LIFE iSEAS PROJECT - LAYMAN´S REPORT

iSEAS

Co-funded under the LIFE+Enviroment
Program of the European Union

LIFE iSEAS PROJECT

KNOWLEDGE-BASED INNOVATIVE SOLUTIONS TO ENHANCE ADDING-VALUE MECHANISMS TOWARDS HEALTHY AND SUSTAINABLE EU FISHERIES

BENEFICIARIES

COORDINATOR

Agencia Estatal Consejo Superior de Investigaciones Científicas, Spain

TYPE OF ORGANIZATION

Research institution

DESCRIPTION

CSIC is the most important multidisciplinary public research institution in Spain. LIFE iSEAS project has been coordinated by Instituto de Investigaciones Marinas (IIM-CSIC) in Vigo which develops, among others, a research line on valorization of marine resources.

PARTNERS

OPROMAR
Organización de Productores de Pesca Fresca del Puerto y Ría de Marín, Spain

CETMAR
Centro Tecnológico del Mar, Spain

JOSMAR
Talleres JOSMAR S.L., Spain

IEO
Instituto Español de Oceanografía, Spain

USC
Universidade de Santiago de Compostela, Spain

CESGA
Fundación Centro de Supercomputación de Galicia, Spain

ADMINISTRATIVE DATA

Project reference:
LIFE13 ENV/ES/000131
Duration:
01-JUL-2014 al 30-JUN -2018
Total budget:
3,866,342.00 €
EU contribution:
1,919,325.00 €
Project location:
Galicia (Spain)

ÍNDICE

INTRODUCTION

Fishing discards are the portion of the catch which, for different reasons, is not wanted and, therefore, it is returned to the sea. Discard are perceived as a negative issue because they constitute a waste of valuable biomass that may adversely affect ecosystems sustainability. Sustainability is the main objective of the Common Fisheries Policy (CFP) and the Landing Obligation (LO), which states that all vessels must keep on board and land all the catch of species subject to quota or minimum legal size regulation.

The main goal of the LIFE iSEAS Project has been related to the exploration and application of innovative solutions for unwanted catch reduction and management. In this regard, the idea was to demonstrate that a sustainable scenario is possible on EU fisheries. According to this objective, this project focused on four different aspects

- Automatic identification and quantification of the whole catch on board commercial vessels: the iObserver.
- Development of decision making tools for fishing activity optimization: SDI and discard probability maps. Such tools will help:
  - To select those regions with lower discard probability considering the associated fuel consumption.
  - To design efficient fishing policies that guarantee stock populations and maximize fishing activity production.
- Development of discard valorization processes. Such processes are carried out in two different kind of pilot plants:
  - iDVP1: for the elaboration of products for direct human consumption.
  - iDVP3: for the elaboration of products that cannot be used for direct human consumption. iDVP3 raw material is mainly constituted by specimens under minimum legal size.
- Demonstration of the benefits/impacts of the solutions proposed within the LIFE iSEAS project on the fishing sector.

THE iOBSERVER

WHAT IS IT?

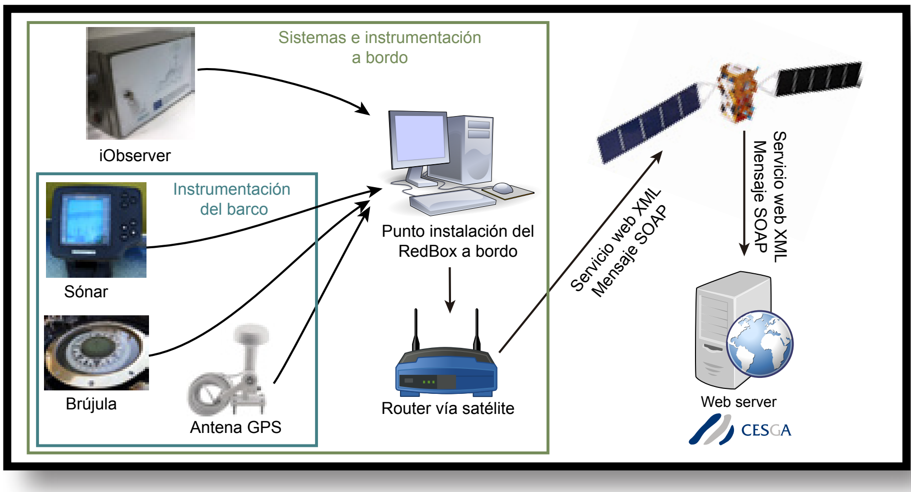
The iObserver is an electronic device whose main objective is to automatically identify and quantify the whole catch on board fishing vessels.

