# UNDULATE RAY (*RAJA UNDULATA*)

## Projects about this species in Europe

Novembre 20th, 2014

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# Map of the ICES areas

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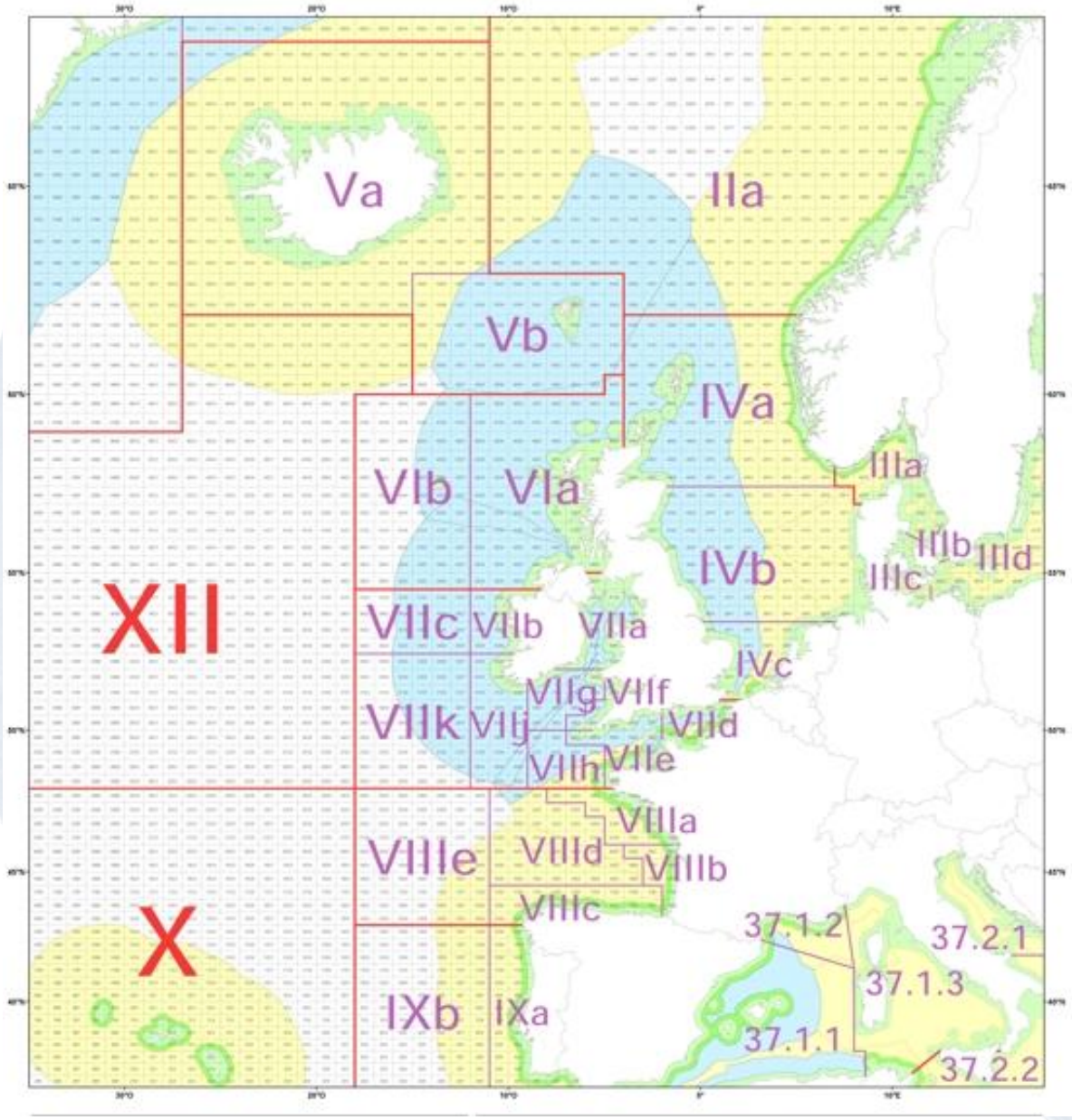

# NEPTUNE

## National Evaluation of Populations of Threatened and Uncertain Elasmobranchs

ICES : Div. VII d,e

## INTRODUCTION

### The project

**Area of study :** Status of undulate ray along the **south coast of England** (UK).

**Goals**: To better identify **distribution** of undulate ray along the coastline of southern England, including the locations of their **nursery grounds** in relation to proposed network of Marine Conservation Zones (MCZs), and their **movements and habitat use**.

**Schedule**: Field work for **juveniles** is being undertaken in October 2014, with work for looking at **adult** fish scheduled for the spring of 2015.

**State of progress**: In progress.

**Previous data on undulate ray**: Yes.
Information on the **distribution** of undulate ray collated, with dedicated sampling also undertaken as part of an earlier project on **skate discard survival**; **at-vessel mortality** examined for inshore vessels; **tagging** programmes; general **biological** studies; scientific trawl **surveys**.

### The partnership

**Partners :** Department of Environment, Food and Rural Affairs (Defra), Natural England (NE), Inshore Fisheries and Conservation Authorities (Southern and Sussex areas), Shark Trust, JNCC, local fishermen.

**Key contact persons:**
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## METHODOLOGY

Data collected using **chartered commercial fishing** vessels; other data collected during **existing scientific trawl surveys** in the English Channel.

## INVOLVEMENT OF FISHERMEN

- Work undertaken to date has all been collected by **scientists** (including field studies on chartered fishing vessels).
- Further involvement of fishermen to collect **additional data** will hopefully be included in future projects.

