Seasons (quarters)	[1-N[
19	Total number of trials	[1-N[
20	Acoustic means	Yes/No/Na
21	type of target species	Large pelagic
22	Main species in trials (no more than 10)	List the scientific names and include; between species
23	Assessment of debris/lost gears in the trials	Yes/No
24	Assessment of non target species in the trials (discards)	Yes/No
25	Assessment of non target species in the trial (bycatch)	Yes/No
26	Assessment impact on benthic habitats in the trails	Yes/No
27	Catch per unit of effort assessment	Yes/No
28	Revenues and costs assessment	Yes/No
29	fuel dependency assessment	Yes/No
30	Ergonomy and working conditions/safety	Yes/No
31	Fishery conservation regulations (TAC, landing minimum size, mesh size, MP	Yes/No
32	Fishery access regulations (licence, vessel quota, individual spatial rights)	Yes/No
33	Reference numbers of the documents	Text
34	Comments	Text

*Depth of operation <10m/10-30m/30-50m/0-100m/100-200m/200-500m/>500m/500-1000m/1000-2000m/2000-3000m/3000-4000m/4000-5000m/>5000m

Note: A preliminary version of the medata file for a selection of OR is provided in annex.

- Variables 1 to 11: Where, When, Who conducted and financed the experiments and identification of the main aims of experiments
- Variables 12 to 22: Gears and type of gears used, depth of operation, number of trial, season of experiments, caught species
- Variables 21 to 32: Type of assessment/analysis of impacts carried out (target or bycatch species, benthic impacts, CPUE, fuel dependency, ergonomy and working conduction, implication for fisheries management)
- Variables 32 to 33: References/number of the documents used to fill the medatafile and comments.

The objective of the metadata file is to provide a synthesis of the experiments carried out and a way to find more detailed information on each experiment. This file will be included in the ORFISH web site including the pdf files of the articles/documents/reports

IV. Results

4.1 Azores

4.1.1 Lessons learned from failures and successes

The fishing experiment described by *Paulo Jorge Morais* (1990) was a trial aiming at estimate the hooks selectivity of three sizes of hooks on *Pagellus bagaraveo* and *Helicolenus dactylopterus dactylopterus*. This first attempt was useful to collect data and information which, together with subsequent experiments, made it possible to fix the legal size of hooks concerning these two species, in particular *P. bogaraveo* (Fauconnet, Laurence; personal communication; April 2018). The conclusion of this study, if tested on other species and with different sizes of hooks, could represent a very important result to be implemented concerning the selectivity in other fishing techniques[1].

The experiments with the nine Moored Fishing Aggregating Devices[2] [3] was not a success due to the a) poor monitoring of the experience; b) five of the devices have been lost, generating problems with the Port Authority concerning maritime safety; c) there have been problems with fishermen that sometimes cut the buoys as opposed to their anchorage; d) and, one of the main conclusions, fishing activities have been carry out only in the surface strata without exploring intermedium/deep sea strata, therefore affecting the outcomes about the catchability/presence of tuna/big pelagic species[69] [70] (Pinho, M. R.; personal communication; April 2018).

The fishing experiment made in 1994 targeting tuna[4] cannot be considered a success because no tuna has been caught[71] (Pinho, M. R.; personal communication; April 2018). The main reason was probably due to the fact that it has been used a small boat with a small number of hooks compared with the same technique looking for the same target species carried out in the Atlantic by other fleets (e.g. Japan) (Pinho, M. R., personal communication, May 02, 2018). And at the time there was little knowledge about deep-sea technology for tuna (e.g. hooks, baits, lines) (Pinho, M. R.; personal communication; April 2018). Besides the fact that there has been a high bycatch of deep-sea sharks (Pinho, M. R.; personal communication; April 2018).

The experiment with drifting bottom longline carried out in the 1998[5], was a success as the stock of *Aphanopus carbo* was still not explored and the yield was quite high. Moreover, the size of fishes was big (mainly in Santa Maria Island) compared with other area in the Atlantic (Melo, Octávio; personal communication; April 2018). Despite these positive outcomes, there weren't development in this fishery mainly due to economic/market reasons; also the number of fishermen needed, the high costs of the fishing gear and the time needed for launching and hauling it, worked as a constraint to further development and implementation of this fishery in the Azores.

Also, the experiment with drifting bottom longline described by *Machete, M., Morato, T., & Menezes, G.* (2010) can be considered a success because the stock of black scabbardfish could

[1] Paulo Jorge Morais, 1990.
[2] Pinho, M. R. & J. Pereira, 1995a.
[3] Pinho, M. R. & J. Pereira, 1995b.
[4] Pinho, M. R. & J. Pereira, 1995c.
[5] Melo, Octávio Emanuel B. M., 1998.

still be considered as almost unexploited and new fishing grounds were assessed. However, there was no further development in this fishery for the same reasons listed above, besides the fact that little is known about the distribution of this species in the region and fishing areas changed between years, with the exception of the fishing grounds of Santa Maria that were sampled throughout all years since then[6] (Fauconnet, Laurence; personal communication; April 2018).

The fishing experiment with pots held in 2001[7] cannot be considered a success because the CPUE was not high enough in order to justify future experiments. *C. affinis* had no marketable value besides the fact that it is a deep-sea species with high operational costs. At the time, the Azorean vessels were small so this limit also the number of pots that could be used, considered the space available on-board, hence affecting the yield (Melo, Octávio; personal communication; April 2018).
There was a market demand in the USA, but the product needed to follow already processed, not possible at the time (Melo, Octávio; personal communication; April 2018).
C. bellianus had the same problems of *C. affinis* plus the fact that it has not much edible parts, not allowing for good market prices (Melo, Octávio; personal communication; April 2018).
Regarding shrimps, the species gather in shoals that depend on the substrate and, for such depth, there is not enough information about substrate type's distribution. Furthermore, like *C. affinis*, this is a deep-sea species and, so, the fishing faced the same physical/technical problems related to the dimension of the boats and so to the yield and CPUE of this species (Melo, Octávio; personal communication; April 2018).

The experiment carried out between 2001 and 2002 targeting *H. atlanticus*[8] can be considered a success mainly due to its very high CPUE (4455 kg/minutes of effective trawling) and its high marketable value (Melo, Octávio; personal communication; April 2018). But there was not a development of this fishing activities because *H. atlanticus* is a very sensitive species with a long life cicle, slow growth rate and little is known about its biology. Besides the fact that this fishery was carried out with trawling and this technique is banned from the Azores. Moreover, *H. atlanticus* aggregate only during spawning season and the bycatch (mainly deep-sea sharks) was high (Melo, Octávio; personal communication; April 2018).

4.1.2 Main identified opportunities

Regarding the MFAD experiments, the devices aggregated a number of other marketable species: wreckfish (*P. americanus*), imperial blackfish (*S. ovalis*), dolphin fish (*C. hippurus*), and triggerfish (*B. carolinensis*). These species are registered to occur from May to September and efforts should be taken to get information of the catches in the future. Tuna species, mainly skipjack (*K. pelamis*), and bigeye (*T. obesus*), were captured only in three occasions. Skippers told that random catches were made in the vicinity of the buoys located at the traditional fishing areas, but they did not report these catches as associated to the device (Pinho, M. R. & Pereira, J., 1995; Pinho, M. R. & Pereira, J., 1995).

Concerning the experiments with longline on black scabbardfish, the bycatch was very low. The fishing gear in combination with the type of fishing operation has a high selectivity. Moreover,

[6] Machete, M., Morato, T., & Menezes, G. (2010).
[7] Mario R. Pinho, Octavio Melo, Joao Gonçalves & Helen Martins (2001).
[8] Gui Manuel Machado Menezes and Octavio Emanuel Barros Moura Melo, 2002.

the outcomes suggested that the stock of black scabbardfish may still be considered as a nearly unexploited stock in the Region. Therefore, black scabbardfish in the Azores has a potential for commercial exploitation (Melo, Octavio Emanuel B. M., 1998; Machete, M., Morato, T., & Menezes, G., 2010).

Regarding mid-water drifting longline fishing experiments, the results appeared to show higher occurrences between 150m and 400m depth for bigeye tuna and adult albacore, corresponding to a temperature range between 8°C and 17°C (Pinho, M. R. & J. Pereira, 1995).
Concerning the fishing experiments with deep-bottom trawl, the size of *Hoplostethus atlanticus* caught during this experience shown that the species caught in The Azores are much bigger compared to the ones trawled in South Pacific and South Atlantic. The approach adopted together with the fishing methodologies and techniques used in this experience were in some way innovative for the Region (Menezes, G. and Melo Octavio Emanuel B. M., 2002).

4.1.3 Main underlined obstacles

In the experiments with MFAD, the assessment of the aggregation effects based on the information received by the fleet cannot be done with precision because the fishermen just reported the visits with successful catch of tuna, which occur only during three occasions. The catches of other species are not registered in the logbooks, but personal information from the skippers seems to show that the catches of dolphin fish (*C. hippurus*), wreckfish (*P. americanus*) and imperial blackfish (*S. ovalis*) are significant, since catches of these species occurred in almost all visits. The analysis of the logbooks and interviews to the skippers supported the conclusion that the visits were made occasional and without any strategy. The fleet did not modify the traditional pattern of operation. Furthermore, no skipper adopted a planning schedule of visits to the buoys in order to visit them regularly, as suggested by scientists. It seems that MFAD's impact in the tuna fishery is low, but fishermen did not follow the recommended strategy for fishing with MFAD's (Pinho, M. R. & J. Pereira, J., 1995; Pinho, M. R. & Pereira, J., 1995).

Regarding the experiments with longline on black scabbardfish at 'Mar da Prata' and 'Banco 70', mainly deep-sea sharks were caught. The fishing vessel was not originally built to operate as a longliner and it presented some problems of manoeuvre and control of the fishing operation by the fishing master (Melo, Octavio Emanuel B. M., 1998; Machete, M., Morato, T., & Menezes, G., 2010).

Concerning mid-water drifting longline fishing experiments, the lack of experience of the crew resulted in the frequent break of the line-setter and the consequent stop of the ship and fishing operation. The electronic system of the line-setter did not turn out to be adequate. The estimation of the distance between the floats by basket was difficult because the radar did not capture the return signal from the reflector, especially on bad sea conditions. Moreover, 1994 was a bad year for tuna, a reduction of close to 50% in the catches of bigeye tuna. These facts may have influenced the results (Pinho, M. R. & Pereira J., 1995).

Regarding the fishing experiments with deep-bottom trawl, *Hoplostethus atlanticus*, it is recommended that more studies should be undertaken, as this species is particularly vulnerable to overfishing (Menezes, G. and Melo Octavio Emanuel B. M., 2002).

Concerning the fishing experiments with bottom longline with different hook sizes, only three sizes of hook were tested, but the sampling design was not efficient, as the hooks were not at the same time and depth on the water, causing disturbance and lack of confidence on the results

or conclusions... Furthermore, this study focused only on two species (*Pagellus bogaraveo* and *Helicolenus dactylopterus*) (Morais, P. J., 1990).

4.1.4 Needs in research and development

Concerning the fishing experiments on hook selectivity[9] and considering the importance of small-scale fishing activities using hooks in the Azores, the experiments that focus on hook selectivity should be tested on a larger variety of species and on a wider *spectrum* of environmental conditions (e.g. depth, temperature).

Regarding the experiments with MFADs[10] [11], in the conclusion it was suggested to place buoys only in the central group of the Azores, in sites near the coast and with a monitoring scheme based on monthly surveys, in order to allow research on the aggregated species, the evolution of the aggregation and times of residence.[77] [78]. Moreover, it was suggested to test the appropriate fishing technique, meaning deeper (Pinho, M. R.; personal communication; April 2018 and Reynal, Lionel; personal communication; March 2018). Furthermore, little is known about deep-sea distribution of tuna species in the region and the patterns of distribution in the surface of the main three species of tuna caught (bigeye, albacore and bluefin tuna) in the Azores change yearly (Pinho, M. R.; personal communication; April 2018). Hence, gather more information about distribution and behaviour on these three species will be needed and important for the fisheries in the region (Pinho, M. R.; personal communication; April 2018).

Regarding surface mid-water longline fishing experiments, it should be test at greater depths, around 150m and 400m depth, which in the Azores correspond to temperatures between 10°C and 15°C, values that are within the limits of preferences of the target species of this study[12]. Even if the major problem of this experiment concerned the characteristics of the Azorean boats, namely too small to be considered really efficient in terms of yields and CPUE to use this kind of fishing gear targeting tuna species (Pinho, M. R.; personal communication; April 2018).

Concerning the experiments with longline on black scabbardfish, it was highlighted the need to carry out more fishing hauls and some additional studies in order to be able to draw definitive conclusions. The absence of a local market and the complexity of the gear and labour requirements for its operation have thus far limited the development of the fishery, even if the commercial value of this species is well established in other regions (Melo, Octávio; personal communication; April 2018). CPUE monitoring should be maintained in the future to allow abundance-trend analysis[13] [14].

Regarding the experiments on deep-sea crustaceans[15] the only way to make this fishing activities targeting these species and to make them profitable is to improve the fishing vessels that, currently, are too small (Melo, Octávio; personal communication; April 2018). Concerning the fishing of shrimp species, improving information on substrates distribution could have

[9] Paulo Jorge Morais, 1990.
[10] Pinho, M. R. & J. Pereira, 1995a.
[11] Pinho, M. R. & J. Pereira, 1995b.
[12] Pinho, M. R. & J. Pereira, 1995c.
[13] Melo, Octávio Emanuel B. M., 1998.
[14] Machete, M., Morato, T., & Menezes, G. (2010).
[15] Mario R. Pinho, Octavio Melo, Joao Gonçalves & Helen Martins (2001).

advantageous implications, always considering the limitations mentioned above (Melo, Octávio; personal communication; April 2018).

Concerning the experiment with otter trawling[16], there is no need in research and development for this technique and above all for this technique targeting *H. atlanticus* (Melo, Octávio; personal communication; April 2018). Trawling was and is banned from the EEZ of the Azores since 2005(EC 1568/2005). There was a experiment to fish *H. atlanticus* with hand-lines technique but no fish was caught (Melo, Octávio; personal communication; April 2018).

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4.2 Madeira

4.2.1 Methodology

The work has been conducted on 8 selected and analyzed references representing the most representative species on which experimental fishing actions have been developed in the last decades in the Madeira.

4.2.2 Lessons learned from failures and successes

Regarding the experiments on the ecological and biological study of the communities of fish and crustacean benthic decapods of the continental slope of Madeira (Biscoito, M.J. *et al*., 1994), the results proved that the new developed fishing gear (MUSTAD) that was tested during the experiments it was much more effective compared to the bottom longline. But the yield of the longline MUSTAD is incomparably lower than that of the bottom traps.

The demersal cruise surveys with longline done in the Macaronesia' archipelago permitted to increase data on the depth distribution and composition of the species along depth gradient (Menezes, G. *et al*., 1998).

During the Project PESCPROF-I (DSIDP, 2006), it was observed that there has been a decrease in the diversity of catches as depth increases in all the three archipelagos (Madeira, Azores and Canaries). Fishing activities carried out with the PESCPROF benthic traps achieved the best fishing yields in the three archipelagos for the whole range of depth considered (1000-2500m), with the exception of Madeira, where at 2500 m depth the best fishing yields were obtained with MMF traps. With the exception of the Azores, in the *stratum* of 1000m depth, the maximum fishing yields corresponded to *Chaceon affinis* and *Mora moro*. While in the *stratum* of 1500m, 2000m and 2500m the species with the highest fishing yield for the three archipelagos was *Centroscymnu coelolepis*, with the exception of Madeira in the *stratum* of 2500m. In the strata of 250m depth, the species that was found to be common in the three archipelagos, and that presented the highest fishing yields was *Plesionika edwardsii*. Between 500 and 1000m depth of the Canaries and Madeira, *C. affinis* was the species with the highest fishing yields, while in the Azores it was *P. edwardsii* (500m) reflecting a deeper distribution of this species in this region.
Concerning the results of the ORPAM Project (Delgado, J. *et al*., 2006), the catch of crustaceans showed residual values, as would be expected since the fishing gear used was bottom longline, and only one individual of *Plesiopenaeus edwardsianus* was captured.

During the Project PESCPROF-II (Carvalho, D. *et al*., 2007), *Chaceon affinis* proved to be an interesting deep resource with the potential to represent an alternative to traditional fisheries in the three archipelagos. Moreover, within this project it was discovered new fishing grounds.