The main components of the iObserver are: an industrial vision camera; a lightning system; and an industrial computer equipped with image recognition software. All components are protected by metallic cases able to resist the harsh conditions of a commercial vessel fishing park.

ON BOARD INSTALLATION AND IMAGE RECOGNITION

The iObserver is installed over the conveyor belt, just before the fishing separation zone. The system takes images of everything that crosses the conveyor belt during the separation process. The recognition software automatically analyzes every image, identifies all the individuals, estimates their length and generates a report containing the results.

Identification/quantification results are sent to the RedBox where they are organized and combined with data, such as vessel position, course, velocity, etc., supplied by the vessel instrumentation. Finally, the RedBox sends, in real time, the information to an inland center for further use/analysis.



MAIN FEATURES OF THE IOBSERVER

- It weights around 18 kg and its dimensions are 40x23x26 cm, which provides enough flexibility for its installation in a large range of fishing parks.
- It is equipped with a graphical user interface (GUI) in order to facilitate its use on board. The iObserver requires minimal interaction with the user so it does not entail extra workload for the fishermen.
- It allows automatic image acquisition through a system of sensors that avoids image repetition and overlapping.
- It contains a module that allows training of new species through the GUI in a simple manner.

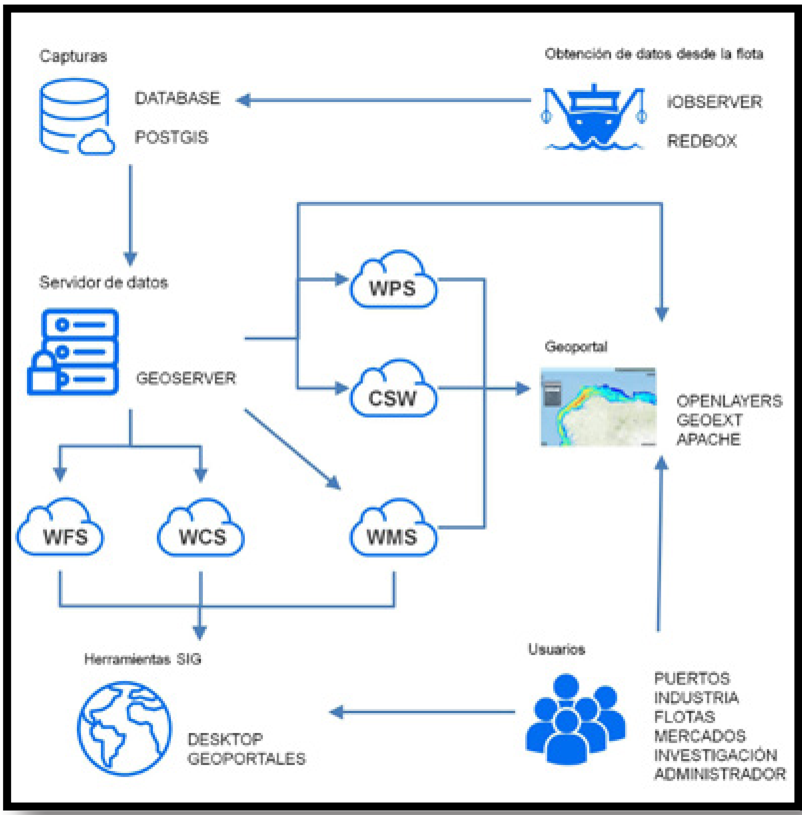
RESULTS

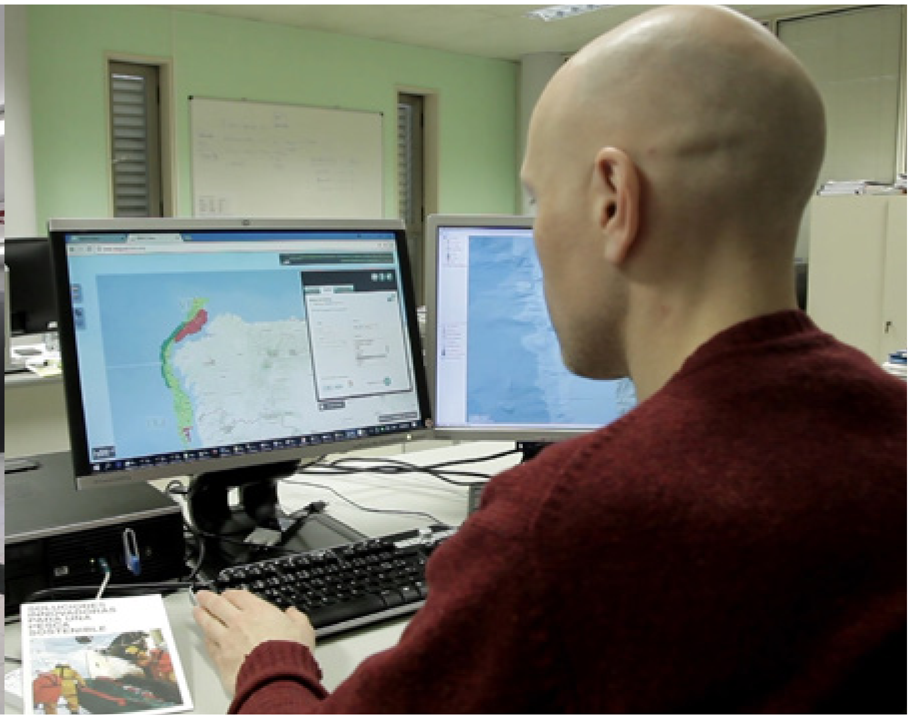
- 17 commercial species have been already trained. Such species are representative of the fishing regions: Great sole bank, Northwest Cantabrian sea, Portugal and NAFO.
- It has been intensively tested in 10 oceanographic campaigns in which around 170.000 images were taken.
- It has been also tested on board 3 commercial vessels on 9 fishing trips in Portugal and Northwest Cantabrian Sea. Around 35.000 images were taken.
- Identification accuracy is over 90% for separated individuals. Mean error in size estimation was below 3%.

SPATIAL DATA INFRAESTRUCTURE (SDI)

All the information of the capture, sent from the vessel through the RedBox, is received, in real time, at the analysis center (CESGA). Then, it is organized inside a system that allows its storage, analysis and publication, fulfilling the standards of the INSPIRE 2007/2 Directive, to create a Spatial Data Infrastructure (SDI). This data is collected in a spatial database implemented with free software technologies (PostgreSQL) and its spatial extension (PostGIS), from where they are distributed through the open source server (Geoserver).

Access through open standards allows the possibility of using the data in different ways and by different user profiles (fishing fleets / skippers, researchers, administrations, general public, etc.). Each of these profiles has a series of permissions to consult or download different levels of information.





HOW DO WE ACCESS?