## RESULTS AND FEEDBACK

Initial synthesis of the **biology** of undulate ray published :
Ellis, J. R., McCully, S. R. and Brown, M. J. (2012). An overview of the biology and status of undulate ray *Raja undulata*. Journal of Fish Biology, 80: 1057–1074.)

Information on **discard survival** of undulate ray and other skates in the following report :
Ellis, J. R., McCully, S. R., Silva, J. F., Catchpole, T. L., Goldsmith, D., Bendall, V. and Burt G. (2012). Assessing discard mortality of commercially caught skates (Rajidae) – validation of experimental results. Report to Defra, 142 pp. (see http://sciencesearch.defra.gov.uk/Default.aspx?Menu=Menu&Module=More&Location=None&Completed=0&ProjectID=17021)

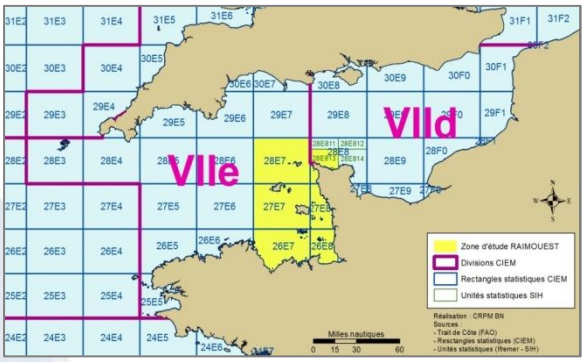
ICES: Div. VIIde

# RAIMOUEST

## Introduction

### Context

**Undulate ray landings have been banned since 2009** while this species appears to be **very abundant in the Normand-Breton Gulf** (ICES Division VIIe). The lack of information resulting in **poorly stock knowledge** is mainly due to poor landings data (recording as miscellaneous rays; no landings since 2009) and lack of scientific survey in VIIe. The landings ban has induced **discards** and **stocks diagnostic issues.**




Area of study (yellow) in the English Channel

### The partnership

**Partners:** Regional fishery committee of Basse-Normandie CRPMEM BN, Ifremer, APECS (NGO), SMEL (technical organization) and fishermen
**Financial backers :** FEP, Regional council of Basse-Normandie, Departmental council of Manche, France Filière Pêche and National fishery committee of French
**Key contact persons:**
- CRPMEM BN, Nicolas LEBLANC, +33 (0) 2 33 44 83 84, nicolas.leblanc@crpbn.fr
- Ifremer, Alain TETARD, +33 (0) 2 31 51 56 45, alain.tetard@ifremer.fr

### The project

**Area of study:**
**Normand-Breton Gulf** (NBG) in the Southeast of the western English Channel (VIIe) with an extension to the **North Coast of the Cotentin peninsula** in the eastern English Channel (VIId)

**Schedule**: April 2012 - April 2014
**State of progress**: Achieved, submitted to the ICES WGEF in June 2014 (1)
**Previous data on undulate ray**: No

**Goals**:
1) **To improve fisheries data** on the main ray species caught in the NBG (focus on the undulate ray)
   - to describe the **fisheries for rays**
   - to provide informations on **spatial distribution** and **stocks status indicators**
   - partnership with the RECOAM project focusing on **biological data**
2) **To propose appropriate management measures** for sustainable exploitation of undulate ray

## Methodology

### Desciption of the ray fisheries in the NBG, 2012

**Rays fisheries fleet** was identified and characterized using the fishing commitee fleet database. Rays **fishing strategies** were described by métiers **using face-to-face interviews (n= 68).**
The **proportions of each ray species** in the total catch of rays were estimated from **inquiries**, **samplings at sea**, and **sales** of rays by species at Cherbourg auction.

### Indicative level of undulate ray catches

- **Before the ban**: the **decrease step in the total ray landings between 2007-08 and 2009-10** can be analyzed as the loss of undulate ray and give an indicative level of the landings of this species.
- **After the ban**: discards of undulate ray based on French on-board observations (both the standard DCF and RAIMOUEST samplings) was estimated by **raising observed discards to the total French fishing fleet**.

### Spatial distribution

The **spatial distribution** was mapped by species at the **NBG** level from the ray catch composition specified by **fishermen inquired** on their fishing area and at the **English Channel** level from the location of the catches by ray species in the **samplings at sea** (standard DCF and RAIMOUEST samplings: 7396 fishing operations).

# RESULTS

## Desciption of the ray fisheries in the NBG, 2012

- **63 % of the fleet operating in the NBG was involved in ray fishing** (catching or having caught rays before the undulate ray landings ban).
  ➔ **289 vessels**, about half of **coastal trawlers/dredgers** and half of **small size netters and longliners** (average length = 9m).
- Bottom trawling and longlining: rays caught as **bycatch.**
  Netting for rays: **occasional activity** (small tidal coefficient, algae constraints…).
- Undulate ray is the **main ray specie** caught in the **NBG.**
- Fishermen indicate a **spectacular jump of undulate ray abundance**.