Regarding the Project PESCPROF-III (DSIDP, 2007), *Plesionika edwardsii* appeared to have low mobility and great vulnerability to exploitation.

Concerning the experiments with traps focused on the fishing of *Plesionika narval* (Sousa, R. *et al*., 2017), the results suggested that *P. narval* has the potential to support a viable and sustainable fishery. And the feasibility in implementing this fishery with floating traps instead of bottom traps. Floating traps are also less prone to capture bycatch and do limited damage to the deep-water ecosystems, unlike traditional bottom traps.

4.2.3 Main identified opportunity

Longline MUSTAD demonstrated to be much more effective than bottom longline. Results shown that the selectivity of the bait influenced the composition and relative abundance of the species. Bait for Atlantic chub mackerel also attracted *Conger conger* (Biscoito, M.J. *et al*., 1994). Concerning the experiments with longline survey cruises in Macaronesia, results encourage monitor the abundance of several demersal and deep-water species, in order to have a valuable tool for the assessment and management of those species in the archipelagos of the Azores and Madeira. Moreover, these experiments could be a valuable alternative to the impossibility of using trawls on these regions (Menezes, G. *et al*., 1998).

Regarding the Project PESCPROF-I, *P. edwardsii* demonstrated to be the species with more fishing potential in the three archipelagos (Madeira, Azores and Canaries) (DSIDP, 2006).
Concerning the ORPAM Project, *Pagru pagrus* it was found to be the more abundant species between 0 and 100m depth. While from 100 to 200m depth, *Phycis phycis* was the species that reached the best fishing yields in all the areas analysed. From 300 to 600m depth, *Beryx splendens* was the species with the best fishing yields, by weight and number. *Helicolenus dactylopterus* was found to be present with high fishing yield between 100 and 800m depth (Delgado, J. *et al*., 2006).

Regarding the Project PESCPROF-III, it was discussed the possibility and the fishing potential of the *P. edwardsii*, taking into consideration the complexity of this species (DSIDP, 2007).
Concerning the experiments with traps focused on the fishing of *P. narval*, the use of floating traps may also allow more profitable and sustainable harvests avoiding overfishing and bycatch problems due to its selectivity properties (Sousa, R. *et al*., 2017).

4.2.4 Main underlined obstacles

During the conduction of the experiment with longline MUSTAD, the experiment with bottom longline was suspended due to the discouraging results and losses of the equipment (Biscoito, M.J. *et al*., 1994).

Regarding the experiment with longline survey cruises in Macaronesia, there was a problem with the ship, which it was repaired permitting to accomplish the surveys in 1997. Moreover, the weather conditions precluded some of the fishing sets that could not be realized (Menezes, G. *et al*., 1998).

Concerning the ORPAM Project, due to boat operational reasons, the bids were usually initiated between 25-30 m depth, therefore complicating the study of the *stratum* 1 (0-50m) (Delgado, J. *et al*., 2006).

Regarding the Project PESCPROF-II, *Chaceon affinis* revealed to be a very complex species, especially in relation to the spatial, temporal and bathymetric distribution (Carvalho, D. *et al*., 2007).

Concerning the Project PESCPROF-III, the main obstacle that was underlines was the difficulty in define and quantify the fishing effort for *P. edwardsii* (DSIDP, 2007).

4.2.5 Needs in research and development

The outcomes of the experiment with longline MUSTAD suggested the need to test different bait simultaneously such as mackerel and viscera of black scabbardfish and squid (Biscoito, M.J. *et al*., 1994).

The results of the experiment with longline survey cruises in Macaronesia highlighted the need to improve the knowledge about depth distribution and composition of the species along depth gradient. In the conclusions, it was stressed the importance to increase the number of fishing sets in order to decrease the current error levels of the Relative Population Number (RPN – an index of relative abundance) estimation (Menezes, G. *et al*., 1998).

The outcomes of the Project PESCPROF-I pointed out the need to assess, considering the indicators of abundance and fishing yields, the fishing potential of *P. edwardsii* in Madeira and in the Azores. The results of the project highlighted also the importance of the maintenance and development of trials for the processing and marketing of "new deep-sea fishing products" (DSIDP, 2006).

Regarding the ORPAM Project, the results highlighted the importance to continue the monitoring surveys of these deep-sea fishery resources in order to prevent situations of overexploitation allowing to anticipate eventual needs of regulation of the fishing activity (Delgado, J. *et al*., 2006).
Concerning the Project PESCPROF-II, it was pointed out the importance of implementing the study on the selectivity of the trap meshes (Carvalho, D. *et al*., 2007).
Regarding the Project PESCPROF-III, it was underlined the need to continue the study on *P. edwardsii* in the three archipelagos in order to complete the knowledge of biology and population dynamics of this species. And the need to establish the rules and regulations of its commercial exploitation (DSIDP, 2007).

Concerning the experiments with traps focused on the fishing of *P. narval*, the minimum size of mesh to be used in these traps should be 15 mm, but in order to avoid overfishing larger mesh sizes are recommended. The measures incorporating selectivity criteria such as type of trap and mesh size should be complemented by fishery closures during the main reproductive period, which would contribute towards reducing the risks of overexploitation and promote a sustainable fishery. Also, due to the low abundance of this shrimp in the study area, fishing activity should be carried out on a small-scale basis (Sousa, R. *et al*., 2017).

4.2.6 References

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Delgado, J., Carvalho, D., Ferreira, S., Sousa, R., Chada, T. 2006. Monitorização da Abundância Relativa de Peixes Demersais no Arquipélago da Madeira (ORPAM – MAC/4.2/A1). Relatórios DBPO n.º 01/2006, 41 pp.

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DSIDP. 2007. Relatório do workshop de: "Avaliação de stocks insulares de *Plesionika edwardsii* em Canárias, Madeira e Açores" (PESCPROF-3, 05MAC/4.2/M11), 40 pp.

Menezes, G., Delgado, J., Krug, H., Pinho, M.R., da Silva, H.M., Carvalho, D. 1998. Design optimization and implementation of demersal cruise surveys in the macaronesian archipelagos – II (DG XIV/C/1 - Study contract 95/095). Universidade dos Açores, Horta, 70 pp.

Sousa, R., Pinho, M.R., Delgado, J., Biscoito, M., Pinto, A.R., Dellinger, T., Gouveia, L., Carvalho, D. & Henriques, P. 2017. Prospective study of the fishery of the shrimp Plesionika narval (Fabricius, 1787) in the Northeastern Atlantic. Brazilian Journal of Biology, 77(3), 585-593.

4.3 Canaries

4.3.1 Activity 1: Collecting data on existing technical information on experimental fishing in each OR.

In the Canary Islands, the sources of information available on fisheries are widely dispersed due to the variety of organisms that finance research. On the other hand, it is necessary to know what works have been carried out to subsequently request them and - if possible - analyze them and extract the necessary statistics. The foregoing is impossible to carry out within the framework of the project (in the Canary Islands) since the experimental fishing data are not made available to the public. In addition, in many cases the data are still subject of investigation and - subsequent - publication (despite being projects of several years ago). The following

sections show the results in this sense. In any case, a great effort has been made to collect and synthesize all this information, which is presented in '

Activity 3: Analysis of the main findings of the experimental fishing highlighting the lessons learned and pointing ways forward.'.

Information sources

On 22.04.16 the General Directorate of Fisheries of the Government of the Canary Islands was requested to provide technical reports on experimental fisheries and on 25.01.17. 24 studies were submitted, of which 12 are of interest in the framework of the project (results in bold in (Table 1). In addition, other sources of information of a digital type are being consulted (Table 2) and external contacts are also being maintained (eg with researchers) to delve into the availability of information that is not open access.

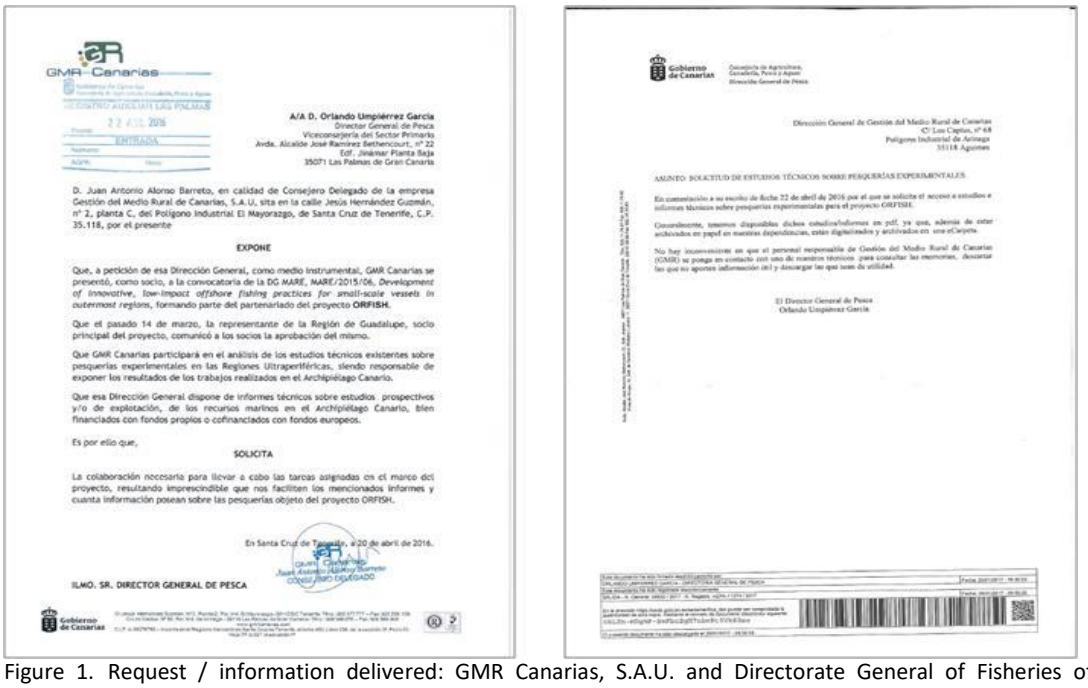

Figure 1. Request / information delivered: GMR Canarias, S.A.U. and Directorate General of Fisheries of the Government of the Canary Islands.

Project titles
1. Informe final del proyecto de investigación: Evaluación de las poblaciones de peces y macroinvertebrados de interés pesquero, análisis de la explotación de los recursos y obtención de parámetros para la gestión de la futura Reserva Marina de La Graciosa e Islotes del Norte de Lanzarote. Tomo I.
2. Memoria - Informe sobre el estado de ejecución del proyecto: Evaluación de las poblaciones de peces y macroinvertebrados de interés pesquero, análisis de la explotación de los recursos y obtención de parámetros para la gestión de la futura Reserva Marina de La Graciosa e Islotes del Norte de Lanzarote.
3. Segunda Memoria - Informe sobre el estado de ejecución del proyecto: Evaluación de las poblaciones de peces y macroinvertebrados de interés pesquero, análisis de la explotación de los recursos y obtención de parámetros para la gestión de la futura Reserva Marina de La Graciosa e Islotes del Norte de Lanzarote.
4. Prospección con nasas camaroneras tradicionales en la zona exterior de la Reserva Marina de La Graciosa (Lanzarote). Telde (Gran Canaria), noviembre de 2001.
5. Prospecciones pesqueras con nasas en aguas de Gran Canaria. Resultados de la campaña "Mogán 8701".
6. Investigación de parámetros biológicos y evaluación de recursos pesqueros. TOMO I. Parte 1: Generalidades. Parte 2: Sobre el bocinegro o pargo *Sparus pagrus pagrus* (Linnaeus 1758)

7.	**Prospección experimental de los recursos pesqueros de fondos profundos en aguas del archipiélago canario. II: Pescas exploratorias con nasas entre 300 y 1000 m de profundidad**
8.	**Prospección experimental de los recursos pesqueros de fondos profundos en aguas del archipiélago canario. Acción 1: Evaluación acústica de los recursos pesqueros en aguas profundas del archipiélago canario**
9.	**Prospección experimental de los recursos pesqueros de fondos profundos en aguas del archipiélago canario. Acciones: I - Evaluación acústica de los recursos localizados entre los 500 y 2000 m de profundidad. II – Pescas exploratorias con nasas entre 300 y 1000 m de profundidad. III – Pescas exploratorias con palangres horizontales de fondo entre 900 y 2000 m de profundidad. CONCLUSIONES Y RECOMENDACIONES**
10.	**Prospección experimental de los recursos pesqueros de fondos profundos en aguas del archipiélago canario. "Palangre Horizontal de Fondo". MEMORIA DE INVESTIGACIÓN**
11.	Impacto de la moratoria de pesca con nasas tradicionales sobre los recursos pesqueros en el caladero de Fuerteventura. Resultados de la campaña de seguimiento 2003.
12.	Campaña de pesca experimental con nasas de pescado en la isla de Fuerteventura. VOL. I. MEMORIA CIENTÍFICO-TÉCNICA FINAL
13.	Campaña de pesca experimental con nasas de pescado en la isla de Fuerteventura. VOL. II. ANEXOS
14.	**Determinación de las muestras de peces recogidas con arrastres mesopelágicos en las Islas Canarias durante tres campañas del B/E "La Bocaina"**
15.	Informe memoria del estado d ejecución del proyecto "Cartografía y evaluación de los recursos pesqueros en la plataforma y talud de Fuerteventura y Lanzarote". 2ª FASE: ISLA DE LANZAROTE
16.	**Informe preliminar sobre las pescas con nasas y palangres realizadas a bordo del buque "Taliarte" durante junio y julio de 1985**
17.	**Memoria – Informe Final del proyecto de investigación "Prospección de las poblaciones de condríctios (tiburones) de los fondos batiales profundos de Canarias, con especial atención a su posible aprovechamiento pesquero".**
18.	Primer informe parcial de la labor realizada en el proyecto "Estudio bioecológico para la optimización del conocimiento de los recursos pesqueros en la zona de Canarias: Especial atención a los túnidos, caballa y cefalópodos".
19.	**Transferencia de tecnología a la flota artesanal canaria y desarrollo de nuevas pesquerías de camarones profundos. Memoria científico-técnica. Junio de 1997.**
20.	**Optimización de la técnica de pesca y del tratamiento de la captura en la pesquería de camarón de aguas profundas en la isla de Gran Canaria. Telde (Gran Canaria), octubre de 1998.**
21.	**Pesquería de camarón de aguas profundas. Isla de Tenerife: Evaluación del recurso, transferencia de tecnología y construcción de prototipos.**
22.	**Plan piloto de pesca y estudio de mercado para el desarrollo de una pesquería de camarón o gamba en aguas profundas de Gran Canaria.**
23.	Species composition of mesopelagic fishes in the area of the Canary Islands, Eastern Central Atlantic
24.	Propuesta para la realización de una pesca exploratoria del calamar diamante en Canarias. Diciembre de 2014.

Table 1. Titles of the Projects delivered by the DGP (Government of the Canary Islands) in "PDF". Projects (in bold) of interest in the framework of the Project.

Table 2. List of the main digital sources consulted.

Sources and links
Faro ULPGC: http://ulpgc.summon.serialssolutions.com/#!/
Catálogo ULPGC: http://opac.ulpgc.es/cgi-bin/abnetopac/O7171/IDde2d234b?ACC=101
Base de datos de Canarias y el Atlántico: http://www.canaratlantico.org/
Punto Q ULL: http://puntoq.greendata.es/primo_library/libweb/action/search.do?vid=ull&reset_config=true&afterPDS=true
Catálogo ULL: http://absysnet.bbtk.ull.es/cgi-bin/abnetopac/O7013/ID7fbcf779?ACC=101
Insituto Español de Oceanografía: http://biblioteca.ieo.es/biblio_ext.htm
Canaratlántico: http://www.canaratlantico.org/
Pesca Base: http://www.pescabase.org/
Google académico: https://scholar.google.es/

Projects

An Excel database with 65 records (Table 3) is owned, about possible projects of interest, which contains the following (23) fields: Title; Acronym; Framework / Reference / Code / Call; Start date; End date; Duration (years); Budget (€); Entity / s Funding / s; Entity / is Participants; Responsible Researcher; Specific geographic scope; Regional geographic scope; Geographical scope mesoscala; Species / s objective; Fishing gear employed;

Availability of study; Documentary content; Transfer to the sector; Possible implementation; Source of data; Web page; Observations

Table 3. Sample of the record table of "Project of interest".

