

# Deep-sea: Vulnerable Marine Ecosystems in the Atlantic Ocean:

## NEREIDA, ECOVUL/ARPA and ATLANTIS projects

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NEREIDA<sup>1</sup>, ECOVUL/ARPA<sup>2</sup> and ATLANTIS<sup>3</sup> Projects

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Programa de Pesquerías Lejanas  
Centro Oceanográfico de Vigo  
ESPAÑA



# Identification of VMEs in the High Seas

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-Since 2004, discussions on VME have been taking place at the United Nations General Assembly (UNGA). This process culminated in 2006 with the adoption of the UNGA Resolution 61/105.

-In 2009, FAO published the *“International Guidelines for the Management of Deep-Sea Fisheries in the High Seas”*

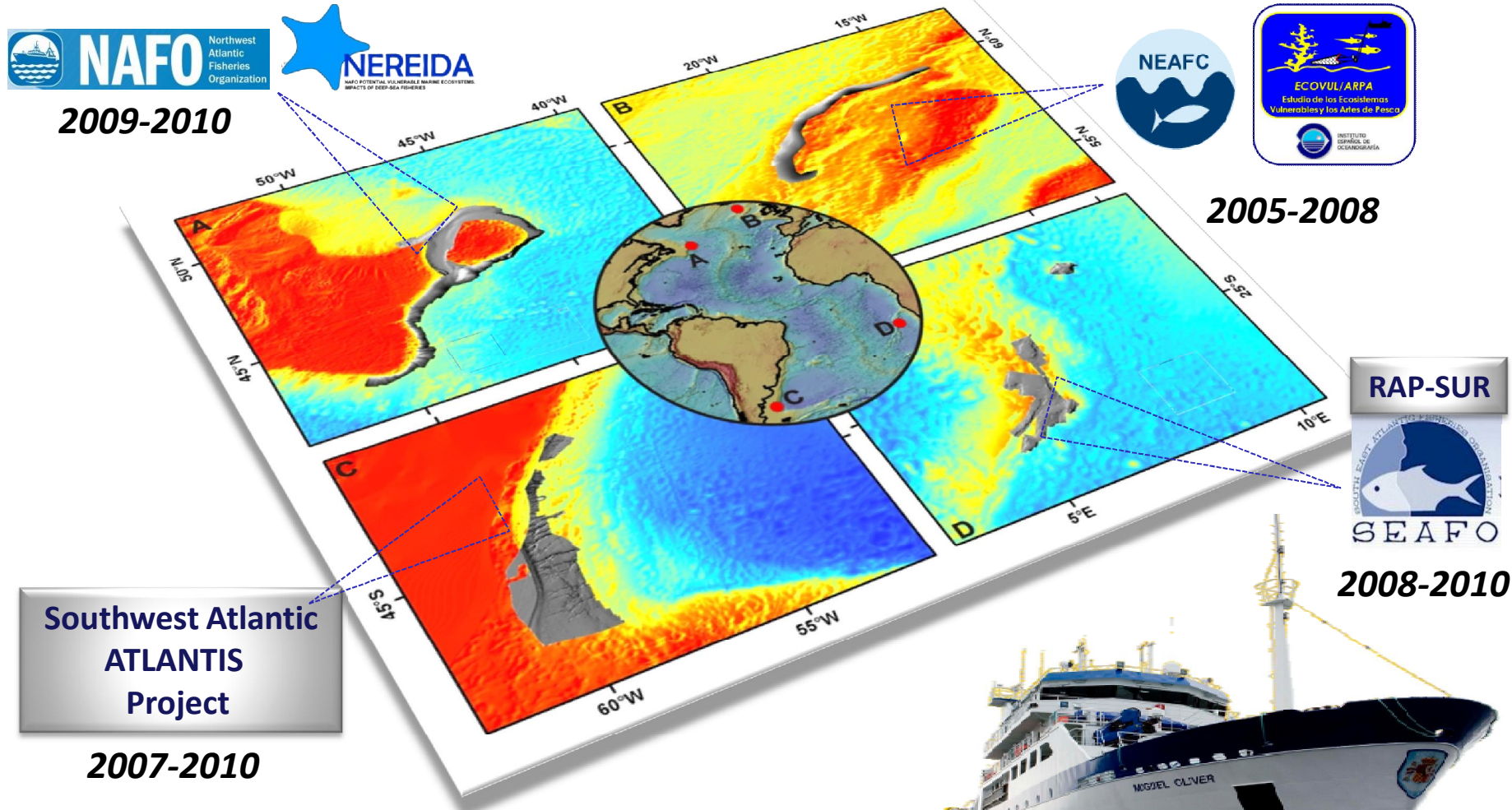


## Biological characteristics used as criteria in VME identification:

- Uniqueness or rarity