Proportions of each ray species in the total catch of rays

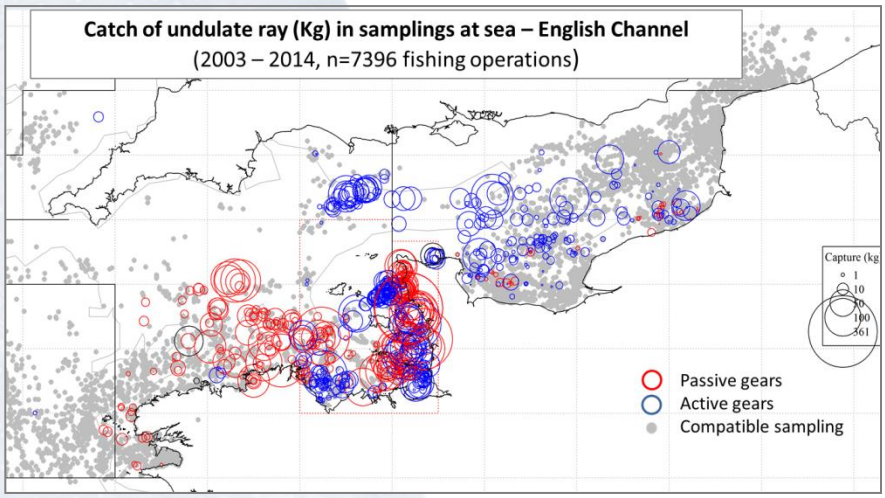
| Species | Inquiries before 2009 GNB (%) | Sampling at sea 2005-2014 GNB (%) N=1387 fishing operations | Sales at Cherbourg auction 2008 (%) |
|---|---|---|---|
| ***R. undulata*** | **74** | **50** | **58** |
| *R. brachyura* | 17 | 30 | 26 |
| *R. montagui* | 2 | 2 | |
| *R. clavata* | 5 | 5 | 10 |
| *R. microocelata* | 2 | 3 | 5 |
| *Raja spp.* | - | 11 | - |

## Undulate ray spatial distribution

- Undulate ray seems to form a **discrete stock in the English Channel (VIIde).**

- **NBG represent the main area of abundance** (undulate ray is **highly dominant on coastal waters**).

- **Connection to areas of lesser density** in other parts of the English Channel.



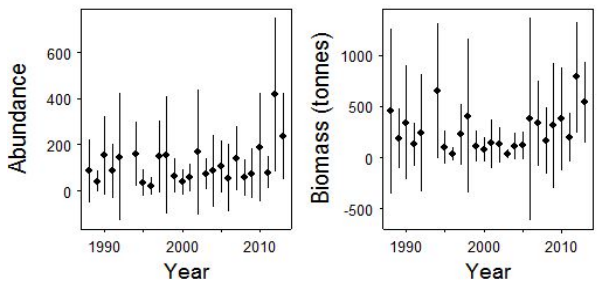

## Indicative level of undulate ray catches

- **Before the ban**, **the annual French landings** were estimated **at least as 300 tons in the Western English Channel (VIIe)** and as **160 tones in the NBG**.

- **After the ban**, **annual discards by French bottom otter trawl fleet in VIIe** were estimated to **750 tons** in 2011-2013. These analysis could not be performed so accurately for gillnet nevertheless the **total discards of undulate ray of marketable size (>50cm) by all métiers of the French fleet in VIIde in 2013** was estimated to **1500 tons** during ICES WGEF 2014[(2)].

➔ **high potential of landings**

## Other results: abundance and biomass indices of undulate ray from CGFS survey (VIId)[(2)]




2012-2013 / 2007-2011 **abundance indices shows an increase of 320 %** (French CGFS surveys in VIId)


For more:

(1) N. LEBLANC, A. TETARD, V. LEGRAND, E. STEPHAN, L. HEGRON MACÉ. RAIMOUEST: the French fishery of rays in the Western English Channel (VIIe), 2014 update. Working paper presented at the 2014 WGEF, 17-26 June 2014, 28 p.

(2) ICES (2014). Report of the Working Group on Elasmobranch Fishes (WGEF), 17–26 June 2014, Lisbon, Portugal. ICES CM 2014/ACOM:19. 671 pp.

# RECOAM - Raies Eaux Côtières Atlantique et Manche

## ICES Div : VIIe, VIIIa,b

# INTRODUCTION

## The partnership

**Project leader :** Association Pour l'Etude et la Conservation des Sélaciens (APECS).

**Technical, logistical and scientific partners :**

- Comités Régionaux des Pêches Maritimes et des Elevages Marins de Basse Normandie et de Poitou Charentes,
- Comités Départementaux des Pêches Maritimes et des Elevages Marins des Côtes d'Armor et d'Ille et Vilaine,
- Syndicat Mixte pour l'Equipement du Littoral,
- Association du Grand Littoral Atlantique,
- Centre Régional d'Expérimentation et d'Application Aquacole,
- Laboratoire BioGeMME de l'Université de Bretagne Occidentale.

**Financial backers :** Agence des Aires Marines Protégées, France Filière Pêche via le Comité National des Pêches Maritimes et des Elevages Marins, Ministère en charge de l'environnement (DEB), Conseils Régionaux de Basse Normandie et de Bretagne, DREAL Bretagne, Fondation Nature et Découvertes, Save Our Seas Foundation.

**Key contact persons:** APECS, Eric STEPHAN / eric.stephan@asso-apecs.org / +33 (0)6 77 59 69 83

## The project

**Area of study :** France, **Atlantic** and **English Channel**, with **2 field work areas**: Pertuis-Charentais and mouth of the Gironde in Atlantic and normand-breton Gulf in the western English Channel.

**Goals**:Contribute to enhance knowledge on:

1. **length at maturity** for each area which is a fundamental parameter given its importance in the assessment models
2. **skates movements** which could contribute to identify important grounds in their life cycles
3. **population structure** which is essential for abundance assessment

**Schedule**: April 2012 to December 2014 (33 months).

**State of progress**: In progress.

**Previous data on undulate ray**:

- Yes about **length at maturity** but based on studies from Portugal (Coelho and Erzini 2006, Moura et al. 2007).
- No for **movements and population structure**

# METHODOLOGY

**Cost compensated fishing trips** targeting skates are done with **volunteer coastal fishing vessels**, mainly gillnetters and demersal longliners to collect **biological data** and tissue samples for a **genetic study**, and to **tag and release** skates. Areas fished are determined based on fishermen knowledge and experience and gear deployment are of commercial duration for longline and are shorter for gillnets when possible (24h instead of the standard 30-48h).