Título	Acrónimo	Marco/Referencia/Código/Convocatoria	Fecha inicio	Fecha fin	Presupuesto (€)	Financia	Participa	Investigador Responsable	Ámbito específico	Ámbito regional	Especie/s objetivo	Arte de pesca empleado	Transferencia al sector
Seguimiento del efecto reserva en	sin datos	Convenio Específico de colaboración entre la Secretaría Gene	16/07/2008	31/12/2011	sin datos	SGM e IEO	SGM e IEO	Pablo Martín-Sos	La Palma	Canarias	sin datos	sin datos	sin datos
Seguimiento del efecto reserva en	sin datos	Convenio Específico de colaboración entre la Secretaría Gene	30/11/2007	31/12/2010	sin datos	SGM e IEO	SGM e IEO	Pablo Martín-Sos	Lanzarote	Canarias	sin datos	sin datos	sin datos
Aprovechamiento y valoración de lo	sin datos	Servicio Técnico de Ganadería y Pesca del Área de Aguas, Ag		2006	2006 sin datos	Cabildo de Tenerí	Ecodesarrollo Ala	Ecodesarrollo Ald	Tenerife	Canarias	sin datos	sin datos	sin datos
European Marine Protected Areas a	EMPAFISH	VI Programa Marco (SSPB-006539)		2005	2008 3.056.808 euros	Unión Europea	Universidad de Má	Dr. Ángel Pérez R	sin datos	Canarias	sin datos	sin datos	sin datos
Biología reproductora de crustáceo	REDECA	Proyecto Coordinado del Programa Nacional de Ciencias y Te	31/12/2005	31/12/2008	sin datos	Fondos FEDER y M	Universidad de La	Dr. I.J. Lozano (U	sin datos	Canarias	Plesionika edwardsii y Cha	sin datos	sin datos
Recursos pesqueros de aguas profu	PESCPROF 3	Proyecto Coordinado del Programa Nacional de Ciencias y Te	01/10/2005	31/10/2008	sin datos	Fondos FEDER, Re	Dirección de Servic	Dalila Carvalho (	sin datos	Canarias	sin datos	sin datos	sin datos
Recursos pesqueros de aguas profu	PESCPROF 2	Programa de Iniciativa Comunitaria Interreg III B (03/MAC/4.2	01/07/2004	30/04/2007	sin datos	Fondos FEDER, Re	Dirección de Servic	Dalila Carvalho (	sin datos	Canarias	sin datos	sin datos	sin datos
Seguimiento de las pesquerías en	sin datos	Convenio Específico de Colaboración para el "Seguimiento d	16/06/2003	31/12/2006	sin datos	SGM e IEO	SGM e IEO	Pablo Martín-Sos	La Palma Lanzarote El Hierro	Canarias	sin datos	sin datos	sin datos
Genetic catalogue, biological	FISHTRACE	V Programa Marco (QLRI-CT-2002-02755)	01/01/2003	31/12/2005	2.000.000 euros	Comisión Europea	Universidad Comp	Dr. J.M. Bautista	sin datos	Canarias	sin datos	sin datos	sin datos
Recursos Pesqueros de Aguas Profu	PESCPROF 1	Programa de Iniciativa Comunitaria Interreg III B (03/MAC/4.2	01/07/2003	30/09/2005	1.387.360 euros	FEDER, Región	Dirección de Ser	Dalila Carvalho (	sin datos	Canarias	sin datos	sin datos	sin datos
Guía PesCanarias. Vol. 1. Productos	GUIA ALIMENT	Acuerdo de Colaboración interdepartamental entre la Conse	01/01/2003	31/10/2004	sin datos	Gobierno de Cana	Instituto Canari	Dr. J.A. González	Tenerife, Gran Canaria	Canarias	sin datos	sin datos	sin datos
Prospección experimental de los re	sin datos	Convenio ULL-PEULL-Gobierno de Canarias	2002	2003	sin datos	Consejería de Agri	Departamento de	Dr. Alberto Brito	sin datos	Canarias	sin datos	Palangre horizontal de fondo	sin datos
Prospección experimental de los re	sin datos	Convenio ULPGC-FULP-Gobierno de Canarias	2002	2003	sin datos	Viceconsejería de	Departamento de	Dr. José I. Castro	Lanzarote (sur)Gran Canaria (sur	Canarias	Crustáceos (31 especies)Mo	Nasa para peces (tradicional)Nas	sin datos
Plan piloto de pesca y estudio de r	PILOTO CAM GC	Subvención específica para proyecto científico-pesquero (Dc	01/04/2002	31/12/2003	sin datos	Gobierno de Cana	Instituto Canario	J.J. Santana (ICD	Gran Canaria	Canarias	Cambarón o gamba	sin datos	sin datos
Acción piloto de pesca experimenta	sin datos	Reglamento (CE) 2792/1999 y Orden de 21 de marzo de 2000 s	18/07/2002	18/12/2002	sin datos	Ministerio de Agri	Instituto Español	Carlos L. Hernánc	bancos al noreste de Lanzarote	Canarias	Mora moro	sin datos	sin datos
Estandarización de procedimientos	PESCABASE	Proyecto Coordinado del Programa Nacional de Alimentación	10/12/2001	10/12/2004	sin datos	Fondos FEDER y M	Instituto Canari	Dr. J.A. González	sin datos	Canarias	sin datos	sin datos	sin datos
Recursos pesqueros de Lanzarote	sin datos	Cabildo Insular de Lanzarote	nov-2001	ene-2002	sin datos	Cabildo Insular de	Departamento de	Dr. A. Brito Hern	Lanzarote	Canarias	Calamar del alto (Loligo for	sin datos	sin datos
Acción piloto de pesca experimenta	sin datos	Reglamento (CE) 2792/1999 y Orden de 21 de marzo de 2000 s	19 de enero de 15 de agosto de 2001		sin datos	Ministerio de Agri	Instituto Español	Carlos L. Hernánc	sin datos	Canarias	sin datos	sin datos	sin datos
Identificación y diferenciación de t	sin datos	Proyecto Coordinado de la Secretaría de Estado de Educación	01/01/2000	31/12/2001	sin datos	Fondos FEDER y M	Instituto Canario	Dr. J.A. González	sin datos	Canarias	sin datos	sin datos	sin datos
Prospección y evaluación de camar	PROS CAM LGLPEH	Convenio específico de colaboración para proyecto científico	01/01/1999	31/12/1999	sin datos	Gobierno de Cana	Instituto Canario	Dr. J.A. González	La Gomera, El Hierro y La Palma	Canarias	Plesionika edwardsii	sin datos	sin datos
Transferencia de tecnología para e	APHANOPUS	Programa Comunitario REGIS II, Regiones UltraPeriféricas (RL	01/01/1998	31/12/1999	sin datos	Unión Europea	Dirección de Servic	L. Gouveia (DG	sin datos	Canarias	Aphanopus carbo (Trichiuri	sin datos	sin datos

Funding programs

A list of the financing programs is presented (Table 4), in order to describe the origin of the financing, its amounts, the most recurrent periods, etc.

Table 4. Financing programs for small-scale experimental fisheries.

Name	Start	End	Web
VI Programa Marco	2002	2006	https://ec.europa.eu/research/fp6/index_en.cfm
Interreg III B	2000	2006	http://www.interreg-sudoe.org/castellano/index.asp
V Programa Marco	1998	2002	http://cordis.europa.eu/fp5/
REGIS 2	1994	1999	http://cordis.europa.eu/programme/rcn/488_en.html
PCT MAC	2007	2013	http://www.pct-mac.org/
POCTEFEX	2008	2013	http://www.poctefex.eu/
Plan Nacional de Investigación Científica, Desarrollo e Innovación Tecnológica	2004	2007	http://www.idi.mineco.gob.es
Subprograma de Apoyo a la Función Transferencia en Centros de Investigación (OTRI)	2006	2006	http://www.idi.mineco.gob.es

Species

A list of the financing programs is presented (Table 5), in order to describe the origin of the financing, its amounts, the most recurrent periods, etc.

Table 5. Deep species of commercial or potential interest in the Canary Islands.

Scientific name	Common name
Aphanopus carbo	Pejesable negro
Aphanopus intermedius	Pejesable negro
Aristaeomorpha foliacea	Langostino moruno, gamba chorizo
Aristaeopsis edwarsiana	Carabinero
Bathynectes maravigna	Cangrejo nadador de fondo
Beryx decadactylus	Tableta, fula ancha
Beryx splendens	Fula de altura, alfonsiño
Cancer bellianus	Cangrejo buey canario
Chaceon affinis	Cangrejo rey
Conger conger	Congrio
Dentex macrophthalmus	Antoñito, dientón
Dentex maroccanus	Dientón, calé
Epigonus telescopus	Candil
Gymnothorax polygonius	Morena papuda
Helicolenus dactylopterus dactylopterus	Bocanegra
Heterocarpus ensifer	Camarón cabezudo
Heterocarpus grimaldii	Camarón cabezudo del alto
Illex coindetii	Pota
Lepidocybium flavobruneum	Escolar negro
Lepidopus caudatus	Pejesable, sable plateado
Loligo forbesi	Calamar del alto
Merluccius merluccius	Merluza, pescada
Mora moro	Merluza canaria, jediondo
Muraena helena	Morena pintada
Ommastrephes bartramii	Volador
Pagellus bogaraveo	Gorás
Phycis phycis	Brota, agriote
Plesionika edwardsii	Camarón soldado
Plesionika martia	Camarón marcial
Plesionika narval	Camarón narval
Plesionika williamsi	Camarón rayado gigante
Polymixia nobilis	Salmón del alto, lirio
Polyprion americanus	Cherne, romerete
Pontinus kuhlii	Obispo, volón
Promethichthys prometheus	Pejeconejo
Ruvettus pretiosus	Escolar rasposo
Sthenoteuthis pteropus	Pota de ley
Todarodes sagittatus	Pota negra, pota europea

Researchers of interest

Also, while the analysis of the information of the publications is carried out, a list of interesting research species is being carried out (Table 6) to serve as a support in locating detailed documentary information.

Table. 6 Principal investigators in deep specias of interest in the Canary Islands

Name	Center	Mail
Alberto Miguel Brito Hernández	ULL	abrito@ull.es
Carlos Luis Hernández González	ICCM	carlos.hernandez@ca.ieo.es
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José Antonio González Pérez	ICCM	solea@iccm.rcanaria.es
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José Juan Castro Hernández	ULPGC	jose.castro@ulpgc.es
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José Mario González Pajuelo	ULPGC	jose.pajuelo@ulpgc.es
Luis José López Abellán	IEO	luis.lopez@ca.ieo.es
María Ángeles Rodríguez Fernández	IEO	angeles.rodriguez@ca.ieo.es
Pablo Martín-Sosa Rodríguez	IEO	pablo.martin-sosa@ca.ieo.es
Rosa Rabanal Gallego	ULL	rrabanal@ull.es

Legislation

On the other hand, the compilation of fisheries and environmental legislation is also being considered (Table 7), which may affect the project objectives in the Canary Islands.

Table 6. Legislation (National and Regional) that could affect the scope of the project.

Rule	Source
LEY 6/2007, de 13 de abril, de modificación de la Ley 17/2003, de 10 de abril, de Pesca de Canarias. Boletín Oficial de Canarias núm. 78, jueves 19 de abril de 2007	Canarias - BOC
Ley 17/2003, de 10 de abril, de Pesca de Canarias (B.O.C. 77, de 23.4.2003)	Canarias - BOC
Decreto 182/2004, de 21 de diciembre, por el que se aprueba el Reglamento de la Ley de Pesca de Ca narias (B.O.C. 4, de 7.1.2005)	Canarias - BOC
Real Decreto 1938/1985, de 9 de octubre, sobre traspaso de funciones del Estado a la Comunidad Autónoma de Canarias en materia de pesca en aguas interiores, marisqueo y acuicultura. BOE núm. 254, de 23 de octubre de 1985	España - BOE
Orden AAA/2536/2015, de 30 de noviembre, por la que se regulan las artes y modalidades de pesca marítima y se establece un plan de gestión para los buques de los censos del Caladero Nacional Canario.	España BOE
Real Decreto 1076/2015, de 27 de noviembre, por el que se deroga el Real Decreto 2200/1986, de 19 de septiembre, de regulación de artes y modalidades de pesca en aguas del caladero canario, y se modifica el Real Decreto 560/1995, de 7 de abril, por el que se establece las tallas mínimas de determinadas especies pesqueras, en relación a determinadas tallas mínimas autorizadas para el caladero de Canarias.	España - BOE
Acuerdo de pesca entre el Reino de España y la República Portuguesa para el ejercicio de la actividad de la flota pesquera artesanal de Madeira y Canarias, hecho «ad referendum» en Oporto el 9 de mayo de 2012.	España - BOE

Publicaciones

After communications from the Coordination of the ORFISH project, these results have been considered to be done in a common way among all partners. As far as we are concerned, the contents of this section are found in the ‘

Activity 2: Build a collection of reports and database compiling the existing information.’

4.3.2 Activity 2: Build a collection of reports and database compiling the existing information.

Results

We have selected and analyzed 11 references that represent the most representative species on which experimental fishing actions have been developed in the last decades in the Canary Islands. Subsequently, the Excel file has been filled out. Point out that the records (rows) of the given table, mix project information with details of campaigns ... this makes it very difficult to achieve a balance in the dump of information. We, what we have proposed, is not to make a record (row) for each reference, but a record (row) for each target species based on the selected references (that is, the same record contains information on several projects). The selected species are the following:

> *Aphanopus carbo* and *A. intermedius* (Osteichthyes, Trichiuridae)
>
> *Chaceon affinis* (Decapoda, Geryonidae)
>
> *Cancer bellianus* (Decapoda, Cancridae)
>
> *Plesionika narval*, *Plesionika edwardsii* and *Heterocarpus ensifer* (Decapoda, Pandalidae)
>
> *Plesionika edwardsii* (Decapoda, Pandalidae)
>
> *Heterocarpus ensifer* (Decapoda, Pandalidae)

This work has been carried out under the supervision of the main expert in experimental and deep fishing of the Canary Islands, PhD. José Antonio González Pérez (ULPGC).

Selected bibliography

Arrasate-López, M., V.M. Tuset, J.I. Santana, A. García-Mederos, O. Ayza & J.A. González (2012). Fishing methods for sustainable shrimp fisheries in the Canary Islands (North-West Africa). ***Afr. J. Mar. Sci.***, 34 (3): 331-339.

Biscoito, M., J. Delgado, J.A. González, S. Stefanni, V.M. Tuset, E. Isidro, A. García-Mederos & D. Carvalho (2011). Morphological identification of two sympatric species of Trichiuridae, *Aphanopus carbo* and *A. intermedius*, in NE Atlantic. ***Cybium***, 35 (1): 19-32.

Biscoito, M., M. Freitas, J.G. Pajuelo, R. Triay-Portella, J.I. Santana, A.L. Costa, J. Delgado & J.A. González (2015). Sex-structure, depth distribution, intermoult period and reproductive pattern of the deep-sea

red crab *Chaceon affinis* (Brachyura, Geryonidae) in two populations in the north-eastern Atlantic. ***Deep-Sea Res. I***, 95: 99-114.

Delgado, J., S. Reis, J.A. González, E. Isidro, M. Biscoito, M. Freitas & V.M. Tuset (2013). Reproduction and growth of *Aphanopus carbo* and *A. intermedius* (Teleostei: Trichiuridae) in the northeastern Atlantic. *J. Appl. Ichthyol.*, 29 (5): 1008-1014.

González, J.A., J. Delgado, E. Isidro, J.I. Santana, A.R. Góis, M.R. Pinho, S. Jiménez, A.M. García-Mederos, M. Arrasate-López, O. Ayza, V.M. Tuset & MARPROF Consortium (2010). Estimating the biomass and fishing potential of the deep-water shrimp *Plesionika edwardsii* (Crustacea: Decapoda: Pandalidae) around the Macaronesian archipelagos. ***Actas del XVI Simposio Ibérico de Estudios de Biología Marina***: 139. Universidad de Alicante, Alicante, 6-10 septiembre 2010.

González, J.A., J.G. Pajuelo, R. Triay-Portella, R. Ruiz-Díaz, J. Delgado, A.R. Góis & A. Martins (2016). Latitudinal patterns in the life-history traits of three isolated Atlantic populations of the deep-water shrimp *Plesionika edwardsii* (Decapoda, Pandalidae). ***Deep-Sea Res. I***, 117: 28-38.

Pajuelo, J.G., R. Triay-Portella, J.I. Santana & J.A. González (2015). The community of deep-sea decapod crustaceans between 175 and 2600 m in submarine canyons of a volcanic oceanic island (central-eastern Atlantic). ***Deep-Sea Res. I***, 105: 83-95.