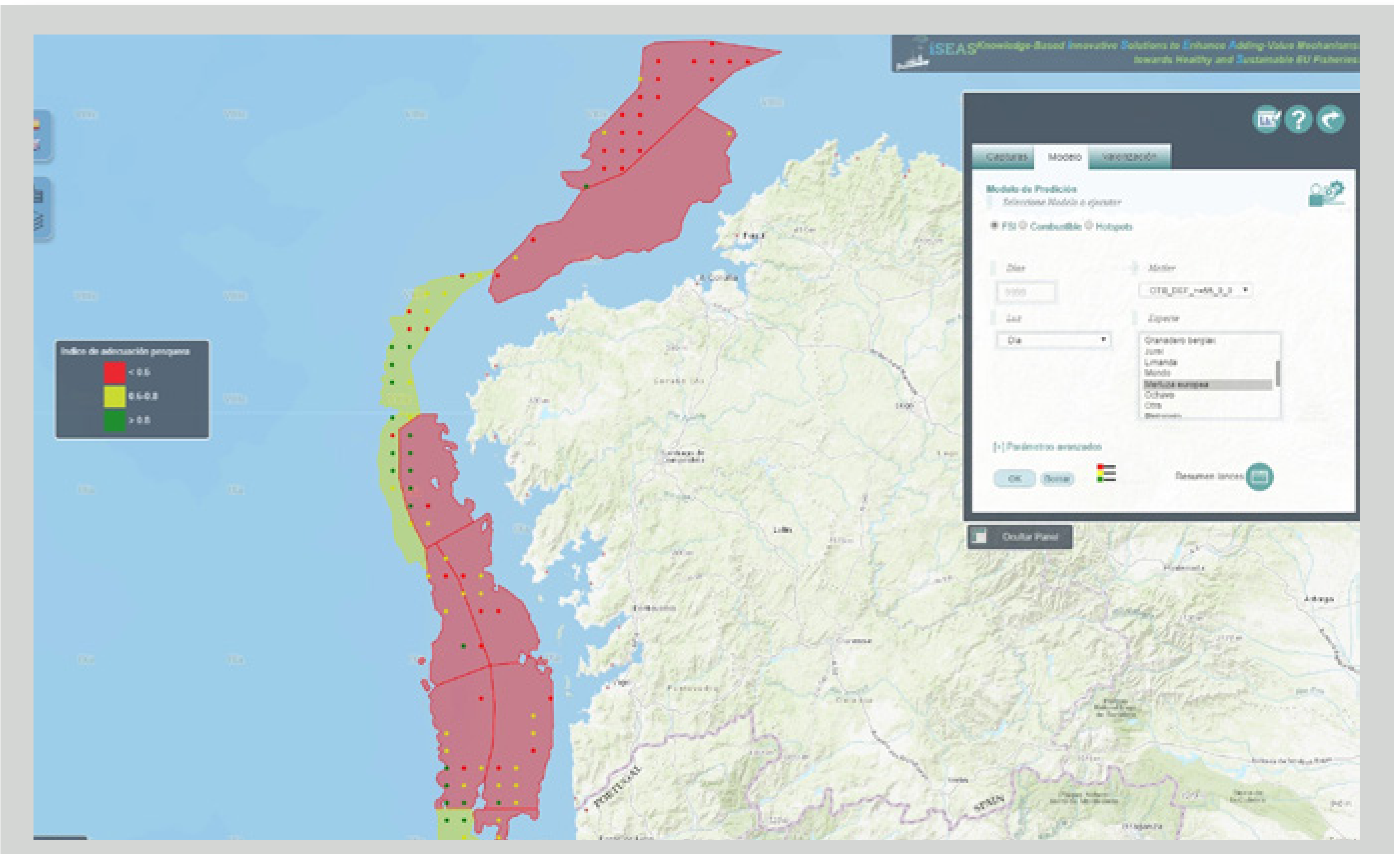
The use of the services deployed through the geospatial data server can be done through two different ways:

- Using any Geographic Information Systems (GIS) software to access this data from two types of services: the WFS and the WCS. These services, known as download, allow direct connection to the system information. In addition, WMS services (Web Mapping Services) are also available.
- Through the Geoportal developed in LIFE iSEAS (http://iseas.cesga.es/). It is built with a map viewer as the main component, with a reference background map with bathymetry, navigation tools and control on available layers. It has two versions: a public one with free access containing generic information and layers with the results of some static models; and a private one that, in addition to the information offered in the public, allows access to the fishing / capture data (filtered according to the user access permissions. That is, each skipper has access exclusively to the catch data of his own ship), and to the dynamic models of prediction.

FUNCTIONALITIES

Models to analyze, in a robust way, the spatio-temporal conditions of specific fishing areas can be executed from the viewer. Analysis can be performed in terms of discards probability; juveniles presence; or cost-benefit ratio.

This tool can be very useful for fisheries management, since it allows the skippers to plan their fishing trips before going out to sea. In this regard, skippers can select the most suitable/profitable fishing areas (minimizing discards) making their activity more sustainable from the environmental and economical points of view. Besides, the Administration could use this tool to determine, in real time, closures of areas where high percentage of discards of certain species are being generated or large volumes of specimens below minimum legal size are being captured, implementing more agile and effective policies.