The database is also updated by data collected by **scientific observers** in the frame of two other regional projects set up in the French waters, the project RaieBECA in the Bay of Biscay and the project RAIMOUEST in the Normand-Breton Gulf.

For the Bay of Biscay study area, the database is also updated using **tagging data from fishermen self-tagging operations** designed in the frame of the project RaieBECA.

Partnership was also established with a **professional fishing guide** in the central Bay of Biscay study area who also contributed to the tissue sampling and tagging.

Tissue samples are also collected from additional geographic areas during **IFREMER scientific surveys** in the eastern English Channel and Bay of Biscay, in the frame of the **French observations at sea program OBSMER**, during **fish market sampling** realized by the Station de biologie marine de Concarneau - MNHN and by a professional fishing guide in the Arcachon Basin in the Bay of Biscay. Few samples were also collected from Morocco and Ireland.

To enhance the recovery of information on recaptured tagged skates, **information posters** were widely distributed on the English Channel and Atlantic French coasts and a **media campaign** was executed. Recapture data can be supplied by telephone or via an online form.

# INVOLVEMENT OF FISHERMEN

16 surveys in Atlantic

26 surveys in the English Channel

5 commercial fishermen involved in Atlantic

9 in the English Channel

# RESULTS AND FEEDBACKS

**Preliminary results** presented in a working document for the ICES WGEF meeting in June 2014:
- **Length at maturity** ,
- **Conversion factors**,
- **Movement patterns** and **population genetic structure** of undulate ray (Raja undulata) around the French Atlantic and English Channel coasts.

| Area | Sex | Number of fish used (number of females between 70 and 93cm used) | Number of mature fish | First maturity | Largest immature | 50% mature $L_{50}$ |
|---|---|---|---|---|---|---|
| Central Bay of Biscay | M | 806 | 402 | 74 | 87 | 81,2 |
| | F | 353 (80) | 75 | 79 | 85 | (84,0) |
| Normand-Breton Gulf | M | 889 | 594 | 74 | 91 | 78.2 |
| | F | 289 (79) | 119 | 78 | 86 | (82,8) |

Summary table of maturity data

For more : E. Stephan, C. Hennache, A. Delamare, N. Leblanc, V. Legrand, G. Morel, E. Meheust, JL. Jung, Length at maturity, conversion factors, movement patterns and population genetic structure of undulate ray (Raja undulata) along the French Atlantic and English Channel coasts: preliminary results, Working paper presented at the 2014 WGEF, 17-26 June 2014, 16 p.

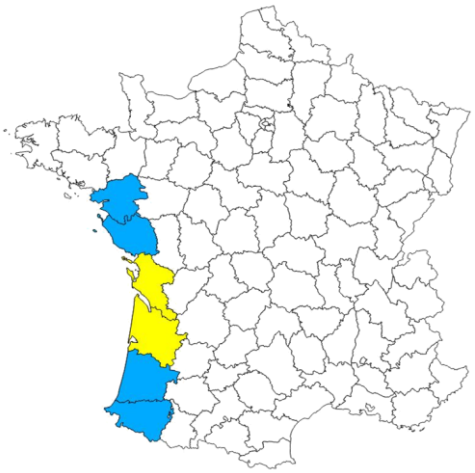
ICES : Div. VIIIa,b

# RaieBECA

## Introduction

### Context

This project was launched after the undulate ray landing ban, because of the lack of scientific evidence demonstrating that the species is an endangered one in the Bay of Biscay.



Areas of the project (in blue) and for the abundance estimate of the stock (in yellow)

### The partnership

**Partners :** fishermen and regional committees of Aquitaine, Poitou-Charentes, Pays de la Loire, the regional technical organization CREAA, the interregional organization AGLIA, NGO APECS and Ifremer.
**Financial backers :** France Filière Pêche, the regional councils of Brittany, Pays de la Loire, Poitou Charentes, Aquitaine.
This project was carried out in close relation with the RECOAM project, carried out by the NGO APECS.
**Key contact persons:**
- AGLIA, Elodie Etchegaray- 05 46 82 60 60, etchegaray.aglia@orange.fr
- CREAA, Cédric Hennache- 05 46 47 51 93, c.hennache.creaa@orange.fr

### The project

**Area of study :** central part of the **Bay of Biscay** (Pertuis-Charentais straits, Gironde estuary and coastal area in the vicinity), **France.**
**Goals**: For the population of the undulate ray:
- to investigate if the undulate ray population in the central part of the Bay of Biscay can be considered as a closed population and according to the result of this first step of the study, to estimate its abundance by mark-recapture, using a Petersen estimate.
- To estimate socioeconomical consequences of the ban of landing in 2009.

**Schedule**: November 2011-July 2014.
**State of progress**: Achieved.
**Previous data on undulate ray**: No.

## Methodology

### Socioeconomical study

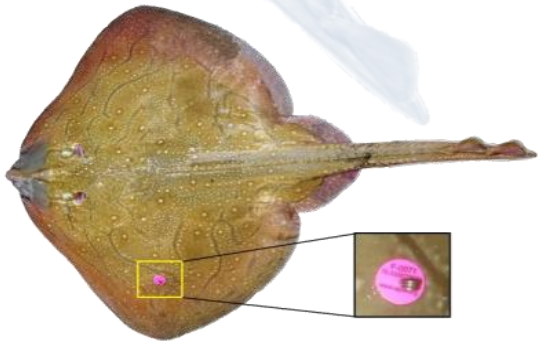
Data collected are **landing data** and the ones from **Community fleet register** for 2007-2008. **Surveys** are organized to collect the fishermen's empirical knowledge about biology of the stock and characteristics of the fishery before 2009.