Quiles, J.A., V. Rico, V.M. Tuset, J.I. Santana & J.A. González (2001). Notes on the biology of *Cancer bellianus* (Brachyura, Cancridae) around the Canary Islands. ***Hydrobiologia*** (Paula, J.P.M., A.A.V. Flores & C.H.J.M. Fransen, eds., Advances in Decapod Crustacean Research), 449: 193-199.

Triay-Portella, R., R. Ruiz-Díaz, J.G. Pajuelo & J.A. González (2017a). Ovarian maturity, egg development, and offspring generation of the deep-water shrimp *Plesionika edwardsii* (Decapoda, Pandalidae) from three isolated populations in the eastern North Atlantic. ***Mar. Biol. Res.***, 13 (2): 174-187.

Triay-Portella, R., J.G. Pajuelo & J.A. González (2017b). Spatio-temporal variation in biomass of the deep-sea red crab *Chaceon affinis* in Gran Canaria Island (Canary Islands, Eastern-Central Atlantic). ***Mar. Ecol.***, 38 (5): 1-14.

Tuset, V.M., J.A. Pérez-Peñalvo, J. Delgado, M.R. Pinho, J.I. Santana, M. Biscoito, J.A. González & D. Carvalho (2009). Biology of the deep-water shrimp *Heterocarpus ensifer* (Caridea: Pandalidae) off the Canary, Madeira and the Azores Islands (northeastern Atlantic). ***J. Crustac. Biol.***, 29 (4): 507-515.

References are attached in digital format. In any case, it is important to point out that you have to be careful when sharing these files because some may have certain editorial rights.
In the following annex you can consult the selected references: **Annex 05. Selected references**

4.3.3 Activity 3: Analysis of the main findings of the experimental fishing highlighting the lessons learned and pointing ways forward.

Work done by the main expert in experimental and deep fishing of the Canary Islands, Dr. José Antonio González Pérez (ULPGC).

This scientific-technical report is called:

González, J.A. (2018). *Análisis de los principales hallazgos de la pesca experimental en aguas de Canarias, destacando las lecciones aprendidas y señalando los caminos a seguir*. Informe científico-técnico para el proyecto ORFISH. Co-financiado por la DG MARE (Unión Europea) y

GMR Canarias, S.A.U. Fundación Parque Científico Tecnológico de la Universidad de Las Palmas de Gran Canaria. Las Palmas de Gran Canaria: 134 pp.

This report collects and examines the scientific and technical information generated and between 1996 and 2012 regarding the state of fish and shellfish resources detected between 200 and 3000 m deep in the waters of the Canary Islands in order to know them, enhance them and analyze their potential. There were other regional projects or Macaronesian, usually prior to 1996 and dedicated to obtaining specimens for biological studies of species of fishing interest (potential or demonstrated). Most of these precursors results projects (1992-1998) were capitalized by successor projects in this report are collected and which have been authentic and robust lines of research and technological development related to new deep-sea fish stocks.

Lessons learnt from successes and failures

Fish or shellfish resources

Deep and semi-deep waters (up to about 1000 m depth) contains a rich diversity of benthic Benthopelagic and Mesopelagic; some dozens of species of megafauna (mainly fish, crustaceans and molluscs) have, a priori, commercial interests. Regardless of potential economic interest that innovation and biotechnology can bring to light, the deep and semi-deep waters megafauna of the Canary Islands is home to three large groups of fish / shellfish resources with commercial interests shown: Bony fish (17 species), shrimp pandalids (5 species), Big crabs deepwater (3 species).

'Camarón soldado' (*P. edwardsii*)

Biological information available. Prospecting and evaluation of the Canary Islands island stocks made. Target species of shellfish, together with P. narval. The product is sold, depending on the size and the island, between 15 and 40 euros / kg. Without any sign of overexploitation. Current catches absolutely lower than the nearly 80 tons / year available in terms of sustainability. This value of the maximum sustainable yield (MSY) for the whole of the stocks of the Canary Islands will be refined soon in light of recent research on the biological parameters of the species.

'Cangrejo rey' (*C. affinis*) (Geryonidae)

Biological information and available space-time distribution, complete and updated data. Maximum weight of a specimen observed in the Canary Islands, 2150 g. Maximum abundance at 600-1000 m depth. Discontinuous and scanty / moderate catches in Gran Canaria, by means of benthic pots directed to the crab itself and to the big headed shrimps. The specimens above 600 g, are sold whole at 14-18 euros / crab. Given their low level of exploitation, the Canarian populations enjoy an excellent state of conservation.

'Pejesables' or 'conejos diablo' (*A. carbo* and *A. intermedius*) (Trichiuridae)

Resources exploited in Canary waters (especially in La Palma, El Hierro and adjacent seamounts) by Maderense fleet. This bi-specific resource has already shown clear signs of overexploitation. Despite being the emblematic marine product of gastronomy of Madeira, in the Canary Islands it has no commercial interest. This fishery has the disadvantages of consuming important quantities of squid such as bait and catching various sharks such as discards or by-catch.

Shellfish or fishing systems

The 'tren de nasas camaroneras semi-flotantes ' (NCSF), imported from the Spanish industrial fishery in the Mediterranean and adapted to the conditions of Canary Islands artisanal shellfish fishing, has proved to be more efficient and efficient than conventional shrimp traps in this

archipelago. present much less impact on seabed (operates about 2.4 m above the substrate and minimizes losses) and provide a higher quality product (minimizes the capture of predators).

The 'tren de nasas cangrejeras' (MMF), coming from an experimental model of the Marine Biology Station of Funchal, in this Archipelago has proved to be as effective and efficient as the large benthic pots infrequently directed to king crab, ox crab and shrimp high. The MMF pots are suitable for the selective shellfishing of Canarian ox crab and king crab. In addition, they are lighter and cheaper and take up less space on board and in storage than conventional pots.
The medium-drift longlines, maderense type, have practically not aroused any interest on the part of the artisanal fleet of the Canary Islands, nor has any appreciation been developed for the black pejesable resource.

Valorization of marine products and communication actions
During the last 15 years (FEDER funds and MAC Programs), a series of communication actions was implemented in each project, aimed at various target audiences or targets: web pages, scientific and informative publications, exhibition of itinerant exhibition, activities or gastronomic events for promotion of marine products, identification, organization and deposit of specimens for the creation of reference biological collections, etc.

Creation and consolidation of Partnership
A Network of Institutions and research groups in Marine Sciences, Fisheries, including the sustainability of resources, the valorisation of products and the ecosystem approach, has been created and consolidated in the Cooperation Space of Macaronesia, including the Azores, Madeira, Canary Islands and Cape Verde.

Main identified opportunities

Biological characteristics of deep-sea species
Pandlid shrimp have the advantage of presenting permanent breeding activity accompanied by high fecundities. On the other hand, fish generally have a medium-long life cycle that is very sensitive to high levels of exploitation, in addition to tending to the formation of reproductive or trophic aggregations.

Exploitation models and the availability of fishery statistics
The Deepwater Resources (RAP, 'Recursos de Aguas Profundas')) show a pattern of fractioning and reduction of fishing effort by species (which is conditioned by the seasonality of other fisheries) and are subject to capture by fishing systems with high selectivity. On the other hand, it is necessary to contemplate as opportunities the possibility of developing scientific bases for the adequate use of scarce or nonexploited resources.

Fisheries management and regulation of RAP
Existence of solids scientific and technological bases to support the development of certain crustacean fisheries (in particular soldier shrimp and, to a lesser extent, king crab, ox crab and big-headed shrimp). They mean, therefore, the real possibility of applying an early precautionary management in scarcely or none exploited resources and, on the other hand, the ability to contribute and advise in the elaboration of a fishing regulatory improvement.

Canarian fishing fleet
Polyvalent and high capacity to change the type of activity (rotary harvests). In addition, it requires few technological requirements for the development of the activity in most of the

fisheries on the RAP and the availability of funds / public aid for the renewal of boats, fishing technologies and professional training.

Fishing systems suitable for RAP

Excellent capacity of the R & D centers and Universities of the Canary Islands to transfer innovative fishing technology and "know-how" (how it is done) to the extractive sector. In addition, innovative fishing techniques (selective gear for invertebrates) have been developed and tested in the archipelago, which are still susceptible to study and improve their selectivity and incorporate biodegradable elements that positively affect the reduction of by-catch and the minimization of environmental impact, particularly on the seabed.

Fishing effort

Regarding the fishing effort to be exercised over the RAP, the development of new seafood activities with target species of shrimp and large crabs as target species, would mean the diversion - permanent and / or temporary - of a part of the current fishing effort towards deep areas through the relocation and specialization of a part of the fleet, thus promoting the recovery of fishing resources and coastal shellfish. The allocation of fishing effort in artisanal fisheries, especially in deep waters, in a complex issue that requires specialized scientific-technical advice that has solid knowledge bases and monitoring capacity.

Research and technology transfer on RAP

The existence in the Canary Islands of qualified research centers and the availability of a sufficient critical mass, made up of both specialized researchers and highly versatile researchers, stands out. In addition, the consolidation and promotion of the creation of multidisciplinary research groups will favor obtaining more financial resources from competitive calls; and, on the other hand, the shared use of the scientific infrastructures available in the different R & D centers and in the Universities.

'Camarón soldado' (*P. edwardsii*)

The soldier shrimp resource, as a new shellfish species for the Canary Islands, could propitiate the emergence of a Canary Islands shellfish fleet specialized in sea-leveling as an exclusive activity or as an alternative / complementary to other fisheries. If the hypothetical Canarian seafood fleet was able to take advantage, in a sustainable way, the almost 80 tons of sold shrimp available for the first year of activity, the gross income of the artisanal fishing subsector generated by this resource would be around 2 million euros anual.

Main underlined obstacles

Exploitation models and the availability of fishery statistics

The general absence of historical series of catches and fishing effort, a situation that is partly inherent to the dispersion of the discharge points and the variability of the target species; ignorance of exploitation levels and the incidence of oceanographic conditions on the distribution and availability of populations; and the difficulty in applying evaluation models to the use.

Ordenación y regulación pesqueras de los RAP

Algunas debilidades detectadas en este campo son: el proceso de ordenación y regulación pesquera/marisquera en Canarias generalmente no ha considerado la información científico-técnica disponible; la escasa relación entre Administración, científicos y pescadores para

elaborar las bases de ordenación y regulación de la pesca; y la resistencia a la innovación y al desarrollo de nuevas actividades por parte de la Administración competente.

Fisheries regulation and regulation of RAP

Some weaknesses detected in this field are: the fishery / seafood management and regulation process in the Canary Islands has not generally considered the available scientific-technical information; the scarce relation between Administration, scientists and fishermen to elaborate the bases of order and regulation of the fishing; and the resistance to innovation and the development of new activities by the competent Administration.

Dynamics of fishery resources subject to exploitation

However, at present we still have an important ignorance of the dynamics of the fishery resources subjected to exploitation. In the archipelago this fact has been aggravated by a numerous and diverse series of weaknesses, such as: insufficient availability of research vessel, lack of polyvalent oceanographic vessel, scarce research effort on the marine environment-fishery resources, low level of coordination among researchers, limited support to researchers for the proper development of administration and management tasks, absence of short, medium and long-term fishing R & D & I planning, shortage of funds and local funding sources, very low involvement of the private company in marine R + D + i, discontinuity of research that negatively affects the usefulness and validity of the results, and scarce disclosure of the results of the research activity. Aspects such as the dissemination and promotion of new fishery products acquire special relevance in this context.

The 'tren de nasas camaroneras semi-flotantes' (NCSF)

At the normative level, it presents an inadequate regulation (which needs to be corrected) of this selective tax collection system that makes this activity practically unfeasible (in terms of economic profitability); In addition, a transfer process (technology, knowledge and know-how) to the artisanal fleet of the Canary Islands is necessary because it is currently incomplete and insufficient.

The 'tren de nasas cangrejeras' (MMF)

The process of transfer (technology, knowledge and know-how) to the Canarian artisanal fleet has been very insufficient and has been limited to Gran Canaria (ICCM and Canary Islands public universities) and Tenerife (IEO).

Needs in research and development

Although there are generic recommendations, only more specific ones are indicated (in summary).

Conducting biological studies and establishing fisheries management measures

Good part of the fishing / shellfish resources of the semi-deep and deep waters of the Canary Islands. These resources can represent an alternative or complement to those currently exploited (especially in the coastal domain). In this sense, it is necessary to promote and support studies to determine, complete or update the basic biological parameters of the following target species of 15 species. We consider it convenient, and of some urgency, to establish a minimum catch size (TMC) for those resources that have been sufficiently studied: 7 species. Also, with a

precautionary nature and based on the best available biological information, also set a TMC for resources yet to be studied.

Improvement of the Canarian system of First Sale
The Canarian system of First Sale, more specifically its IT platform, has to be improved to capture adequate and correct statistical information, useful for the continuous evaluation and the permanent improvement of the management of the fisheries. We also deem it necessary that the markets receive technical support in this regard.

Support for the transfer for the sustainable development of "new" fishing / shellfishing activities
In addition, it is necessary to address actions aimed at demonstrating and developing responsible fishing technologies, including social innovation and new business models. We are talking about development, demonstration, transfer and prospecting campaign with selective, specialized and responsible fishing systems (more respectful) with the environment.

4.3.4 Activity 4: Exchange and share the information among partners and stakeholders from different ORs.

No actions have been taken in this activity. In any case it is proposed the use of Bibliographic Managers to share the information collected between partners. The following paragraphs justify this statement and propose, in our case, the use of the Mendeley program.

Selection of a Reference Management Software

Reference Management Software (RMS) are tools that allow the creation, maintenance, organization, sharing and shaping of bibliographic references of journal articles, books or other documents from different sources of information (databases, magazines, web pages, etc.). They will also create quotations and bibliographies in the working documents in a standard format (MLA, Vancouver, etc.). The different managers of bibliographic references share the same basic functionalities: storage of bibliographic references; description, organization and retrieval of references; creation of bibliographies and citation tools, as well as share references.

An important part of our task is to do a bibliographic review. The titles of the different references that are found, as well as the associated files, must be stored in some program that allows the efficient management of this information among the different partners of the project. The use of this tool should also allow all partners to integrate the results of this project into their reference management databases.
The RMS selection criteria best suited to our interests are based on whether it is web version or desktop, software compatibility, language and price. Several RMSs have been valued, and on the most noteworthy, a comparative table has been made (see below). Finally the best rated, under the established criteria, is "Mendeley"".

Name	Versions		Software	language	Prize	Obs.
	web	*desktoop*				
Mendeley	yes	yes	Windows, Mac, Linux, Android	English	Free	-
EndNote	yes	no	Windows, Mac	English	Free	Basis version
	yes	yes	Windows, Mac	English	249,95 €	-

Zotero	yes	no	Windows, Mac, Linux	English	Free	Only works with Mozilla
RefWorks	yes	?	?	several?	100* €	* annual

Added activity

It could be interesting for the Project to have a tool that allows, in light of the information gathered, to know the status of the stock, the impact and the management of the fishery. In this sense, during a business practice developed in 2017, in the framework of a collaboration agreement signed between the University of Cadiz and GMR, 2 students and their own staff have worked on the development of a qualitative tool [based on the fisheries standard of the Marine Stewardship Council (MSC)] to contribute - within the framework of the ORFISH Project - to knowing how close or far a fishery of sustainability is based on 3 criteria: (i) stock status of the target population , (ii) impact on species, habitats and ecosystems and (iii) management at the international, national, regional and local levels. These works were presented as Masters Thesis.

Belmonte González, L. 2017. *Propuesta de una herramienta para la evaluación de la sostenibilidad de una pesquería, basada en los Principios 1 y 3 del estándar de pesquerías del Marine Stewardship Council (MSC)*. Memoria presentada para la obtención del Título de Máster en Acuicultura y Pesca. Universidad de Cádiz. 53 pp.

Jaén Medinilla, M. 2018. Propuesta de una herramienta de evaluación y seguimiento de pesquerías. *Aplicación al caso práctico de Plesionika edwardsii en la isla de Gran Canaria*. Memoria presentada para la obtención del Título de Máster en Acuicultura y Pesca. Universidad de Cádiz. 57 pp.

Next, the BOXs that were raised for each of the criteria are inserted. Add that in both works, in addition to the theoretical approach, a practical one is made based on information on one of the main deep experimental fisheries of the Canary Islands (*Plesionika edwardsii*).