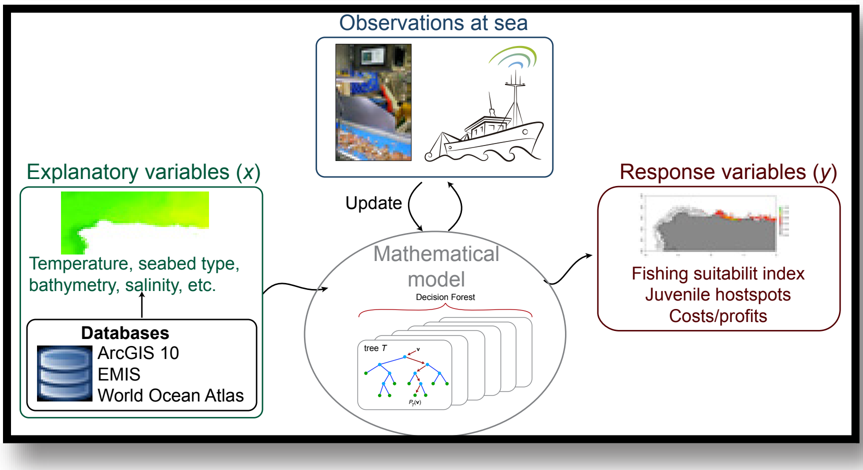


DISCARD PROBABILITY MAPS TO IMPROVE FISHING SUSTAINABILITY

WHAT DO WE DO?

Statistical tools (mathematical models) aiming at the production of maps to identify and visualize the best fishing areas, considering those areas as the ones with lower discarding probability, have been developed in the framework of the LIFE iSEAS project.

Hence, the most suitable areas for fishing, in addition to providing a profitable catch, should avoid areas where a large amount of unwanted catch is concentrated, either because they are species or sensitive sizes or because the species have no commercial value.



MODEL CHARACTERISTICS:

The mathematical models (random forest) developed in the project consist of a series of equations that describe the evolution of the variables of interest, such as the fishing suitability index, as a response to changes in the explanatory variables, for instance, water temperature, salinity or bathymetry. Model equations are obtained from correlations between historical data of the explanatory variables and the response variables. Besides, recent catch data, provided either by human observers or by the iObserver, are considered to update the models.

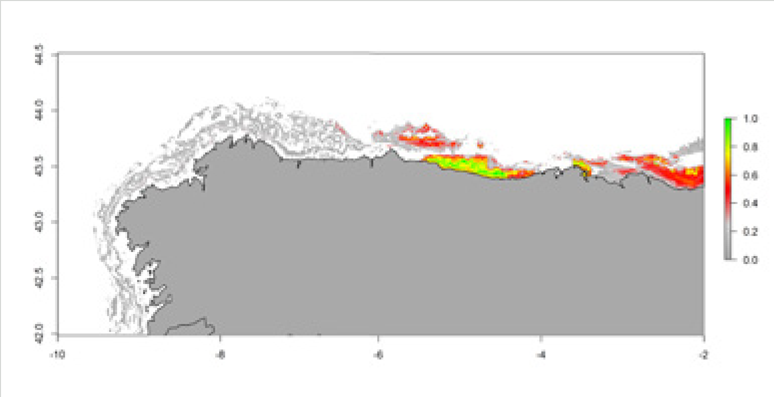
Explanatory variables may be directly measured although, for practical reasons, they are obtained from different sources such as: IEO database, ArcGIS 10 geographic information system, World Ocean Atlas 2013 or the marine geoportal EMIS.

Once the explanatory variables are available, they are fed to the model which in turns provides an estimation of the variables of interest.