### Tagging survey

The Undulate ray tagging was launched by the end of **2011** and carried out up to **2014**, gathering scientists of **several organizations** (Ifremer, CREAA, Apecs and Aglia) and fishermen. **Petersen discs** were used.

The tagging was carried out by :
- **scientific observers** on board of commercial fishing vessels,
  - in real commercial conditions (fishermen carry out usual fishing operations and do not target undulate ray)
  - or on chartered vessels in order to go in areas known for their high undulate ray abundance
- and **commercial fishermen** and **fishing guides** trained to do the tagging on their own.

For the abundance estimate, a split between rays shorter and longer than 65 cm in total length has been defined as a criteria to ease the voluntary work of fishermen.



Undulate ray tagged with Petersen disc
Copyright : CREAA

# RESULTS AND FEEDBACK

## Socioeconomical study

Before 2009, inshore small boats used to fish undulate ray to **increase their incomes**, for example for the winter. Also, fishing undulate ray could **make profits from trips when target species wasn't there**.

In the Poitou-Charentes, Aquitaine and Pays de la Loire Regional Council areas in 2007 and 2008:

- ✓ **Landings** of undulate ray were **82 to 120 t** per year.
- ✓ **Annual turnover** was **290 to 310 000€.**

The ban implications were :

- ✓ **Changes in working areas to avoid** high undulate ray abundance areas
- ✓ **No return on the investment** from purchases of nets

**Quantity of rays landed decreased to 50%,** in 2009. It couldn't be explained by the decrease of the vessels quantity (-5%).

## Involvement of fishermen

**23 trips** for tagging the rays, and to recapture them, with **commercial vessels**

**47 vessels** involved in 2013, with fishermen trained to tag skates on their own

**38% skates tagged** by commercial fishermen

## Tagging surveys

### RECAPTURE RATE

In November 2014, the **recapture rate** was **10%**: 2 916 undulate rays were tagged and 295 recaptured by **various stakeholders:** 56% by scientific observers, 38% by commercial fishermen, 4% by fishing guides, and 2% by the CREAA (study of survival rate).

### AN ISOLATED STOCK (JUNE 2013)

The **average distance** between tagging and recapture are **10 km**. The hypothesis of an **isolated stock in the central part of Bay of Biscay** has been confirmed.

### ABUNDANCE ESTIMATE (JUNE 2014)

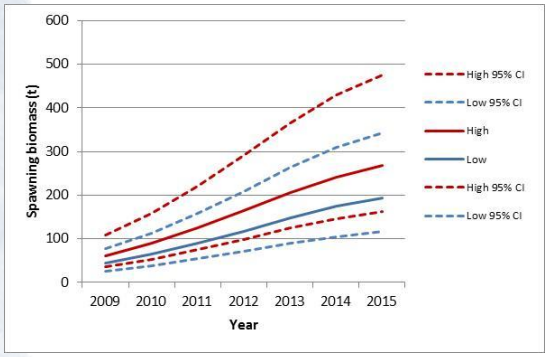
According to 2011-2014 tagging and recapture positions, **4 habitat areas** were identified: Gironde Estuary, West Oléron, Pertuis d'Antioche, and Pertuis Breton.

Biomass estimate in the Bay of Biscay for the part of the stock formed by the larger fish (>65 cm length), for the winter of 2007-2008 :

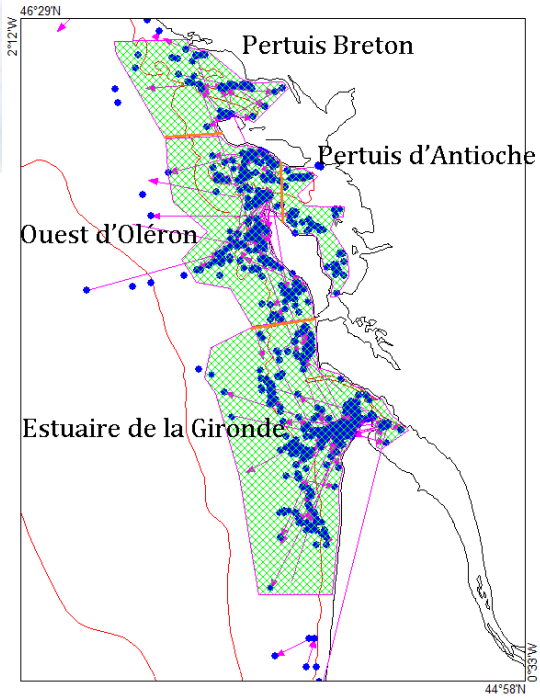
- ✓ For the Gironde Estuary, biomass is estimated to 51 to 70 tons
- ✓ Biomass for the global area, Pertuis/Gironde, is estimated to 87 to 120 tons.

A simulation based on the mark-recapture abundance estimates and conditional on no fishing mortality from 2009 onwards shows that the **biomass has increased** in response to the fishing ban.

For more : BIAIS G., HENNACHE C., STEPHAN E., DELAMARE A., Mark-recapture abundance estimate of undulate ray in the Bay of Biscay, Working Document presented at WGEF 2014, Lisbon, 17-26 June 2014, June 2014, 11p.




Simulation of the spawning biomass (more than 7 years) from 2009 to 2015 - Copyright : Ifremer




Undulate ray habitat areas in the centre of the Bay of Biscay Copyright : Ifremer)

# IM11RAYAS

ICES : Div. VIII c

Basque Country, Spain

## INTRODUCTION

### Context

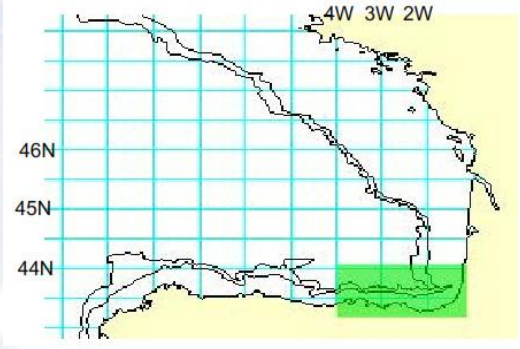
This project improved knowledge of the ray's fisheries in the Bay of Biscay (ICES Divisions, VIIIc and VIIIabd).