Box 1: Sustainable fish populations

'To achieve a good state of stock in terms of biomass and yield, population should be within specific limits and to that it must be able a solid harvest strategic which to allow for keeping the described above'

To an optimal **stock state** it must be sure that population is around of point where recruitment would be impaired, PRI. Besides, population must be in a coherente point with the maximum sustainable yield (MSY) or one roughs according to aceptable reference points (selected from expert choice in funtion of data type, for example: B/B_{MSY}, F/F_{MSY}, $F_{0,1}$, $SSB/SSB_{F0'1}$, among others). In the case of population has decreased under required levels, it would be neccessary to stablish a period of stock rebuilding (determinated from expert choice according specie) which not go too far of the length of a generation and it has to be based on simulation models and harvesting rates both.

As concerns to the **harvest strategic**, it must develope allowing which population is over PRI and it is expected that the stableshed harvest control rules (HCR) keep population round of a MSY level. This harvest strategic must be reviwed regularly and improve when it is neccessary. Also these aspects must be considered: the activities of rest of fisheries that harvest the same population, the biology of species and the characteristics of the fishery.

Figure 1. Resume about principle 1 of Marine Stewardship Council protocol (Belmonte, 2017).

Box 2 a: Primary species

'The impact of a fishery over primary species must be low or nonexistent, in such a way that a high likelihood of surviving is ensured. That is, spawning biomass of these primary species is maintained over PRI and commensurate with the MSY'.

The **stock state** must show that population is around of PRI (point where recruitment would be impaired) and achieve the MSY (maximum sustainable yield). As reference points are able to choose all those points which reflect biomass or mortality parameters on the damaged stock by fishery (for example, B_{LIM}, B_{MSY}, F_{MSY}, F_{LIM},...). In the absence of these parameters it will be necessary thinking about uses of the Risk Based-Framework method (RBF) from a productivity-susceptibility analysis (PSA).

By definition, primary species count with a **strategy of manage** (SM). SM includes harvest control rules, mínimum sizes, time and area closures, ... In this section, its effectiveness, degree of implementation (this will be determined through a before and after comparison of results since SM implementation, in a way that to show evidences of recovery) and development of its continuous monitoring, are assessed. In case of sharks considered primary species, not finning (with national regulations, special surveillance systems, ...) will be taken into account as a favourable sustainability index.

Besides, it is necessary to ensure that obtained **information** previously is enough and appropriate to determinate sustainability of fisheries.

Figure 2. Resume about principle 2 (primary species) of Marine Stewardship Council protocol (Jaen, 2018).

Box 2 b: Secondary species

'The fishery must have one low or nonexistent impact, in such a way that secondary species should be within the safe biological limits where their survival and recovery are ensured'.

The stock state will be evaluated making use of the same steps than on primary species: according to parameters which show that stock is within of the safe biological limits, and in the absence of them, it is necessary thinking about uses of the Risk Based-Framework (RBF) method from a productivity-susceptibility analysis, PSA (Annex III). The most important species of the fishery will be evaluated (those which have been evaluated in different studies or that due to their biology possess a certain vulnerability to the fishery). The less occurrence species must be register and it is neccesary to justify that these are not vulnerable when it is possible.

The **strategy of manage** evaluation will be develop taking in account that these species present a little management by definition (these are assessed through of landings time series, biological data on weight and length, number of fishery days and length boat controls, inspections, vessel monitoring system, …). When the captured specie is a shark, not finning it will be viewed favourably.

All obtained **information** will be viewed of the same way that on primary species.

Figure 3. Resume about principle 2 (secondary species) of Marine Stewardship Council protocol (Jaen, 2018).

BOX 2 c: Endangered, threatened and protected (ETP) species

'Fishery will be keep to ETP species within the mortality limits that have been regulated by the international agreement or national legislation'.

The **stock state** will be described as sustainable when the fishery effects (direct or indirect) over these species are not harmful, in such a way that the mortality limits do not exceed the regulated values by national legislation or binding international agreements. This state could be evaluated or determinated through of capture reports, observers on board, studies from non-governmental organizations, mitigations measurements of impacts (modifications on the fishing gears, special actions, …), papers about other indirect impacts (e.g. noise or pollution). In the absence of necessary parameters to this evaluation, it is necessary decides to use the risk analysis (the productivity-susceptibility analysis, PSA; Annex III). The most abundant species on captures are evaluated and the relevants which mean less than 5 %, too.

The existence of a **strategy of manage** (SM) that minimizes mortality and overcomes national and international requirements, will be an indicator about the sustainability of stock. In the absence of a SM, an alternative strategy which ensures the recovery and protection of ETP species will be take in account. Once SM has been identified, will be deemed positive on an evidence-based research process about its effectiveness, degree of implementation and its periodical reviews.

Information used must be appropriate, update and enough for evaluating impacts over the stock and the SM in itself.

Figure 4. Resume about principle 2 (endangered, threatened and protected species) of Marine Stewardship Council protocol (Jaen, 2018).

Box 2 d: Habitats

'Fishery must not cause a grave damage over structure or functionality of the habitat'.

The **state of the hábitat** will be sustainability when initial condition is maintained. To that end, it is possible to consider evidencies of 'no impact' from fishery (it can be evaluated by using information about types and geomorphology of substrate, biological communities, maps or images of the ocean floor, modifications on fishery gears, ecosystem modelling, time series of data, ...). Where information is not enough, it is necessary thinking about uses of a consequence spatial analysis (CSA) of the Risk Based-Framework (Annex III).

The existence of a **strategy of manage** (SM), its proper operation and implementation will be a sustainability indicator, according to each part of pressure develops by all associated fisheries. Evaluation of this section may be based on the existence of time and area closures, spatial protection measures, research and monitoring programs adjusted to the requirements of management, control fishery effort by regulation, the existence of incentives related to develop of SM , information about periodical reviews, ...

To end, **information** used must be appropriate: of quality, suitable, update and enough.

Figure 5. Resume about principle 2 (habitats) of Marine Stewardship Council protocol (Jaen, 2018)

Box 2 e: Ecosystems

'Fishery must not cause a grave or irreversible damage over the key elements of ecosystem, and its structure or function neither'.

The **sustainability ecosystem state** will be evaluated from its structure and function. That is to say, it has to be based on trophic relationships, biodiversity, caused damages on its functions (services), keystone predator species state, changes on genetic diversity related to selective fishing, invasive species, pollution, …. One ecosystem will be assessed as sustainability under some conditions. These requirements are to have in-depth knowledge of: the fishery, the fauna, ecosystem functionality on special areas (spawning, feeding and hatchering areas), prey and predators, climate change effects, knowledge on on trophic relationships, …. In the absence of information to develop the analysis on ecosystem state, it is necessary thinking about uses of the scale intensity consequence analysis (SICA) of the risk based-Framework (RBF) (Annex III).

The **strategy of manage** (SM) must be efficient, implemented and reviewed periodically, so that the fishery impacts over ecosystem can be controlled.

Information about different ecosystem aspects must possess an adequate understanding. These aspects are the elements and function of the ecosystem, the impacts of a fishery over it, and explain how these affect to the other parts of the Principle 1 and Principle 2.

Figure 6. Resume about principle 2 (ecosystems) of Marine Stewardship Council protocol (Jaen, 2018).

Box 3: Principle of management

Governance and policies (general scope)

'A fishery must have a management system which is within an proper legal framework to ensure that the fishery management general conditions must be appropriated to achieve the good resources and ecosystem state'.

Within the **context of an international legal or common law framework** must establish procedures to an effective management and proper mechanisms on 'disputes' settlement among all the parties concerned, all in a transparent manner.

On the level of **consultations, roles and responsibilities**, it is neccesary that exists communication and cooperation among all the parties concerned, always in a transparent manner, to achieve a most effective mangement (e.g. doing the minutes of the meeting).

Finally, it must have a set of the **long-term targets** to lead in the making-decisions process. These aims must be issued in conformity with a precautionary approach that is part of the management policy, implicitly.

A specific system of management for the fishery.

'The management system of each fishery must fulfil the aims which have been chosenas a result of a making-decisions process, and its compliance and application must be reviewed regularly'.

An optimal management system must set up **specific objetives** of the fishery that conduct to consistent results with the Principle 1 and Principle 2.

As concerns to the **making-decisions process** (within the different jurisdictions), it must set up the proccess in a transparent manner, taking into account the precautionary approach and avoid the conflict between parts, actively.

For their **compliance and application**: it must ensure that making use of management and conservation measures on the fishery. These measures are applied on the basis of a monitoring, surveillance and control system that review all parts of the management system regularly. It must contain a process of penalties, and therefore able to find that the fishermen compliance the law.

Figure 7. Resume about principle 3 (general and specific scopes) of Marine Stewardship Council protocol (Belmonete, 2017).

4.4 La Réunion

4.4.1 Introduction

International policies are increasingly supportive of the return and upholding of small-scale fisheries, including small-scale fisheries (Reykjavik Summit, 2002). While these fisheries are difficult to define as a whole, they appear as potentially sustainable modes of exploitation of fisheries resources. The number of jobs involved, energy consumption, income distribution, the quality and value of fishery products, as well as cultural diversity and the social and economic importance of artisanal fisheries in Reunion are all arguments which advocate for the upholding and development of this important component of the fishery.

The assessment of the pressure of different uses, and in particular fishing, its possible impacts on the ecosystem and its socio-economic benefits, allow for the production of sound opinions on the evolution of the fishing system and the management measures to be adopted to preserve the fishery functionality of the reef and deep ecosystem and the sustainability of human activities.

Thus, the objectives of fisheries management are defined by various international agreements such as the United Nations Convention on the Law of the Sea (1982), the United Nations Agreement on Straddling Stocks (1995) or the Code of Conduct for responsible fisheries of FAO (1995), but especially with the biodiversity law 2016 (Section 5 / Chapter IV / Article 98) and the Common Fisheries Policy (CFP), at European level.
In Reunion, the Regional Committee for Marine Fisheries and Marine Aquaculture (CRPMEM), supported by Ifremer, initiated in 2000 a prospective study on the fishing potential of deep demersal resources between 200 and 700 meters deep (Roos et al., 2001).

4.4.2 Objectives

The objective was to highlight complementary resources for the professional coastal demersal fishery and to test a new fishing method with electric reel.

4.4.3 Methodology

4.4.3.1 Fishing equipment and organization of fishing trips

A small artisanal fishing boat measuring 9 meters long and developing 200 hp was equipped (electrical equipment, fishing equipment) for the realization of this study.

To respond to the technical difficulties of catching deep sea species in Reunion Island, the choice of equipment involved the acquisition of two DNG brand C-600i electric reels, equipped with electronic keyboards and crystal screens to visualize the selection and configuration of fishing programs. The originality of this material allows the fisherman to explore the entire water column dynamically ("jigging") or static.

The fishing technique developed and tested consists of immersing a bottom longline with 4 to 8 hooks. The 40 cm long branchlines are spaced about 1 meter apart. Variants were tested by varying the number of hooks, the length and distance between branchlines, the hook size (7/0 to 13/0) or their shape ("toothfish" hook, circle and wide-gap hooks). Various baits were tested during the first fishing operations, mainly squid, skipjack and big-eye scads. The characteristics of the electric reels allowed to test different fishing methods based on vertical "jigs" movements, which were adapted and gradually adjusted according to the catching results.

Fishing operations did not follow any particular sampling design. The choice was made to place the exploratory fisheries under the best conditions (meteorological, bathymetric, and hydrological).

4.4.3.2 Fishing areas prospected

On the whole of the west coast of the island, the selection of the daily fishing zones to be prospected was decided by agreement between the CRPMEM and the fisherman's boss, for each day of departure. The spinning positions of the longline were determined according to the meteorological conditions observed the day before the departure (direction and strength of the current and the wind), output and plots of isobaths of SHOM map. The positioning of the longline spinning also took into account the configuration of the bottoms observed on the sounders (ascent, descent, plateau ...) and the depth.

4.4.3.3 Data collected

For each longline spinning operation, positioning data, fishing characteristics and catches by species, number and weight, were noted. For each fish caught, information on species, size (fork length), live weight and sex were collected. Biometric relationships (sizes and weights), size structuring, as well as observations on fish maturity, were collected in addition to the original objectives.

4.4.4 Main results

The main results highlighted the exploitation potential of the longtail red snapper (*Etelis coruscans*) and a less known commercial interest species, the brilliant pomfret (*Eumegistus illustris*). Beyond the clear fishing interest and suggestions for habitat mapping around the island, a precautionary approach was recommended. The latter was intended not to encourage the establishment of efficient fishing units targeting mainly those resources sensitive to exploitation, but rather to consider it as a complementary resource for the only professional units of the small artisanal fishery fleet.

4.4.4.1 Lessons learned from failures and successes

Considering the success of the experiments with longline between 200 and 700 m depth carried out in Reunion in 2000, a precautionary approach was recommended in order not to encourage the establishment of efficient fishing units targeting mainly those resources sensitive to exploitation in that range of depth. And to underlined that this type of fishing was to be seen as a complementary resource for the only professional units of the small-scale fishery fleet.

Since the early 2000s, following the outcomes of Roos *et al*., (2001), the use of the electric reel or the line-hauler grown exponentially in Reunion. This allowed a diversification of fishery resources, alleviating the fishing pressure on target species in the reef areas and moving it more offshore. On the other hand, this development has not been accompanied by management and monitoring measures, as recommended by Roos *et al*., (2001) in the initial report.

At the same time that this new fishing activity began to develop, conflicts between the different trades and practices began to arise on these stocks of deep demersal fish sensitive to exploitation and vulnerable considering their restricted habitats that are easily accessible in Reunion.

Considering the lack of scientific information on these habitats and on these resources, the use of nets (e.g. gill and trawl) has to be avoid. Only the use of longlines equipped with large hooks is recommended to ensure gear selectivity (species, size) in the context of sustainable

exploitation of stocks. Financial aid in this area could then be directed more towards the purchase of equipment (sonar, GPS) or fishing equipment (electric reel) which would ensure the versatility of small units, instead of acquiring new boats for targeted of these deep resources. In order to preserve stocks and guarantee their profitability, it is desirable that techniques for fishing with electric reels or lines are, for example, prohibited beyond the 150-meter probe for non-professional fishermen, the others traditional hand-line or wheel-type fishing techniques are maintained. Similarly, it would have been prudent to ban this trade periodically for the entire fishery (a period of biological rest), in order to support the restoration of stocks.

3.4.4.2 Main identified opportunity

This project has highlighted new exploitable resources for the profession, with an efficient fishing method for a lower cost.
This experience has allowed collaboration between professional and scientific organizations. It did not give rise to external collaborations.
A similar experiment was conducted in Mayotte in 2005 (Herfaut 2005), but with bottom vertical longline gear. With an average yield of 30 kg per day, this experiment showed that the sole exploitation of deep-sea species in Mayotte was hardly profitable, with the methodology used. On the other hand, this fishing practice could be a complementary activity for small artisanal fishing boats in Mayotte Island.

3.4.4.3 Main underlined obstacles

Weather and ocean conditions are the main limiting factors to the practice of this deep-water fishing practice in Reunion Island. The distribution of deep demersal species is strongly related to the bathymetry and an assessment of the available area for their habitat around the island shows that the abundance of these resources is necessarily limited to a level incompatible with intensive exploitation. Without more precise scientific information, the precautionary approach encourages to recommend to not favouring the exploitation of new efficient fishing units on this resource, but rather to consider it as a potential complementary activity for the artisanal fleet professional units, which target other species, such as large pelagic fish on FAD. The use of nets (gill, trawl ...) has to be avoided. Only the use of longlines equipped with large hooks is recommended to ensure gear selectivity (species, size) in the context of sustainable exploitation of stocks. Financial aid in this area could then be directed more towards the purchase of equipment (sonar, GPS) or fishing equipment (electric reel) which would ensure the versatility of small units, instead of acquiring new boats for targeted of these deep resources.

The conservation of deep resources in Reunion Island must be accompanied by preventive management measures to limit access to the resource. The interest for this fishing activity in Reunion, with attractive selling price, leads to the establishment of an informal market for fish from deep-sea fisheries. In order to maintain stocks and guarantee the profitability, it is desirable that techniques for fishing with electric reels or lines are, for example, prohibited beyond the 150-meter probe for non-professional fishermen, the others traditional hand-line or wheel-type fishing techniques are maintained. Similarly, it would have been wise to ban this trade periodically for the entire fishery (a period of biological rest), in order to support the regeneration of stocks.

3.4.4.4 Needs in research and development

The rapid and poorly managed development of the demersal fish exploitation at Reunion has raised concerns about sustainability and resource sharing. The use conflicts and fears caused by the absence of regulatory measures and regular controls on practices and catches motivated a first study project of these resources, carried out by Ifremer in 2011 and financed by the European Fisheries Funds (FEP), the French State and Ifremer (ANCRE-DMX project, Fleury et al.