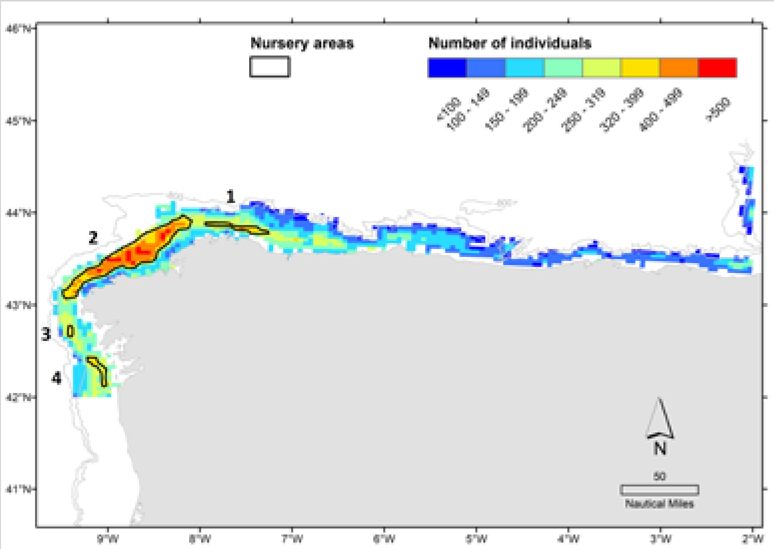
RESULTS:

A different type of map has been made for each of the three models. All models were based on data from the commercial fishing fleet or oceanographic campaigns and include environmental and geographical variables.

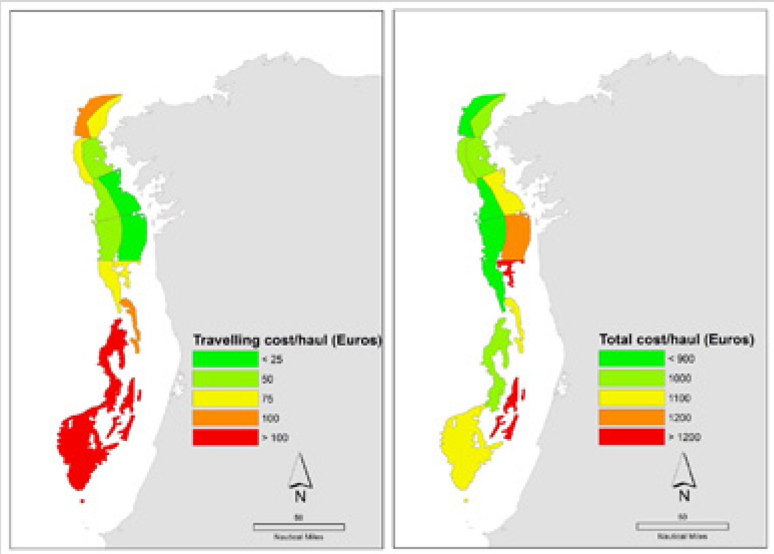
- **1. Maps of suitable fishing areas through the Fishing Suitability Index (FSI), based on data from the commercial fleet. The most suitable areas for fishing follow a traffic light color code, the best ones as green.**



- **2. Maps of sensitive species or vulnerable fraction of commercial species, based on data from oceanographic campaigns. Red zones indicate a large probability of presence of such species, and therefore, it is convenient to avoid them. Four species have been considered: European hake, Norwegian lobster, Starry ray, and Sea pen.**



- **3. Maps of cost and benefit strategies, based on commercial and economic data. They are aimed at improving fishing efficiency, including energy and fuel savings. Green regions correspond to those with larger profit.**



VALORIZATION PLANTS iDVPS

WHAT ARE THEY?

The iDVP pilot plants (iDVP 1 and iDVP 3) are two spaces equipped with different machinery (operating units) in which treatment and recovery processes are developed and executed on a semi-industrial scale. The objective is to recover, isolate, purify or produce materials and compounds of medium-high added value from discards and fishery by-products.

The essential elements of the iDVP 1 plant (where the final product obtained, minced fish block, can be used for human consumption) are: a separator of fish bones and skins, a crusher, a hydraulic press, a mixing tank with liquid discharge to different levels, scales and auxiliary deposits. The iDVP 3 plant (in which the final product obtained cannot be used for direct human consumption) is equipped with: three 500 L reactors with agitation, pH and temperature control equipment as well as a reagent addition system, a centrifuge, a drying equipment by spray-dryer, several auxiliary tanks equipped with pumping units, a microfiltration equipment, a transfer pump, a solid-drying oven, a freezer, a refrigerator and a filtering system by plates.