### The partnership

**Partners :** AZTI-Tecnalia (Basque Country) and IPMA, (Portugal).
**Financial backers :** Data Collection Framework (Europe).
**Key contact person:** Guzman Diez, AZTI-Tecnalia
Mail : gdiez@azti.es
Phone : 0034 946574000

### The project

**Area of study : Basque Country (Spain).**
**Goals**: Characterization of the rays landings of the Basque trammel net fleet (and trawler fleet) in the Bay of Biscay (VIIIc East).
**Schedule**: November 2011-2013.
**State of progress**: Achieved.
**Previous data on undulate ray**: No.




Green rectangle= Area of study in the Basque Country coast (VIIIc East).

## METHODOLOGY

### Specifically for R.undulata and other coastal rays

The period of sampling was the whole year (from January to December) in 2011, 2012, 2013. Up to **118 trip/hauls** of **21 vessels** (trammel nets) belonged to the **9 main ports** of the Basque Country were sampled with the aim to characterize :

- **SPECIFIC COMPOSITION OF THE LANDED RAYS**

Live weight of this species was calculated from the estimation of the individuals discarded on board.

- **SPECIES SPECIFIC LPUE**

The effort was estimated by the product of engine power (kW) and trip duration (days). The LPUE was calculated for every sampled trip, vessel and species, and then the proportion of landed rays was raised to the total fleet landings to estimate the landings of years 2011,2012 for each species to get the **GEOGRAPHICAL DISTRIBUTION OF THE CATCHES.**

### Involvement of fishermen

118 trips/hauls

21 vessels involved

# RESULTS AND FEEDBACK

## Ray species identified in the program

The sampling program has analysed and identified **1 225 rays** belonging to **7 species**: Raja clavata, Raja montagui, Leucoraja naevus, Raja undulata, Leucoraja fullonica, Leucoraja circularis and Raja brachyura.

No discards were reported for this species, except for R. undulata that is discarded according the current regulations.

**5%** of rays sampled were undulate rays (**56** fishes).

Specific composition of rays identified in the sampled trips.

| Species | n | % |
|---|---|---|
| *Raja clavata* | 736 | 60% |
| *Raja montagui* | 330 | 27% |
| *Leucoraja naevus* | 87 | 7% |
| ***Raja undulata*** *(estimated catches)* | **56** | **5%** |
| *Leucoraja fullonica* | 9 | 1% |
| *Raja brachyura* | 6 | 0% |
| *Leucoraja circularis* | 1 | 0% |
| **Total** | **1225** | |

## Weight of rays landed by the fleet

For undulate ray, the estimation was calculated from the individuals discarded on board. For undulate ray, the estimated landings are :
- In 2011 : 1.3 tons
-In 2012 : 1 ton.

Estimation of total weight of rays captured by the fleet

| Species | Ton 2011 | Ton 2012 |
|---|---|---|
| *Raja clavata* | 11.3 | 17.3 |
| *Raja montagui* | 4.7 | 7 |
| *Leucoraja naevus* | 1.8 | 1.4 |
| ***Raja undulata*** | **1.3** | **1** |
| *Leucoraja circularis* | 0.1 | 0.0 |
| *Leucoraja fullonica* | 0.1 | 0.3 |
| **Total** | **19.3** | **26.9** |

## Market prices

The price is variable in each port according the appreciation of these species by the local consumers.
The **average price** in the period 2009-2012 was 2.85 €/kg with **maximum** of 12.00 €/kg in 2009 and **minimum** of 0.12 €/kg.

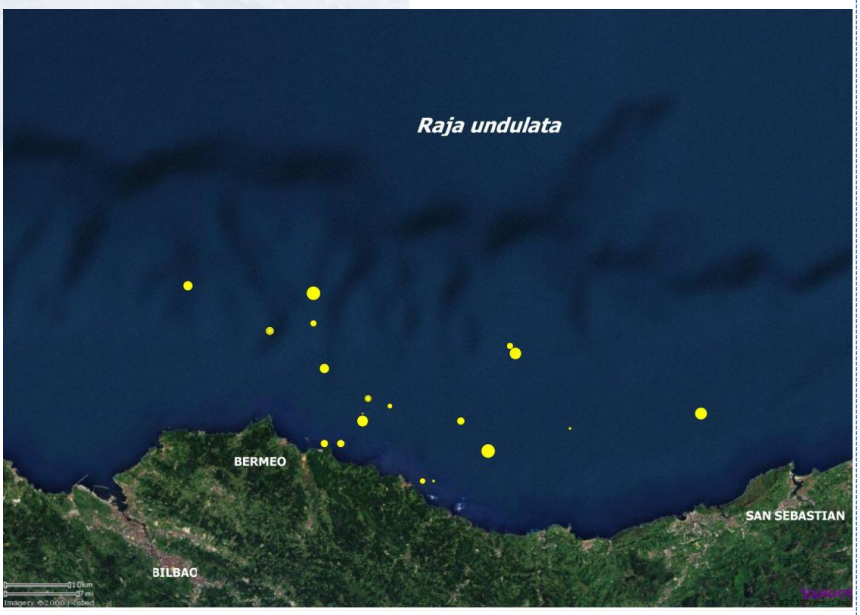
Average price (€/kg) of rays in the Basque Country (first sale in fishing auctions, all ray species combined)

| Year | Price (€/kg) | | |
|---|---|---|---|
| | Average price | Maximum price | Minimum price |
| **2009** | 2,66 | 12,00 | 0,12 |
| **2010** | 3,05 | 7,20 | 0,12 |
| **2011** | 2,86 | 6,22 | 0,12 |
| **2012** | 2,84 | 6,94 | 0,12 |
| **Average price** | **2,85** | **8,09** | **0,12** |

## Undulate ray specific LPUE

R. undulata caught in the trip was discarded according the current regulations. The LPUE were plotted on the fishing area map (Basque Coast, VIIIc east) in the period 2011-2013.