- Functional significance of the habitat
- Fragility
- Life-history traits of component species that may recovery difficult
- Structural complexity

# Identification of VMEs in the High Seas

Spain has undertaken, since 2005, an ambitious and costly program of scientific mapping of the seabed in different parts of the oceans:



# VME Case Studies



	<i>Ecovul-Arpa</i>	<i>Nereida</i>	<i>Atlantis</i>	<i>Rap-Sur</i>
<b>RFMO</b>	NEAFC	NAFO		SEAFO
<b>Multibeam (km<sup>2</sup>)</b>	18.760	68.900	59.100	15.823
<b>Seismic (km)</b>	1.121	18.600	91.900	1.455
<b>Box Corer</b>	13	341	209	
<b>Rock Dredges</b>	22	104	102	15
<b>CTD</b>		414	519	136
<b>Trawls</b>	38		413	63
<b>Commercial Hauls</b>	3.675	SLB-NAFO	12.788	1.267
<b>Cooperative Surveys</b>	+		+	+
<b>Photos/video</b>		+	+	

**Surveyed  
area ~ 19.000 km<sup>2</sup>**

**[~22,500 km<sup>2</sup>]**

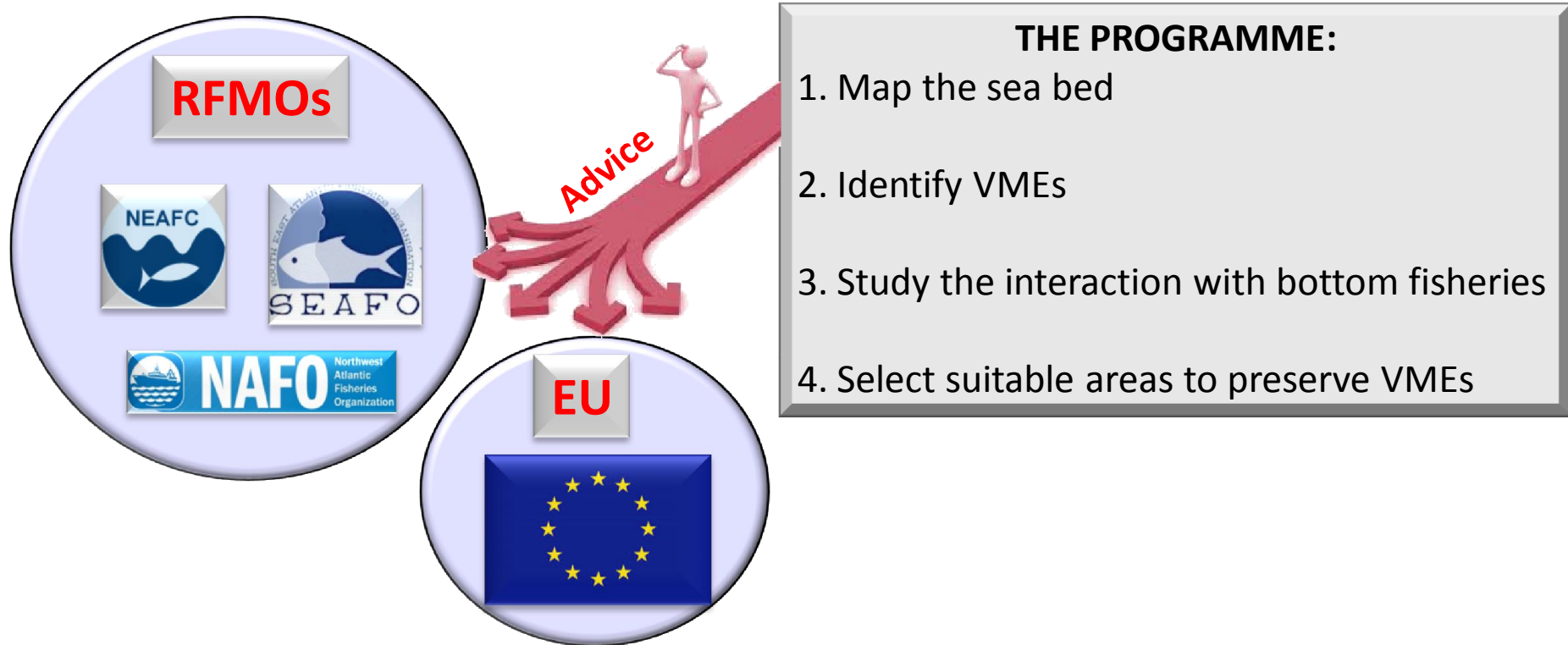
**Surveyed  
area ~ 69.000 km<sup>2</sup>**