PROCESSING OF FISHERY DISCARDS AND BY-PRODUCTS

Individuals of all commercial species with size above the legal one that, for any reason, have no interest to be sold directly in auction are sent to the iDVP1 for the production of minced fish block. These blocks can be used later on as raw material for the production of food (restructured products) or animal feed (petfood).

Individuals of all species subject to TACs regulation, with size below the minimum legal size, are sent to the iDVP3 for processing. In this plant by-products generated in the iDVP1 (head, viscera, skin and bone) are also processed.

The products obtained in the iDVP3 were: Collagen and Gelatine from skin, Chitin and Chitosan from exoskeleton of crustacean or endoskeleton of cephalopod, Chondroitin sulphate from cartilage and Enzymatic hydrolysates of fish protein (FPH). Discards and by-products that do not have another processing path that could generate products with higher added value constitute the raw material for iDVP3.

MAIN CHARACTERISTICS OF iDVPS

- Flexibility and versatility of both plants to efficiently tackle multiple valorization processes.
- Ability to treat large enough quantities to address reproducible optimal operations which are representative of scaling processes.

RESULTS:

- 20 pilot plant experiences have been carried out with different discarded species (mackerel, blue whiting, hake, megrim, boarfish, etc.) and by-products of the fish processing industry in order to produce high quality FPH, fish oils and bioapatite.
- Three experiences have been also carried out to valorize skin of tuna and blue shark in order to produce gelatine.
- Other 3 experiments have been carried out with cartilaginous material from different discards and by-products to produce chondroitin sulphate.
- Finally, two batches of swimming crab, a common discard in the coastal fishing fleet, have been processed to recover the chitin present in their skeletons.
- In all cases, excellent production yields have been achieved, with equal or even better results than those obtained in the optimization experiments previously carried out at laboratory scale.

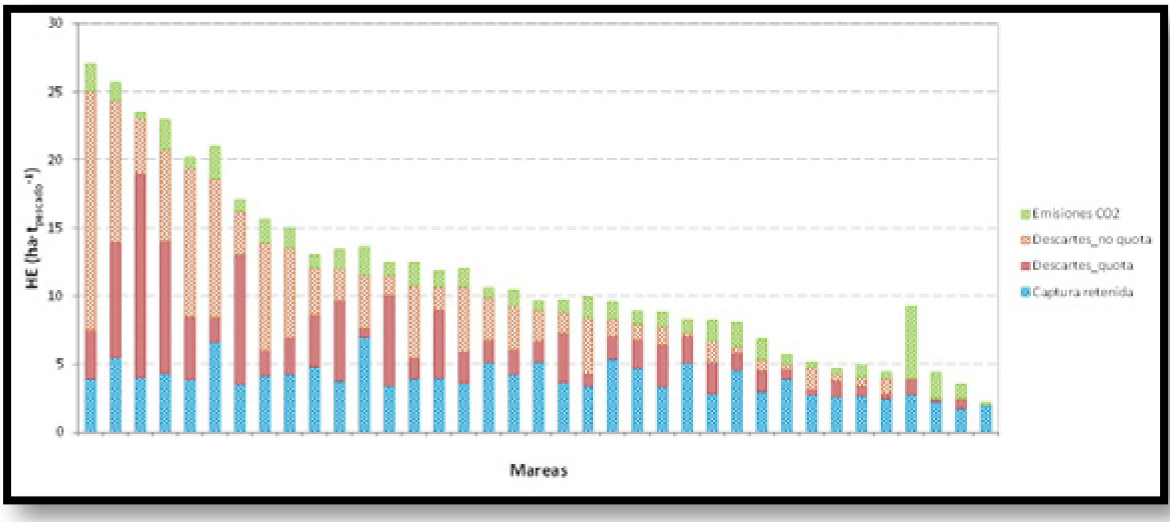
ENVIRONMENTAL INDICATORS

WHY ARE THEY NECESSARY?

Different environmental indicators have been used in order to analyze the impacts derived from both fishing activity and processes for the valorization of the new landed biomass associated to the LO. This allows evaluating the contribution of each stage as well as identifying improvement points.