R. undulata was found only in 25 trips/hauls, but was also **widely distributed** in the fishing area from the shallower waters to more than 200 m depth where the highest LPUE values were recorded (0.33 kg of live weight/Kw).




Distribution area of the R. undulata along the Basque Coast as showed by retained catches (LPUE=kg live weight/Kw*day)

For more : DIEZ. G.1, MUGERZA, E. IRIONDO, A., and SANTURTUN, M., Characterization of the rays catches of the Basque trammel net fleet in the Bay of Biscay (VIIIc East), Working Document for the ICES Working Group on Elasmobrach Fishes (WGEF) Lisbon, 17 to 26 June 2014, 11 pp.

# UNDULATA

## Population dynamics of the Raja undulata of the continental Portuguese coast

ICES : Div. IX a

# INTRODUCTION

## Context

Recently fishermen and vessel's owners of the artisanal fleet whose vessels operate along the Portuguese continental coast are quite apprehensive with the prohibition of *Raja undulata* fishing that was settled by EU in 2009 (CE Regulation No 43/2009, 23/2011, 57/2011 and 43/2012). According to them this ban has had **severe socioeconomic repercussions**, particularly on fishing communities located in areas where the species tends to concentrate.
Portuguese stakeholders, as others from other European countries, continue not to understand the reasons that lead to the implementation of this EU measure. From a scientific point of view it was also referred that there is **no scientific justification for the current prohibition** (ICES, 2014).

In mainland Portugal, the **lack of accuracy of fishery dependent data on rays and skates**, particularly on species identification, hinders the availability of historical landing data. Time series of landings by species is a basic and crucial information in stock assessment. Regarding fishery independent data, the Portuguese research surveys are not designed to inform on *R. undulata*. The **shallow and patchiness spatial distribution** of the species have contributed to lack of data derived from the Portuguese surveys, which do not include fishing hauls close to the coast.

These **data deficiencies** are the main reasons for the **uncertainty on stock status** of *R. undulata* in mainland Portugal.
The project UNDULATA, coordinated by IPMA was proposed to address this deficiency. The project is focused on the *R. undulata* and was constructed considering the actual EU regulation.

UNDULATA aims to contribute with relevant information on the **species knowledge**, particularly on the current exploitation status of the stock. The project will further provide information on the evaluation of **alternative management measures**, which has been also suggested by ICES (2014) to the different stocks within ICES area. According to ICES, given the **distribution patterns** of the species, it might be more appropriated to adopt **local management measures**.

## The partnership

**Partners :** IPMA.
**Financial backers :** European Fisheries Fund and Portuguese government.
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## The project

**Area of study : Portugal mainland.**

**Goals**: The main goals of the project are:
- Study the structure and spatial and temporal **dynamics** of the species, particularly in **areas of high abundance** of the species;
- Estimation of **growth rates** and abundance indexes;
- Estimation of **migration rates**;
- Evaluation of **migration patterns** and **spatial connectivity**;
- Determination of **survival rates** according the life cycle phase;
- Evaluation of the degree of **genetic differentiation** between the main occurrence areas of the species.

**Schedule**: June 2014-December 2015.
**State of progress**: In progress.
**Previous data on undulate ray**: Yes.

Area of study

# Previous data on undulate ray

Most of the studies carried in Portugal mainland have been focused on the distribution and biology of *Raja undulata* and have been carried out by IPMA.

In mainland Portugal, the species is distributed along the **continental coast,** being more frequently caught in the some areas of **north** of **Matosinhos** and **Aveiro**, in the **centre** of **Peniche**, in the **southwest coast** of **Setúbal** and in the **Algarve** (Fig. 1).

*R. undulata* occurs mainly associated to **sandy or coarse sandy bottoms**. Juveniles are observed in **estuarine and lagoon habitats**, like Tagus River (centre of Portugal) and Ria Formosa (south of Portugal). The range of its bathymetric distribution varies from **4 to 128 m deep** however it is more abundant between **30 and 40 m deep**. The occurrence of **egg-laying sites** are located along the coast between **10 and 55 m depth**, but preferentially tend to occur at depths **shallower than 30 m**. **Estuaries and coastal lagoons** are likely to be important habitats for the species, particularly to newborn/juveniles and egg-laying females where both groups tend to concentrated in some periods of the year.

The Table 1 below summarizes the main biological informations available for *Raja undulata* at the Portuguese continental coast.