2011 & 2012). This project was not a stock assessment study (no evaluation of the biomass), but a monitoring of fishery indicators on two sets of successive fishing periods. On the basis of the protocols deployed, the first signs of unsustainable exploitation of resources, in western and northern Reunion, had been highlighted, with a 90% decrease in the yields of the main commercial species evaluated in 2000s. In addition, gaps in the biology and ecology of the species and poor consistency in demersal fishery statistics have been noted. It was necessary to monitor and specify the evolution of the defined indicators. Information from previous studies was still insufficient to qualify the state of health of stocks and the most appropriate management measures to implement.

In this context, the Direction de la mer sud océan Indien (DMSOI) the gouvermental body in charge of fisheries management, also supported by the professional fishermen organisation (CRPMEM), called for the continuation of monitoring of fisheries indicators, in order to clarify the opinions and diagnoses, as well as recommendations for management. Sustainable deep demersal resources in Reunion, the ANCRE-DMX2 project (FEP and State funding), carried out by Ifremer over the 2014-2015 period (Roos et al. 2015), and was a complementary study to the DMX1 project (2011-2012). It made it possible to complete the information described as missing or incomplete in previous studies, particularly those on the exploitation situation of deep demersal fish stocks (200-600 m) as well as the biological and ecological data of the main species exploited. Finally, the sampling plan was extended for the first time to shallower habitats (80 meters deep), to gradually integrate the more coastal transition zones, for which, none fishery indicators were available.

For the main species selected, the monitoring of catches at sea and the biological samples collected allowed to estimate yields, demographic structures, biometric relationships, growth parameters, spawning cycle, sizes at first maturity, the relative composition of diet, as well as the variability of the body condition according to the seasons and the geographical areas of the island. For some species, the biological and ecological parameters obtained had never been studied. From the population and bioecological indicators selected in the project, it was possible to assess the health status of the six main deep-sea stocks exploited and to compare them with the situation and evolution of the professional fishery targeting these species. Based on a precautionary approach, diagnoses were variable depending on the state of health of each stock and their sensitivity to exploitation. One of the main stocks identified as potentially interesting (Etelis coruscans) showing signs of over-exploitation. Increasing of the fishing pressure on deep demersal resources tends to encourage the growth overexploitation of the main targeted stocks, not in agreement with sustainable and profitable exploitation.

The need for knowledge about the bioecological characteristics of deep-sea species is still relevant. An assessment of the state of the main deep-sea stocks is suitable every 3 to 5 years, as well as the establishment of a management plan for these demersal resources at Reunion Island.

4.4.5 References

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4.5 Guadeloupe and Martinique

Guadeloupe and Martinique are two islands forming part of the arch of the Lesser Antilles. They are located 180 km apart and have similar fisheries. Development and technical assistance policies have been coordinated between these two islands. After the war, it is mainly the motorization of boats (gum, yole and saintoises) which was encouraged with the establishment of credits to facilitate the acquisition.
Support is provided to fisheries by SATEC, which began operations in 1958, in the area of credit and technical assistance. The latter at its headquarters in Guadeloupe. The action of SATEC will be stopped in 1970.

In the early 1960s, the SATEC (Society of Technical Assistance and Cooperation) acquires and experiments with Mediterranean "pointus", both in Guadeloupe and Martinique. These vessels are considered unsuitable because of the lack of speed for offshore trolling, which is a highly profitable technique for exploiting large offshore pelagic fish.
The experimentation of "improved" craft (yeas and saintoises), working with diesel begins at the beginning of the years 1970. These boats do not develop in any of the two islands.

Fisheries recovery plans will then encourage the development of diesel-bridged units from the second half of the 1970s. The difficulties encountered by these units led to the completion of work aimed at evaluating the resources available from these islands. This work began during the 1980s and intensified in the 1990s.

Buoyancy compensation for motorized vessels is required by “klégecell” plate fixation. The renewal of gums and beach seines is not encouraged.

In 1962 in Martinique, the Barbadian fillet with flying fish and the large Venezuelan trap for the fishing of demersal fish are experimented. These tests are unsuccessful because of the instability of the boats mainly used at that time, the gum tree.

In Guadeloupe, in 1963 a fishing operation was realized on the banks of the northern islands in Saint-Barthélemy with 9 Saintois canoes and a trawler that must ensure transport to Guadeloupe. The importance of poisonous fish due to ciguatera impacts the operation.

Technical assistance spreads nets and trammel nets in Guadeloupe (1963) and Martinique (1964-1965). These nets spread quickly. In 1965, the spinning net and night fire fishing were experimented at the initiative of the priest of Carbet (Martinique).

It is from the second half of the 1980s that the IRPM in Guadeloupe, following the SDAT, and Ifremer from Martinique will conduct prospecting works of resources little or not exploited. This work will focus on funds essentially beyond 100 deep around Martinique and Guadeloupe.

The resources prospected are demersal fish, sharks and deep crustaceans. The results of these surveys led to diagnoses of:

- Insufficient yields for crustaceans and deep-sea sharks,
- The interest of deep-water snapper (Etelis oculatus) fishing, especially in Guadeloupe where the favorable areas for this species are more extensive than in Martinique. But this resource is considered fragile and easily exploited, as illustrated by the development of this fishery in some neighboring islands.
- The potential profitability of a 12 m vessel operating moored FADs.

The study of the ciguatera resources of the northern banks around the islands of Saint-Barthélemy and Saint-Martin made it possible to quantify the consumable catches of fish and better describe the distribution of ciguatera species.

Interest in fishing for offshore pelagic fish began in the 1950s with exploratory tuna surveys. Tests are made with different techniques: longlines, spinning nets, live bait. These last two prove to be unsuited to the region. These campaigns continued unsuccessfully until the early 1970s. In Martinique, ownership shares of Venezuelan longliners were acquired by shipowners in the late 1950s. This activity will last until the 1990s. But to make profitable their activity, these ships are mainly crewed by Venezuelan sailors.

The intensification of the offshore pelagic fishing from traditional boats (yoles and saintoits) will be done with trolling on free schools or under driftwood, thanks to the development of motorization, on the one hand, and in the manufacture by the local shipyards of synthetic fiber hull from the beginning of the years 1970, on the other hand.

The first experiments of anchored FADs will begin during the 1980s. The operational fishing around these devices will develop from the beginning of the 1990s and cap with 300 boats in each island during the first half of the years. 2000. This fishery has been the subject of scientific and technical support for several years, in order to promote its sustainable development.

These experiments have shown that fishing gear adapted to fishermen's boats has developed rapidly (ie gillnets and trammel nets). The introduction of outboard boats without an analysis of the needs of the professionals (ie, “pointus” are not suitable for offshore fishing) was doomed to failure. Similarly, the willingness to develop larger units without prior knowledge of accessible resources has not allowed fisheries to develop.

Work in support of the sustainable development of fishing for MFADs has highlighted the need for scientific and technical assistance at different levels of the value chain, from shipbuilding to product marketing.

V. Conclusion and perspectives

The content of this deliverable is based on a work in progress and the results are preliminary and subject to revisions. A synthesis workshop (#2) is organized in Azores at the end of March 2018 to improve and consolidate the following deliverable. These preliminary results of this task have been shared between the contributors and disseminated within the project to get feedback and improvements from the partners.

In order to collect data on existing technical information on experimental fishing in each OR over a period covering the last 30 years, a systematic literature review consisting in three steps has been carried in each OR according to the following common approach: (1) Article/document/report selection, (2) Abstract screening, (3) Review of relevant articles/documents/reports. A data base with the collection of reports and database compiling the existing information is in also progress. This includes a metadata file which aims at providing a synthesis of the experiments carried out and a way to find more detailed information on each experiment. This file will be included in the ORFISH web site including the pdf files of the articles/documents/reports. For each OR, a global synthesis of all the information collected has been made, answering these 4 following questions: 1) Lessons learnt from successes and failures, 2) Main identified opportunity 3) Main underlined obstacles, 4) Needs in research and development. During the synthesis workshop, we will share these informations and identify the potential needs for experimental fishing.

VI. Annexes

6.1 Açores

Introduction and methodology

A systematic literature review consisting in three steps has been conducted: (1) article/document/report selection, (2) abstract screening and (3) review of pertinent articles/documents/reports, which were identified in the second step.

The main findings regarding experimental fishing activities carried out in the archipelago of the Azores in the last thirty years are presented below. For each articles/documents/reports reviewed, four questions were answered:

1) Lessons learnt from successes and failures;

2) Main identified opportunity

3) Main underlined obstacles; and

4) Needs in research and development

Main results

- Pinho, M. R. & Pereira, J., 1995. Dispositivos para a concentraçao de peixes nos Açores. Archivos do DOP, Serie: Estudos n° 9/95, 17p.;
- Pinho, M. R., & Pereira, J. (1995). Anchored fish aggregating devices in Azorean waters. COLLECTIVE VOLUME OF SCIENTIFIC PAPERS-INTERNATIONAL COMMISSION FOR THE CONSERVATION OF ATLANTIC TUNAS, 45, 229-235:

1) The results confirm the expected performance of the buoys related to the conditions of the Azorean waters. However, the sites selected for the buoys seems to be too far way for monitoring and maintenance purposes, creating difficulties in the case of losses.
Observations made during the visits of monitoring, although not conclusive, confirm that the tuna are not attracted frequently to the FAD's. These results could be related with several aspects as the period of the day that visit was made or even with the sites where the buoys were placed.

2) Although results are not conclusive related to the aggregating effects of tuna schools, the devices aggregating successfully a number of other marketable species: Wreckfish (*P. americanus*), Imperial blackfish (*S. ovalis*), Dolphin fish (*C. hippurus*), and Grey trigger (*B. carolinensis*). These species are observed and caught from May to September and effort should be made to get information of the catch in the future. Tuna species, mainly skipjack (*K. pelamis*), and bigeye (*T. obesus*), were captured only in three occasions at different buoys, but the skippers reveal that sometimes catches were made in vicinity of the buoys located at the traditional fishing areas, but they do not report these catches as associated to the device.

3) The evaluation of the aggregation effects based on the information received by the fleet cannot be done with precision because the fishermen just reported the visits with successful

catch of tuna, which occur only during three occasions. The catches of the other species are not recorded in the log books, but personal information from the skippers seems to show that the catch of Dolphin fish (*C. hippurus*), Wreckfish (*P. americanus*) and Imperial blackfish (*S. ovalis*) are significant, since catch of this species were made in almost all visits. Catch of baitfish (200Kg), oceanic horse mackerel (*T. picturatus*), made in the buoys was reported only by one baitboat, although schools of this species were observed in several occasions at FAD's.
The analysis of the logbooks and interviews to the skippers supported the conclusion that the visits were made occasional and without any strategy. The fleet does not modify the traditional pattern of operation even after the successful catches of tuna reported on three occasions. No skipper adopted a planning schedule of visits to the buoys, trying to visit them routinely at different periods of the day as the suggestions made by scientists. Beside the scepticism of the skippers related to the effects of the anchor devices in attracting and holding tunas, there is not a comprehensive explanation for this behaviour, especially during the year of 1994 characterized by a reduction of about 50% of the catches of bigeye tuna. If this reduction was due to the real variation of the abundance of this species, as a consequence of some environmental anomaly, it is possible that this fact influenced the results of the experiments.
The albacore (*T. alalunga*) were captured too in the vicinity of the FAD's but the fishermen believed that this species doesn't aggregate to the FAD's and it is difficult to have conclusions because they were caught in areas of traditional operation of the fleet.
The impact of the FAD's in the tuna fishery seems to be poor but this conclusion must be interpreted with some caution because one year and half for this kind of experience are not sufficient, and fishermen do not follow an adequate strategy of fishing with the FAD's. They are reluctant in reporting the visits and catches, and the available information with quality has only covered 40% of the total fleet.
In a general way the fishermen are sceptical about the aggregating effects of the anchored devices and request often experiments with drifting devices. Although constructed these devices were not placed because legal and administrative problems related to the security of the commercial navigation and due the difficulties in monitoring this kind of devices.

4) In the conclusion it was suggested to place buoys only in the central group, in sites near the coast and with a monitoring scheme on a monthly basis. In a way to permit to study with precision the species aggregated, the evolution of the aggregation, times of residence, etc.

- Melo, O. E. B. M. 1998. "Relatorio da experiencia de pesca ao peixe-espada-preto (Aphanopus carbo Lowe, 1839) levada a cabo pela embarcaçao " Baia dos Juncos" no Arquipelago dos Açores. Arquivos do DOP, Série Relatórios Internos, nº 2/99: 21pp

1) Analysing the fishing yields obtained for black scabbardfish, it is found that these, on the shores of the Islands of Santa Maria and São Miguel (despite the problems that have arisen on this last island, with local fishermen), were more than those obtained in 'Mar de Prata' and 'Banco 70', where practically only deep-water sharks were captured.
In a first approach, it can be concluded that black scabbardfish is more abundant on the shores of the islands of Santa Maria and São Miguel, at this time of year, than in the fishing grounds mentioned above.
On the other hand, based on a report by Reis (1996), it is concluded that the fishing yields obtained during this experimental phase of the fishing of the black scabbardfish, it can be considered good (mainly those obtained in the south coast of the Island of Santa Maria), when it is compared with those obtained in the archipelago of Madeira.

2) When analysing the catches made during this experience, it was verified that, with the exception of the fishing hauls made at "Bank 70" where only deep-water sharks were practically captured, the by-catch in relation to black scabbardfish was very low.
This fact seems to indicate that the fishing gear used in conjunction with the type of fishing operation carried out has a high selectivity for the target species of this fishery. In relation to some of the species caught in a smaller number, it should be noted that their catches are perfectly understandable since they are deep-sea species.

3) After four fishing trips on the south coast of the Island of Santa Maria, the fishing master decided to prospect the coast of the Island of São Miguel. Here, he had some problems with local fishermen who cut his devices in the two fishing sets he was doing. As a result, the fishing master ended up going to the fishing ground, starting in the area called "Mar da Prata". Here he realized only one fishing haul in which he obtained a low income. Then he went to "Banco 70", where he also performed a unique fishing haul, capturing practically only deep-sea sharks, thus ending up returning to the Santa Maria Island, where he made other 7 fishing sets, before returning to Madeira Island.
The fishing vessel was not originally constructed for longline fishing, it presented some difficulties of manoeuvre and control of the fishing operation by the fishing master. Moreover, the equipment that was used was a little be old and it undergone some modifications.
Due to the fact that both in Madeira and Sesimbra the catch of black scabbardfish increased and at the same time the demand of this species was still limited, the prices were negatively affected.

4) It would be necessary to carry out more fishing hauls and some additional studies in order to be able to draw definitive conclusions.

- Machete, M., Morato, T., & Menezes, G. (2010). Experimental fisheries for black scabbardfish (Aphanopus carbo) in the Azores, Northeast Atlantic. ICES Journal of Marine Science, 68(2), 302-308:

1) This experiment created a unique opportunity to gather life-history data, which are often missing for deep-sea species, and at the same time allowed monitoring of fisheries activity from its inception. In this study, were used observer data to analyse and describe the start of the black scabbardfish fisheries in the Azores in terms of type of gear, catch per unit effort (CPUE), and size composition.
The total number of black scabbardfish caught during the fishing experiments was 110244 fish with a total estimated weight of 222t. most of the longline sets were on the island of Santa Maria (36% of all sets) and south of Pico (31%) on the island slopes. In 2005, some new areas were investigated between Pico and São Jorge islands (12%) and São Jorge and Graciosa islands (7%). Fishing areas changed between year; only the Santa Maria fishing grounds were sampled every year.
Standardize catch in numbers per 1000 hooks varied from 103 to 210 with an overall average of 132.
Standardize catch showed a positive logarithm relationship with the number of hooks which also varied between boats.
Fish size ranged from 56 cm to 147 cm (Fork Length), with a mean size of 108 cm.
It is worth noting that the size frequency distribution of fish caught south of Pico was skewed towards smaller sizes than other areas (e.g. Santa Maria).
In general, the fishing gear used experimentally in the Azores was similar to the gear described for other regions (Martins and Ferreira, 1995; Bordalo-Machado and Figueiredo, 2009). The average number of hooks per set applied in the Azores (~3625) was similar to that used in

Madeira or the mainland Portugal fisheries in the early 1990s, but lower than used in recent years; 7000-8000 were reported in recently in Madeira and 4000-10000 in the mainland (Reis *et al*., 2001; Bordalo-Machado and Figueiredo, 2009; Bordalo-Machado *et al*., 2009).
In this study was found low bycatch values similar to those observed for other longline fisheries, such as in Madeira or mainland Portugal (Martins and Ferreira, 1995; Bordalo-Machado and Figueiredo, 2009). In the Azores, as in other regions, the main bycatch was deep-sea sharks.