**[~8,500 km<sup>2</sup>]**

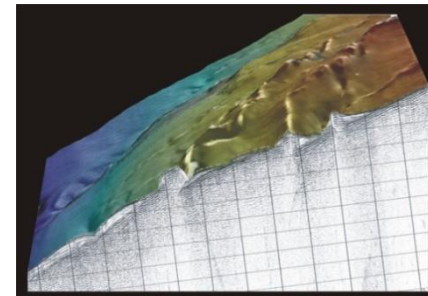
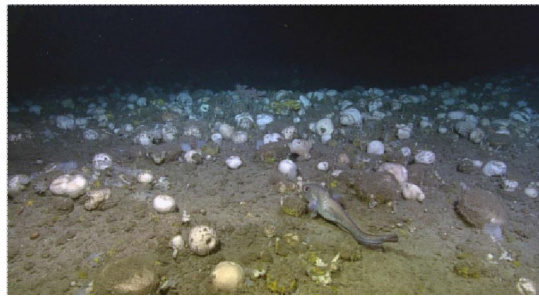
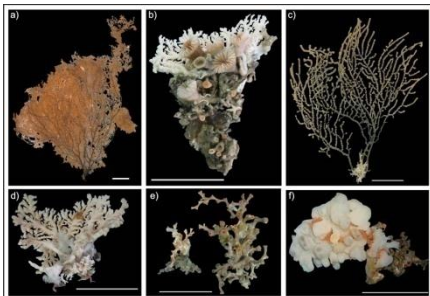
**Surveyed  
area ~ 59.000 km<sup>2</sup>**

**[~41,300 km<sup>2</sup>]**

# Research program in the Atlantic Ocean: Objectives

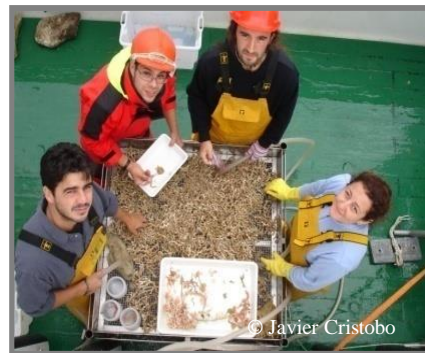
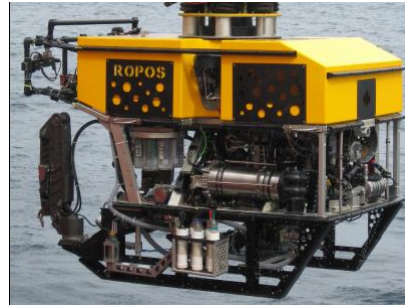