| **Period** | | 1999-2001 | 1999-2001 | 2003-2006 | 2001-2008 | 2003-2013 |
|---|---|---|---|---|---|---|
| **Region** | | Algarve | Algarve | Centre | North/Centre | North/Centre |
| **Depth range (m)** | | - | - | - | - | 4 to 128 (mostly 30-40) |
| **Egg-laying depth range (m)** | | - | - | - | - | 10 to 55 (mostly < 30) |
| **TL range** (cm) | | 19.4-88.2 | 32.0-83.2 | 23.7-90.5 | 48.0-95.9 | 23.5-95.9 |
| $L_{50}$ (cm) | F | 76.2 | - | 83.8 | - | 86.2±2.6 |
| | **M** | 73.6 | - | 78.1 | - | 76.8±2.4 |
| $I_{50}$ (years) | F | 8.98 | - | 9 | - | 8.7±0.3 |
| | **M** | 7.66 | - | 8 | - | 7.6±0.4 |
| **$M_{50}$ (cm)** | | - | - | - | - | 95.7±15.3 |
| **Reproductive period** | | Dec-Feb | - | Feb-May | - | Dec-Jun |
| **Fecundity** (eggs per female) | | - | - | - | - | 69.8±3.4 |
| **Fecundity/batch** (eggs per female) | | - | - | - | - | 15 |
| **Number of batches** | | - | - | - | - | 3.6 |
| **Size-at-birth** (cm) | | - | - | - | - | 13.5 |
| $L_{max}$ (cm) | | 88.2 | 83.2 | 90.5 | - | 95.9 |
| **$L_\infty$** (cm) | | 110.2 | 119.3 | 113.7 | - | - |
| **k** ($year^{-1}$) | | 0.11 | 0.12 | 0.15 | - | - |
| **$t_0$** (years) | | -1.58 | -0.41 | -0.01 | - | - |
| $I_{max}$ (years) | | 13 | 9 | 12 | - | 12.6 |
| $I_\infty$ (years) | | - | 28.9 | 23.6 | - | - |
| **TW ~ $aTL^b$** | **a** | - | - | - | $1.92*10^{-5}$ | - |
| | **b** | - | - | - | 2.86 | - |
| **r'** (method : Jennings et al. (1999) | | - | - | - | - | 0.49 |
| **M** (method : Jensen 1996) | | - | - | - | - | 0.24 |
| (method : Pauly 1980) | | - | - | - | - | 0.27 |
| **References** | | [1], [2] | [3] | [3] | [4] | [5] |

(*TL*: total length; $L_{50}$: size-at-maturity; $I_{50}$: age-at-maturity; $M_{50}$: size-at-maternity; Fecundity; $L_\infty$: asymptotic length; *k*: growth rate; $t_0$: size ate age-0; $L_{max}$: maximum observed length; $I_{max}$: maximum observed age; $I_\infty$: maximum theoretical age; $TW \sim aTL^b$: weight-length relationship; *r'*: potential rate of population increase; M: natural mortality)

[1] Coelho and Erzini 2002; [2] Coelho and Erzini 2006; [3] Moura et al. 2007; [4] Serra-Pereira et al. 2010; [5] Serra-Pereira et al. *submitted*.

# METHODOLOGY

## The mark-recapture program

A robust design was adopted by the **mark recapture program** carried on under the UNDULATA project.

According to this design two main tagging periods are considered: **October/November** and **April/May**.
In each period it is expected to tag around **1000 specimens** at the Center of Portugal (Peniche, Sesimbra and Setúbal) (Fig. 1).
Between the two tagging periods a **continuous monitoring program** of the fishing activity and on the level of recaptures will take place.

This monitoring program will include both **trips** to landing port and **onboard observations** at the neighborhood areas where tagging took place.

If conditions become favorable, the tagging program will be **extended** to the North, Póvoa do Varzim and Matosinhos, and to the South of Portugal, Portimão, Olhão and Tavira (Fig. 1).


Data from program

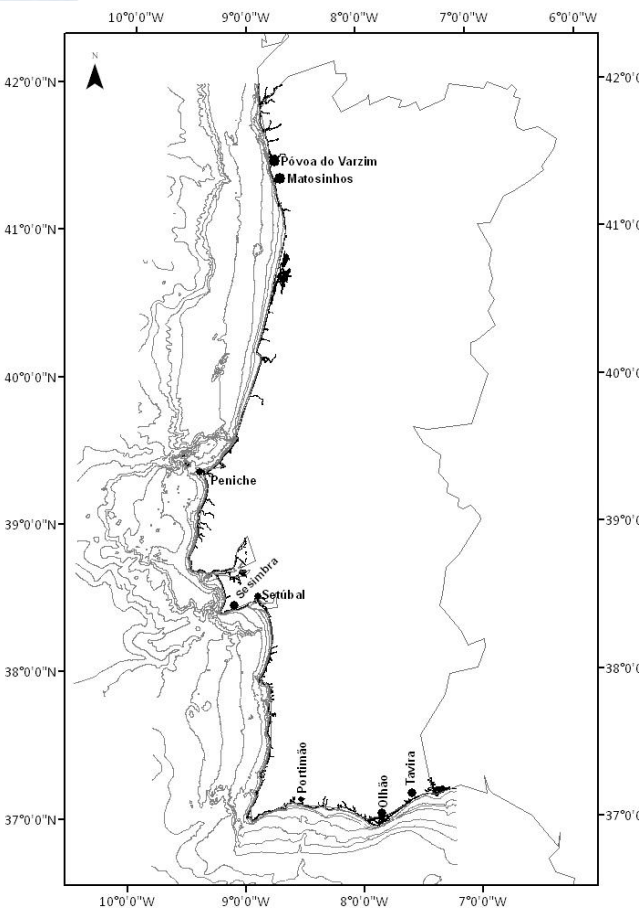
## Involvement of fishermen

Availability to **carry observers** to onboard to mark specimens.

**Self-sampling** - Collection of information on tagged and non-tagged specimens after each tagging period.

Collaboration on providing **historical information** on the **species** and on its **fishery**.

Fishery association – contribution to **divulgate** the Project.




Location of the fishing ports where the project will take place.

# RESULTS AND FEEDBACKS

First results scheduled for **December.**

For more : Figueiredo, I., Maia, C. and Serra_Pereira, B, 2014. Overview of the information available on Raja undulata from Portuguese mainland waters (ICES Division IXa). Working Document presented at WGEF 2014, Lisbon, 17-26 June 2014.