2) The resource of black scabbardfish may still be regarded as a nearly virgin stock in the region. Standardized CPUE in the Azores was similar to that recorded in Madeira (Reis *et al*., 2001) and the Portuguese mainland in the past (ICES, 2006), but higher than that observed in mainland Portugal in recent years (Bordalo-Machado and Figueiredo, 2009). This comparison suggest that Azores has relatively lightly exploited resources of this species with a likely potential for commercial exploitation.
This study suggests that the black scabbardfish in the Azores is an almost unexploited resource. Provided appropriated caution is taken to prevent exploitation developing beyond sustainable levels, there is a potential for a new longline fishery.

3) The standardize catch per 1000 hooks varied seasonally, but the patterns were not very clear. In terms of area, the standardize catch was higher in the area south of Pico and in the channel between São Jorge and Graciosa islands, but that area had very few records.

4) The black scabbardfish fishery in the Azores has received sporadic experimental activity despite previous indications that a potential for a fishery exists (Vinnichennko, 1998; Hareide and Garnes, 2001).
The absence of a local market and the complexity of the gear and labour requirements for its operation have thus far limited the development of the fishery. The commercial value of the species is, however, well- established in other regions (Gordon *et al*., 2003; Large *et al*., 2003; ICES, 2006; Bordalo-Machado and Figueiredo, 2009).
CPUE monitoring should be maintain in future to allow abundance-trend analysis. If this fishery becomes commercial, such information is essential to ensure optimal management of the resources.

- Pinho, M. R. & J. Pereira, 1995. Pesca experimental com palangre de profundidade dirigido a grande pelagicos. Arquivos do DOP, Serie: Cruzeiros, n° 1/95, 18 p.:

1) Although these results appear to be discouraging, consideration should be given to a number of aspects relating to the question of the vertical distribution of these species and of the fisheries technology.
For the first case, the information available seems to suggest that bigeye tuna and albacore are distributed preferentially in zones between 150 and 400 meters depth, corresponding to temperatures between 8 ° C and 17 ° C, while other species are distributed more in the surface, corresponding to temperatures between 20 ° C and 32 ° C.
The results show, however, that longline surface fishing conducted during the day mainly catches sharks, which is not desirable since these species, considered as bycatch, seem to be the target of intensive fishing.

2) Experiences of the vertical distribution seem to show higher occurrences between 150m. and 400m. depth for bigeye tuna and adult albacore, corresponding to a temperature range between 8 and 17 ° C.

3) There are difficulties due to the lack of experience of the crew, especially in the coordination of the line-setter with the speed of the ship and monofilament reel (*moulinet*), resulting in the frequent break of this and consequent stop of the ship. The electronic system of the line-setter did not turn out to be adequate, stopping the sound warning to stop, due to humidity. A problem that could not be solved. Alternatively, it was decided to perform the task manually, moving a second crew member to the line-setter controlling the amount of cable placed in the sea, making the warning by means of a whistle. The operation of collecting the equipment was less problematic and was improving as the cruise was evolving and the commander and crew were gaining experience.
The estimation of the distance between the floats by basket was difficult because of the difficulties of coordinating the launching of the fishing equipment by the line-setter or by the impossibility of estimating this distance using navigation equipment. in fact, the radar did not capture the return signal from the reflector, especially on bad sea conditions. Several attempts were made, using other alternatives but they were not practical. It was decided to estimate this distance in an indirect manner, by calculating the distance that the ship was traveling from one end of the longline to the other, by the speed and time spent running through it. Dividing this distance by the number of baskets placed, we obtained the average distance between the buoys by baskets.
1994 was a bad harvest year, it was characterized by a reduction of about 50% in the catch of bigeye tuna. These facts may have influenced the results.

4) Once the fishing technology is controlled, fishing sets should be tried at greater depths, around 150 and 400m. depth, which in the Azores correspond to temperatures between 10 ° C and 15 ° C, values that are within the limits of preferences of the target species of this study.

- Manuel Machado Menezes G., and Barros Moura Melo O. E., 2002. Projecto de Acompanhamento da Experiencia de Pesca Dirigida ao Peixe-Relogio (Hoplostethus atlanticus) - FISHOR. Relatório final. Arquivos do DOP, Serie Estudos n° 4/2002, 37 p.:

1) 92% of the total catch is attributed to the *Hoplostethus atlanticus*, with 343 tons, while the bycatch of black scabbardfish represented the 4% of the total (15.5t.).
Hoplostethus atlanticus catching occurred between 1000m and 1200m depth, with a temperature at the bottom between 5°C and 7°C.
The CPUE (in weight) of *Hoplostethus atlanticus* has been calculated in a range between 0 and 4450 kg/minute of actual fishing.
The cooperation between the researchers and the ship owner experienced in this fishing experience, following a precautionary approach, was successfully achieved. The implementation of an initial precautionary TAC and a system of catch limits per fishing unit made it possible to prevent potential localized deforestation and to force fishing operations to be distributed as much as possible. This last point can be improved in order to obtain a better coverage of all the potential distribution areas of this species in the Region. This management plan proved to be essential during the experience due to the lack of previous information on the abundance and distribution of the resource in the Azores.

2) If we compare the size of *Hoplostethus atlanticus* caught during this experience with other areas, it is evident that it is much greater than those found in the fishing direct to this species in the South Pacific and South Atlantic.
The prospecting approach together with the fishing methodologies and techniques used in this experience were in some way innovative for the Region and they will contribute significantly to

the advancement of the fishery in the Azores, and in particular to the potential resources of some species in the Region.

3) Because of several factors, *Hoplostethus atlanticus* is very susceptible to overexploitation, and even those with excellent management and control of fishery, total industry cooperation, and high levels of research and management of populations, should severely limit catch levels until the necessary knowledge about the behaviour and dynamics of the stock is obtained so as to obtain confidence reference points about the resource.

4) It was not possible from the data obtained to evaluate the distribution and the actual abundance of the resource in the EEZ of the Azores. Therefore, the development of this fishery will always have to be preceded by further investigation and coverage of a larger area of prospection. It will also be important to maintain a precautionary approach until the ecological and biological aspects of species are better known, while maintaining the conditions set out in the Code of Conduct, if the experience will be developed in the future.

- Jorge Morais P., 1990. Selectividade do anzol relativamente ao Pagellus bogaraveo (goraz) e ao Helicolenus dactylopterus dactylopterus (boca negra), pescado nos Açores. Relatorio de estagio de licenciatura em biologia marinha e pescas, TA-183, 74 p.:

1) A bottom longline selectivity experiment was conducted, in June and July 1989, in waters of Azores Islands. These experiments aimed at estimating hook selectivity, relative to blackspot seabream *Pagellus bogaraveo*, presently the most important species in Azores bottom longline selectivity fishery, and rockfish *Helicolenus dactylopterus,* an associated species. Of the several methods available in the bibliography for estimating selectivity curves, only the modified Ishida method was successfully used.
In both species, the structure seems to vary with the bathymetry. Thus, data processing will only make sense if the devices with the three hook sizes have fallen at identical depths and consequently in populations with the same structure.

2) The conclusion of this study, if tested on other species, could represent a very important result to be implemented concerning the selectivity in other fishing techniques.

3) This study was focused only on two species (*Pagellus bogaraveo* and *Helicolenus dactylopterus*) which is not representative enough to assess general conclusion. Moreover, this work is an internship report.
It was studied only three sizes of hook and they were not use at the same time and depth in order to assess them in the same conditions. And, therefore, it was not possible to relate them to one another. And to relate properly the different sizes of hook to the species caught.

4) Considering the importance of small-scale fishing activities in the Azores, these experiments should be tested on a larger variety of species and on a wider spectrum of environmental conditions (e.g. depth, temperature).

6.2 Madeira

Below, a sample of the Reference Database filled by the government of the autonomous region of Madeira (the second table is the continuation of the lines of the first table):

Main body that financed the project (most important %)	Co-funded project	Coord./leader of the project (institution)	Total cost (k€)	Fishers or fishers organisation involved	Beginning Year of the trial	Ending Year of the trial	Main aims of the project	What was mainly tested	Depth of operation	Gears type used (FAO codification) or MFAD	Vessel size for the trials (m)
JNICT Portugal (now FCT) under contract PMCT/C/MAR/985/90	yes	Museu Municipal do Funchal		No	1990	1995	Ecological and Biological Study of the Communities of Fish and Crustaceans Benthic Decapods of the Madeira Continental Slope	test different fishing gear and techniques	Longline 100-1000 m deep & bottom traps at 600-1000 m deep	Bottom traps; Longline	
DG XIV/C/1 - Study contract 95/095	yes	Departamento de Oceanografia e Pescas		No	1995	1997	Implement abundance survey designs for demersal fishery communities of the Macaronesian archipelagos of Azores and Madeira	the fishery of demersal fishes	23-1042 m deep	Longline	25.4
PESCPROF-1; INTERREG III B (2000-2006)	yes	Direção Regional de Pescas	1644	No	2003	2005	Prospective fisheries for several species of marine fauna (fishes and crustacean) from 50 to 1200 m and study of techniques for processing, conservation and commercialization.		50-1200 m deep	floating traps	19.6
INTERREG III-B, ORPAM I "Observatório em Rede das Pescas e Ambiente Marinho da Macaronésia – Fase I" (MAC/4.2/A2)	yes	Direção Regional das Pescas dos Açores, Horta	821	No	2003	2005	Exploratory fishery of demersal fishes and obtaining relative abundance of the demersal species of Madeira	the fishery of demersal fishes		Longline	25.4
INTERREG III-B, ORPAM II "Observatório em Rede das Pescas e Ambiente Marinho da Macaronésia – Fase II" (MAC/4.2/A2)	yes	Instituto do mar, Horta	630	No	2004	2006	Exploratory fishery of demersal fishes and obtaining relative abundance of the demersal species of Madeira	the fishery of demersal fishes	0-1200 m deep	Longline	25.4

Dimension (length, number of hooks, traps, ...)	Seasons (quarters)	Total number of trials	Acoustic means	Type of target species	Main species in trials (no more than 10)	Assessment of debris/lost gears in the trials	Catch per unit of effort assessment	Ergonomy and working conditions/safety	References
	all		No	Fish and Crustaceans	*Plesionika narval; Plesionika edwardsii; Chaceon affinis; Heterocarpus ensifer; Heterocarpus laevigatus;*	Yes	yes	yes	Biscoito, M.J., Delgado, J.M., Pinto, A.R., Abreu, A.D., Maul, G.E., Faria, G.T., Amorim, A.B. 1994. Estudo ecológico e biológico das comunidades de peixes e crustáceos decápodes bentónicos da
ARQDMAD-07-P96 = 61506 hooks; ARQDAÇO-08-P97 = 154343 hooks;	2	Azores Islands/ARQDAÇO-08-P97 = 28 fishing sets; Madeira archipelago/ARQDMAD-07-P96 = 13 fishing sets;	No	Demersal	*Beryx splendens; Pagrus pagrus; Helicolenus dactylopterus; Phycis phycis; Pontinus kulli; Galeus melastomus; Deania profundorum; Scomber japonicus*	Yes	yes	yes	Menezes, G., Delgado, J., Krug, H., Pinho, M.R., da Silva, H.M., Carvalho, D. 1998. Design optimization and implementation of demersal cruise surveys in the macaronesian archipelagos - II
			No		*Plesionika edwardsii*	Yes	yes	yes	Recursos Pesqueiros de Águas Profundas do Atlântico Centro-Oriental (PESCPROF-1). 2006
		ARQDMAD-04-P04	No	Demersal		Yes	yes	yes	
≈ 40000		ARQDMAD-05-P05 = 15 fishing sets	No	Demersal	*Deania profundorum; Galeus melastomus; Pagrus pagrus; Phycis phycis; Helicolenus dactylopterus; Pagellus bogaraveo; Pontinus kulli; Beryx decadactylus; Serranus atricauda*	Yes	yes	yes	Delgado, J., Carvalho, D., Ferreira, S., Sousa, R., Chada, T. 2007. Monitorização de Peixes Demersais no Arquipélago da Madeira. DBPO Nº03/2007

6.3 Canaries

Below, sample of the Reference Database filled by GMR Canaries (the second table is the continuation of the lines of the first table):

Main body that financed the project (most important %)	Co-funded project	Coord./leader of the project (institution)	Total cost (k€)	Fishers or fishers organisation involved	Beginning Year of the trial	Ending Year of the trial	dura-tion in months	Main aims of the project	What was mainly tested	Depth of operation	Gears type used (FAO codification) or MFAD	Vessel size for the trials (in meters)	Dimension (length, number of hooks, traps, ...)	material
EU ERDF funds	Yes	Direcção de Serviços de Investigação das Pescas - Madeira (DSIP)	1850	Yes. A local professional fishing boat rented. Fishermen hired for one research vessel	2004	2008	N/A	To analyse morphological characterization of the two black scabbardfish species (Biscoito et al. 2011) Fishing impact of the black scabbardfish fishery off the Canary Islands (Pajuelo et al. 2010)	Based on the largest genetically validated sample obtained to date (Biscoito et al. 2011) Evaluate the composition, structure and fishing impact of the black scabbardfish fishery off the Canary Islands (Pajuelo et al. 2010)	between 200 and 3000 m	LLD	F/V Mary Nere (15.47 m), R/V Pixape II (25 m)	7000-8000 hooks (from Biscoito et al 2011 in Pajuelo et al 2010) 1400 hooks (Pajuelo et al. 2010)	nylon lines with metallic hooks
EU ERDF funds	Yes	Direcção de Serviços de Investigação das Pescas - Madeira (DSIP)	4084	Yes. Two local professional fishing boats rented. Fishermen hired for two research vessels	2005 (Biscoito et al. 2015)	2011 (Biscoito et al. 2015)	N/A	To investigate the biology of *Chaceon affinis* in two isolated populations of the Atlantic Ocean, including depth distribution, sexual structure, reproductive patterns and intermoult period (Biscoito et al. 2015) The spatial and temporal biomass distribution of *Chaceon affinis* and its vulnerability to fishing activity in Gran Canaria (Canary Islands) were investigated (Triay-Portella et al. 2017b)	The first goal was to assess the influence of the slope steepness and substrate on the size of crab patches, size of the crabs, and crab biomass. The second goal was to evaluate spatial and temporal variation in the biomass over a 15-month period. The last goal was to assess the influence of fishing activity upon the reduction in the biomass over the same 15-month period (Triay-Portella et al. 2017b)	400-1300 m (Biscoito et al. 2015) 500-900 m (Triay-Portella et al. 2017b)	FPO	F/V Mary Nere (15.47 m), F/V Juan Carlos Primero (13.79 m), R/V Pixape II (25 m), R/V Profesor Ignacio Lozano (25 m)	Crabs were captured with square traps, with 80x50 cm base length and 50 cm in height. Each trap had one truncoconical opening, with a 23-cm outer diameter and a 19-cm inner diameter (Biscoito et al. 2015)	metallic (Biscoito et al. 2015)
Several (in several decades)	Several regional projects involved, as well as one project from CAMARON programme co-funded with EU ERDF funds	Several (in several decades), mainly the Canarian Institute of Marine Sciences (ICCM)	N/A	Yes. A very-specialized professional fishing boat from mainland Spain rented, but many local fishers organisations involved	1974	1998	N/A	Information on biometric and biological parameters of the Canary Islands is given (Quiles et al. 2001)	Carapace length, carapace width, total wet weight, sex and ovigerous condition were determined. Allometric relationships, sex ratio and size at first maturity were estimated	120-750 m	FPO	F/V González López (24.15 m), among others	N/A	metallic
EU ERDF funds	Yes	Direcção de Serviços de Investigação das Pescas - Madeira (DSIP)	1397	Yes. Two local professional fishing boats rented	2003	2004	12	To examine a subset of data from different surveys to investigate the best fishing method (i.e. traditional bottom traps versus semi-floating shrimp traps) for catching target species and to examine the bycatch associated with using these traps. The effect of shrimp morphology on trap efficiency was also investigated.	2 types of traps were used in these surveys: bottom traps and semi-floating shrimp traps. (i) to investigate possible differences among averages of CPUE per trap type. (ii) Bycatch and discard species collected were also quantified (CPUE) to explore possible effects of trap types in competition-predation of the target species as a contribution to the development of an ecological approach to the fishery.	120-1300 m	FPO	F/V Mary Nere (15.47 m), F/V Juan Carlos Primero (13.79 m)	bottom traps, an iron rectangular frame (100 × 100 × 50 cm); and semi-floating shrimp traps comprising of a plastic mesh lining that covered a conical cylinder (56 × 57 cm) and deployed about 2.4 m above the seabed.	bottom traps, made up of a metallic mesh lining and an iron rectangular frame (metallic); and semi-floating shrimp traps comprising of a plastic mesh lining that covered a conical cylinder (metallic).