## UNGA Resolution 61/105 on protecting VMEs on the High Seas



# Research programme: Multidisciplinary Approach

- “ Conventional Fisheries Science
- “ Geomorphology
- “ Benthic Ecology
- “ Sedimentology
- “ Oceanography



# Northwest Atlantic: **NEREIDA project**



Main Researcher: **Dra. M<sup>a</sup> Mar Sacau Cuadrado**

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# NW Atlantic: NEREIDA Project

Nafo potEncial vulneRable marine Ecosystems.  
Impacts of Deep-seA fisheries

INTERNATIONAL PROGRAMME LEAD BY SPAIN

## Spain

SGM-SGP Secretaría General del Mar. Ministerio de Medio Ambiente y Medio Rural Marino  
IEO-Instituto Español de Oceanografía. Ministerio de Economía y Competitividad

## Canada

Geological Survey of Canada. Natural Resources  
Canadian Hydrographic Service. Fisheries and Oceans  
Ecosystem Research Division. Fisheries and Oceans

## UK

CEFAS-Centre for Environment Fisheries and Aquaculture Science

## Russia

Russian Academy of Sciences. P.P. Shirshov Institute of Oceanology.



Main Researcher: **Dra. Mar Sacau Cuadrado**

 [mar.sacau@vi.ieo.es](mailto:mar.sacau@vi.ieo.es)



# NEREIDA project: Objectives

## GENERAL OBJETIVE

NEREIDA SURVEYS HAVE AS MAIN OBJETIVE THE MULTIDISCIPLINARY RESEARCH OF THE SENSITIVE HABITATS AND FISHING ACTIVITIES AS WELL AS ANALYSIS OF THE FISHING RESOURCES FOR THE STUDY AND PROTECTION OF THE VULNERABLE ECOSYSTEMS

## SPECIFIC OBJETIVES

TO IDENTIFY THE PRESENCE AND DISTRIBUTION OF THE ORGANIMS THAT CONSTITUTE VULNERABLE MARINE ECOSYSTEMS (COLD WATER CORALS, LARGE SPONGES ...)

TO DESCRIBE THE ECOLOGY OF THE DEEP SEA HABITATS IDENTIFIED

TO MAP THE DISTRIBUTION OF VMEs AND OTHER TOPOGRAPHICALLY DISTINCT FEATURES IN THE AREA OF STUDY

TO CREATE AND MAINTAIN A GEOGRAPHIC INFORMATION SYSTEM DATABASE OF ALL INFORMATION COLLECTED DURING THE PROYECT



*R/V Miguel Oliver*

## MULTIDISCIPLINARY SURVEYS (2009-2010)

Cartography  
Benthic ecology  
Hydrography



*R/V Hudson*

# NEREIDA: Study area & surveys

## 6 MULTIDISCIPLINARY SURVEYS

68,900 km<sup>2</sup> Multibeam bathymetry  
18,606 km Sub-bottom profiles  
341 BoxCorer  
104 dredges  
414 CTD