TYPE OF INDICATORS

- **Ecological footprint**. This indicator measures the land and water area required to generate the consumed resources and absorb the generated emissions and wastes. It has been used to analyze the impacts derived from the fishing activity including two productive areas: fishing regions and carbon sinks. The required data for this analysis, that includes discarded species, were collected in 37 commercial trips.
- **Life cycle analysis**. This methodology evaluates the inputs, outputs and potential environmental impacts of a process through its life cycle. It was used in the analysis of the impacts derived from the different valorization processes. Data were obtained from direct measurements of electric energy consumption and raw materials in the iDVP pilot plant.



RESULTS

- **A mean value of 11,6 gha (global hectares) is required for each ton of landed fish.**
- **Discards represent 55% of ecological footprint, whereas retained capture only represents 34%.**
- **Forest area saved to absorb the emissions derived from fuel combustion represents 11% of the ecological footprint.**
- **Electric energy consumption contributes to the environmental impact derived from the discard valorization processes with over 80%.**

ECONOMICAL IMPACT OF THE LANDING OBLIGATION

THE PROBLEM

The new LO considers that environmental regulations can help to reduce impacts from human activities through the internalization of the environmental and social costs. The fact that discards are not just forbidden indicates that the objective is to maintain the activity that produces such externality, although in a sustainable and responsible way. It is, therefore, of key importance the analysis of costs that the LO entails for the different fishing sector stakeholders.

WHAT IT HAS BEEN DONE?

In order to identify the additional costs that the LO will suppose for these actors, it was required: i) to carry out in depth interviews to ship-owners and skippers of the trawling fleet operating in the Cantabrian Sea and Iberian Atlantic Coast (ICES divisions VIIIc and IX); ii) to collect fishing data, included discarded and retained biomass; and iii) to collect updated economic information from the input-output tables for the Galician Fishing and Preserved Fish Sectors.

Typical production costs of a trawler, as well as on board and in land processes that may cause additional costs, have been identified in detail. Additional costs include the quota impact of the discard quantification/registration and were introduced in the production function, considering four scenarios:

- Base case is Business as usual (BAU) i.e. without the application of the LO.
- LO without *de minimis* exemption
- LO with 5% of *de minimis* exemption for all species.
- LO with 5% of *de minimis* exemption + 50% discard reduction.

CONCLUSIONS

The solutions developed within the LIFE iSEAS project to help in the implementation of the LO will reduce the discards. However, it can also cause a significant income loss ranging 5.3% to 15.4%.

The main impact derives from quota loss. Catch that cannot be sold for direct human consumption must be counted as capture against the quota of other species causing a reduction in the value of such quota.

In average, every euro obtained from unwanted catch will cause a loss of 35.8 € of valuable catch. The main reasons for such opportunity cost are: i) high discard ratios due to large volumes of specimens below minimum legal size; and ii) a low price for the fish dedicated to fish meal and oil (0,05 €/kg), which is nowadays the main valorization alternative for this fraction of capture.

It can be also highlighted that some costs, such as fuel, are reduced under the LO because quota is consumed faster so the number of trips is reduced. Other costs, such as the salary, will increase due to the extra workload derived from classification, management and storage of additional fish.

THE LIFE ISEAS PROJECT MAY CONTRIBUTE TO:

- The minimization of the environmental impact and the socio-economic costs derived from the compliance with the LO of the new CFP through:
  - ➤ The valorization of biomass that, for different reasons, is not sold in the fish market.
  - ➤ The reduction of costs associated with on board and ashore management of the whole catch.
- The reduction of unwanted catch and, therefore, the fishing pressure on marine resources using real fishing data, SDI tools and probability discard maps.
- The reduction of the fishing activity impact on biodiversity and structure of marine ecosystems by improving the knowledge on that activity.

DISSEMINATION CHANNELS

YouTube

YOUTUBE CHANNEL

@lifeiseas

DISCARD VALORIZATION PLANT

THE iOBSERBER SYSTEM

iSEAS
http://lifeiseas.eu/es/

THE LIFE iSEAS PROJECT

MARTEC18
https://www.martec2018.com/

LIFE iSEAS: RESULTS AND CONCLUSIONS

CONTACT

Contact person:
Ricardo I. Pérez-Martín
Tel: +34 986 231 930
Fax: +34 986 292 762
Email: ricardo@iim.csic.es

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