Mesh size	Seasons (quarters)	Total number of trials	Acoustic means	type of target species	Main species in trials (no more than 10)	Assessment of debris/lost gears in the trials	Assessment of non target species (discards)	Assessment of non target species (bycatch)	Assessment impact on benthic habitats	Catch per unit of effort asses-sment	Revenues and costs assessment	fuel depen-dency asses-sment	Ergonomy and working conditions /safety	Fishery conservation regulations (TAC, landing minimum size, mesh size, MPA or fishing cantonment)	Fishery access regulations (licence, vessel quota, individual spatial rights)	Reference numbers of the documents	Comments	References
N/A	1;2;3;4 (Pajuelo et al. 2010)	34 (Pajuelo et al. 2010)	No	Bentho-pelagic or bathyal fishes	*Aphanopus carbo* and *A. intermedius* (Osteichthyes, Trichiuridae)	Yes	Yes (Pajuelo et al. 2010)	Yes (Pajuelo et al. 2010)	No	Yes	N/A	N/A	N/A	N/A	N/A	CAN_2011 CAN_2010	Mainly 2 Projects: PESCPROF-2 and 3 (03/MAC/4.2/M8 & 05/MAC/4.2/M11). Mid-water drifting longline gear	- Biscoito, M., J. Delgado, J.A. González, S. Stefanni, V.M. Tuset, E. Is García-Mederos & D. Carvalho (2011). Morphological identificatic sympatric species of Trichiuridae, *Aphanopus carbo* and *A. intermed* Atlantic. Cybium, 35 (1): 19-32. '-Delgado, J., S. Reis, J.A. González, E. Isidro, M. Biscoito, M. Freitas & (2013). Reproduction and growth of *Aphanopus carbo* and *A. inte* (Teleostei: Trichiuridae) in the northeastern Atlantic. J. Appl. Ichthy
covered with15x15 mm mesh (Biscoito et al. 2015)	N/A (Biscoito et al. 2015) 1;2;3;4 (Triay-Portella et al. 2017b)	47 (Biscoito et al. 2015) 5 (Triay-Portella et al. 2017b)	No	Benthic crustaceans	*Chaceon affinis* (Decapoda, Geryonidae)	Yes	Yes	Yes	No	Yes	No	Yes	No	No	No	CAN_2015 CAN_2017	Mainly 4 Projects: PESCPROF and PESCPROF-2 (03/MAC/4.2/M11, 03/MAC/4.2/M8), REDECA (CTM2005-07712-C03/MAR) and MARPROF (MAC/2/M065)	- Biscoito, M., M. Freitas, J.G. Pajuelo, R. Triay-Portella, J.I. Santana, A Delgado & J.A. González (2015). Sex-structure, depth distribution, ir period and reproductive pattern of the deep-sea red crab *Chaceor* (Brachyura, Geryonidae) in two populations in the north-eastern Atla Sea Res. I, 95: 99-114. -'Triay-Portella, R., J.G. Pajuelo & J.A. González (2017b). Spatio-te variation in biomass of the deep-sea red crab *Chaceon affinis* in Gra Island (Canary Islands, Eastern-Central Atlantic). Mar. Ecol., 38 (!
N/A	N/A	12	No	Benthic crustaceans	*Cancer bellianus* (Decapoda, Cancridae)	N/A	N/A	N/A	N/A	Yes	N/A	N/A	N/A	N/A	N/A	CAN_2015	12 research surveys were conducted	- Quiles, J.A., V. Rico, V.M. Tuset, J.I. Santana & J.A. González (2001). N biology of *Cancer bellianus* (Brachyura, Cancridae) around the Cana Hydrobiologia (Paula, J.P.M., A.A.V. Flores & C.H.J.M. Fransen, eds., A Decapod Crustacean Research), 449: 193-199. '-Pajuelo, J.G., R. Triay-Portella, J.I. Santana & J.A. González (201 community of deep-sea decapod crustaceans between 175 and 26 submarine canyons of a volcanic oceanic island (central-eastern A Deep-Sea Res. I, 105: 83-95.
bottom traps (19 × 19 mm) and semi-floating shrimp traps (15 × 20 mm)	1;2;4	4	No	Epibenthic crustaceans	*Plesionika narval*, *Plesionika edwardsii* and *Heterocarpus ensifer* (Decapoda, Pandalidae)	No	Yes	Yes	No	Yes	No	No	No	No	No	CAN_2012	Mainly 1 Project: PESCPROF (03/MAC/4.2/M11). They were 4 week-long trials from October 2003 to October 2004.	Arrasate-López, M., V.M. Tuset, J.I. Santana, A. García-Mederos, O. A González (2012). Fishing methods for sustainable shrimp fisherie Canary Islands (North-West Africa). Afr. J. Mar. Sci., 34 (3): 331

6.4 La Réunion

Below, sample of the Reference Database filled by Roos from IFREMER (the second table is the continuation of the lines of the first table):

Main body that financed the project (most important %)	Co-funded project	Coord. /leader of the project (institution)	Total cost (k€)	Fishers or fishers organisation involved	Beginning Year of the trial	Ending Year of the trial	Duration in months	Main aims of the project	What was mainly tested ?	Depth of operation	Gears type used (FAO codification) or MFAD	Vessel size for the trials (in meters)	Dimension (length, number of hooks, traps, ...)	material	Mesh size	Seasons (quarters)	Total number of trials	Acoustic means	type of target species
CRPMEM REUNION	Yes	CRPMEM REUNION	?	YES	2000	2000	6	Prospecting of deep coastal demersal resources	Demersal ressources with new fishing gear	200-600	LHMDEF	8	5 to 8 straight hooks on mono drop line	Electric reel	Hook number 7/0 to 13/0	1 to 3	38 days 348 spinning	YES	Deep Demersal, benthic and bentho-pelagic fish
FEP 2007-2013	Yes	IFREMER	182	YES	2011	2012	6	Prospecting of deep coastal demersal resources	CPUE trend to evaluate stocks status	200-700	LHMDEF	<8	5 to 12 circle hooks on mono drop	Electric reel	Hook 7/0 to n°14 (small)	43161	61 days 514 spinning	YES	Deep Demersal, benthic and bentho-pelagic
FEP 2007-2013	Yes	IFREMER	420	YES	2014	2015	12	Prospecting of deep coastal demersal resources	CPUE trend and biology parameters indices to evaluate stocks status	80-700	LHMDEF	<8	5 to 10 circle hooks on mono drop line	Electric reel	Hook n° 4 to 14	1 to 4	133 days 2948 spinning	YES	Deep Demersal, benthic and bentho-pelagic fish
Fisheries Dep. of Dir. for Agric & Forest & County Council of Mayotte	NO	INENV private office	?	YES	2004	2005	12	Prospecting of deep coastal demersal resources	Discribe demersal fish ressources with new fishing gear	200-600	LVS	9	3 to 12 circle hooks on mono drop line	Hydrolic winch	NA	1 to 4	20 days 643 spinning	YES	Deep Demersal, benthic and bentho-pelagic fish

Main species in trials (no more than 10)	Assessment of debris/lost gears in the trials	Assessment of non target species in the trials (discards)	Assessment of non target species in the trial (bycatch)	Assessment impact on benthic habitats in the trails	Catch per unit of effort assessment	Revenues and costs asses-sment	fuel depen-dency asses-sment	Ergonomy and working conditions /safety	Fishery conservation regulations (TAC, landing minimum size, mesh size, MPA or fishing cantonment)	Fishery access regulations (licence, vessel quota, individual spatial rights)	Refe-rence numbers of the docu-ments	References
Etelis carbunculus, Etelis coruscans, Eumegistus illustris, Berix decadactylus Pristipomoides sp., Epinephelus sp. Squalus sp., & All sp.	YES/NO (hooks lost)	YES (very few discards)	YES (very few bycatch)	impossible to evaluate but considered weak (vertical drop line)	YES	NO	NO	NO	Recommandation made in report	Recomman-dations made in report	1	Roos David, Tessier Emmanuel, Taquet Marc (2001). Prospection des ressources côtières démersales profondes autour de La Réunion. Analyse des données des campagnes à la mer réalisées du 23/02/2000 au 28/07/2000. Rapport de synthèse des travaux confiés par le CRPMEM de La Réunion à l'Ifremer Délégation Océan Indien. RST-DOI/2001-01
Etelis carbunculus, Etelis coruscans Eumegistus illustris, Berix decadactylus, Pristipomoides sp., Epinephelus sp., Squalus sp.& All sp.	YES/NO (hooks lost)	YES (very few discards)	YES (very few bycatch)	impossible to evaluate but considered weak	YES	NO	NO	NO	Recommandation made in report		5	1°) Fleury Pierre-Gildas, Evano Hugues, Le Ru Loic, Aureche Vincent (2012). Synthèse de l'étude et des campagnes à la mer 2011 sur l'exploitation aux vire-lignes des espèces démersales profondes autour de La Réunion . RST.Délégation Océan Indien /2012-13 .
Etelis carbunculus, Etelis coruscans Eumegistus illustris, Berix decadactylus Pristipomoides sp., Epinephelus sp. Squalus sp.& All sp.	YES/NO (hooks lost)	YES (very few discards)	YES (very few bycatch)	impossible to evaluate but considered weak (vertical	YES	NO	NO	NO	Recommandation made in report		8	1°) Roos David, Aumond Yoann, Huet Jerome, Bruchon Franck (2015). Projet ANCRE-DMX2 : Indicateurs biologiques et écologiques pour une gestion durable des stocks de poissons DéMersauX profonds (100–700 m) d'intérêt halieutique à La Réunion . RST/RBE-DOI/2015-11 . http://doi.org/10.13155/45812
Etelis carbunculus, Etelis coruscans Eumegistus illustris, Berix decadactylus Pristipomoides sp., Epinephelus sp. Squalus sp. & All sp.	YES/NO (hooks lost)	YES (very few discards)	YES (very few bycatch)	impossible to evaluate but considered weak (vertical drop line)	YES	YES/NO	NO	NO	Recommandation made in report		1	Herfaut J. (2005). Prospection des ressources côtières démersales profondes autour de Mayotte. Résultats et conclusion des campagnes de pêche expérimentales de juillet 2004 à juin 2005. Etude INENV commandée par le Service des Pêches de la Direction de l'Agriculture et de la Forêt de Mayotte. 37p.

6.5 Guadeloupe and Martinique

Below, sample of the Reference Database filled by Lionel Reynal from IFREMER (the second table is the continuation of the lines of the first table)

OR	Main body that financed the project (most important %)	Co-funded project	Coord./leader of the project (institution)	Total cost (k€)	Fishers or fishers organisation involved	Beginning Year of the trial	Ending Year of the trial	duration in months	Main aims of the project	What was mainly tested	Depth of operation	Gears type used (FAO codification) or MFAD	Vessel size for the trials (in meters)	Dimension (length, number of hooks, traps, ...)	material	Mesh size	Seasons (quarters)	Total number of trials	Acoustic means	type of target species
MARTINIQUE	MARTINIQUE REGIONAL CONCIL & IFREMER	Yes	IFREMER	NA	No	1984	1987	7	Estimate of species abundance Distribution of ciguateric species	Consumable fish yield	0-300 m	GTR FPO	3 boats: 25 m, 24 m 12 m	Trap: 40 cm of side 15 cm of height Tramel net: 200 m length, 2 m height	Hydrolic winch	Trap: 43 mm Tramel net: 80 mm & 400 mm stretched mesh	dry & wet seaesons	7 campaigns sets: 239 with traps & 67 with tramel nets	Yes	Demersal species
MARTINIQUE	IFREMER	No	IFREMER	NA	No	1991	1992	10	Inventory of exploitable deep resources	Deep crustacea resources	60-900 m	FPO	12 m	. m X 0.50 m diamete	Hydrolic winch	1 cm mesh side	Q3, Q4, Q1	59	Yes	Deep crustacea
GUADELOUPE	NA	Yes	SDAT & IRPM	NA	No	1983-1989-1993-1994	1983-1989-1993-1994	9.5	Deep resources exploitation conditions	Crustacea	250-600 m	FPO	12 m	NA	Hydrolic winch	31 mm	Q4, Q1	NA	Yes	Deep crustacea
GUADELOUPE	FEDER	NA	IRPM Guadeloupe	53,000 €	No	1994	1995	3	Deep long line to sharks	Deep sharks with long lines	250-1100 m	LTL	12 m	180 hooks	Hydrolic winch			29	Yes	Deep sharks
GUADELOUPE	EUROFORM/European Social Funds Regional coucil, Departmental Directorate of Labor and Employment	Yes	IRPM		Yes	1995	1995	4	Training and experimentation of the Portuguese deep longline	Portuguese deep longline	60-600 m	LTL	12 m	1900 hooks	Hydrolic winch			4	Yes	Fishes

Main species in trials (no more than 10)	Assessment of debris/lost gears in the trials	Assessment of non target species in the trials (discards)	Assessment of non target species in the trial (bycatch)	Assessment impact on benthic habitats in the trails	Catch per unit of effort asses-sment	Revenues and costs asses-sment	fuel dependency assessment	Ergonomy and working conditions/ safety	Fishery conservation regulations (TAC, landing minimum size, mesh size, MPA or fishing cantonment)	Fishery access regulations (licence, vessel quota, individual spatial rights)	Reference numbers of the documents	References
	No	No	No	No	Yes	No	No	No	No	No		
NA	Yes	No	No	No	No	No	No	No	No	Yes		
Sphyrnidae, Lutjanidae (Lutjanus vivanus & Etelis oculatus), Carcharhinidae, Hexanchidae, Gempylidae, Squalidae, Odontaspididae, Scyliorhinidae	No	No	Yes	No	Yes	No	No	Rudimentary recommendations	Rudimentary recommendations	Rudimentary recommendations	1, 1a	Guillou A., 1 989 - Ressources démersales du talus insulaire de la Martinique. Rapport d'étude, Contrat de Plan État/Région Martinique 1 984- 1 988. Rapp. int. Ifremer. RI DRV 89-037. 121 p. Battaglia A., R. Dhellemmes, A. Guillou, A. Lagin, L. Reynal et J. Sacchi, 1989. Les ressources des fonds de 100 à 300 m autour de la Martinique. Rapport Ifremer DRV-RH/Le Robert Martinique, 30 p.
Acanthurus bahianus, Calamus calamus, cephalopholis fulva, Epinīphelus guttatus, E. striatus, Haemulon melanurum, H. plumieri, H. ascensionis, Lutjanus buccanella, L. synagris	No	No	Yes	No	Yes	No	No	Rudimentary recommendations	Rudimentary recommendations	Rudimentary recommendations	2, 2a, 2b	Lorance P., 1989. Ressources démersales et description des pêcheries des bancs de Saint-Martin et Saint-Barthelemy. Rapport Ifremer DRV-89.039-RH/Martinique, 75 p. Lorance P. et J. Huet, 1988. Evaluation des ressources démersales potentielles des bancs de Saint-Barthelemy et Saint-Martin. Rapport Ifremer DRV/RH n° 88.003, 147 p. Battaglia A., A. Guillou, P. Lorance et L. Reynal, 1989. Développement de la pêche martiniquaise. Mise en valeur des ressources démersales : des bancs du nord de la Guadeloupe et entre 100 et 300 m de profondeur autour de la Martinique. Rapport Ifremer-RH/Le Robert Martinique. 21 p.
Plesionnika edwardsi, P. polyacanthomerus, P. laevi, Heterocarpus ensifer, H laevigatus, Eunephrops cadenasi, Bathynomus giganteus	No	No	Yes	No	Yes	No	No	No	Rudimentary recommendations	Rudimentary recommendations	3	Paulmier G. et P. Gervain, 1994. Pêches expérimentales des crustacés profonds dans les eaux de la Martinique (Pandalidae, Nephropidad). Prospections, rendements et biologie des espèces. Rapport IFREMER RI DRV 94-04, 72 p.