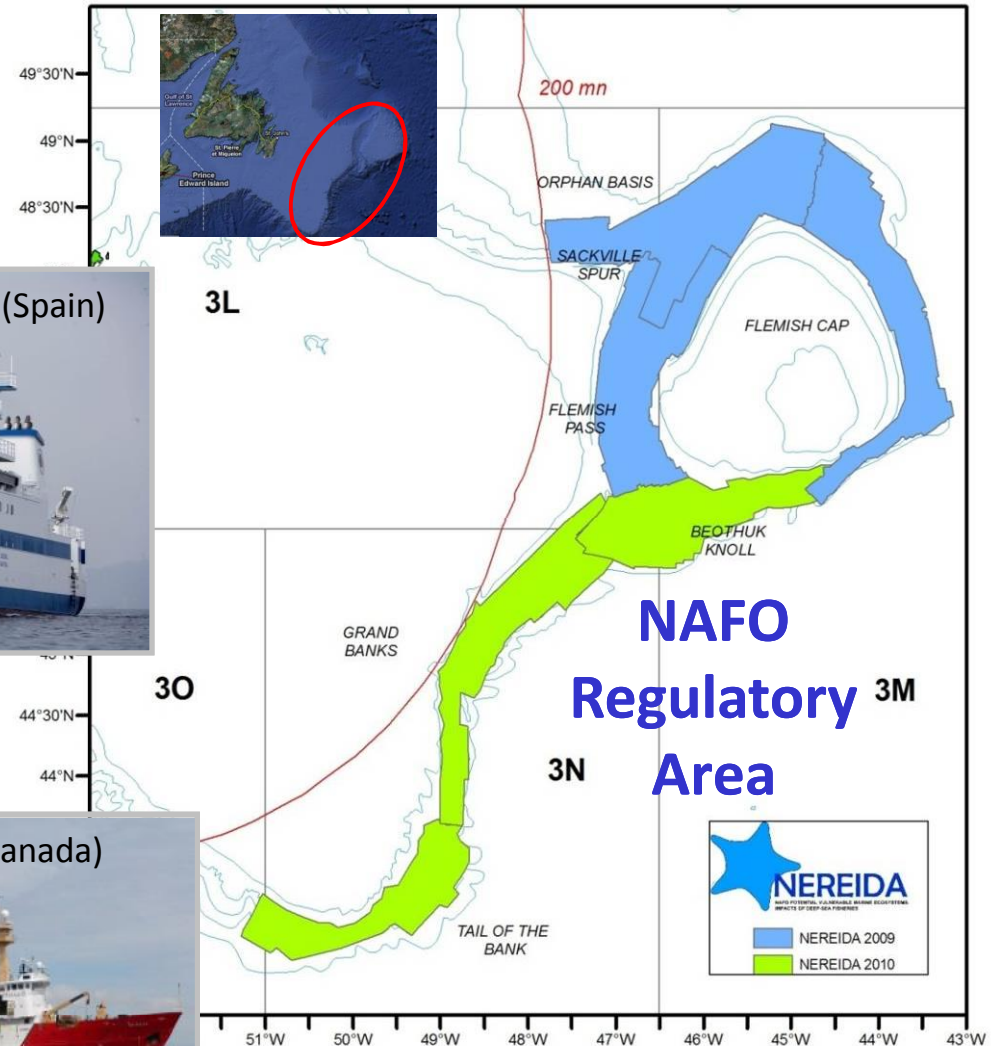
RV Miguel Oliver - SGM (Spain)



## 2 VISUAL SURVEYS

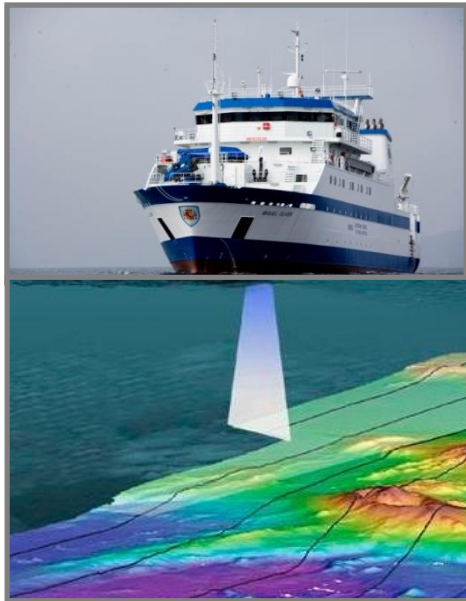
2,143 photos  
116 hr video footage

RV Hudson - DFO (Canada)

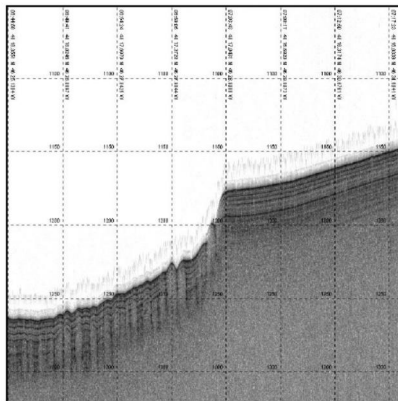


Surveyed area: ~69,000 km<sup>2</sup>  
(High-seas)

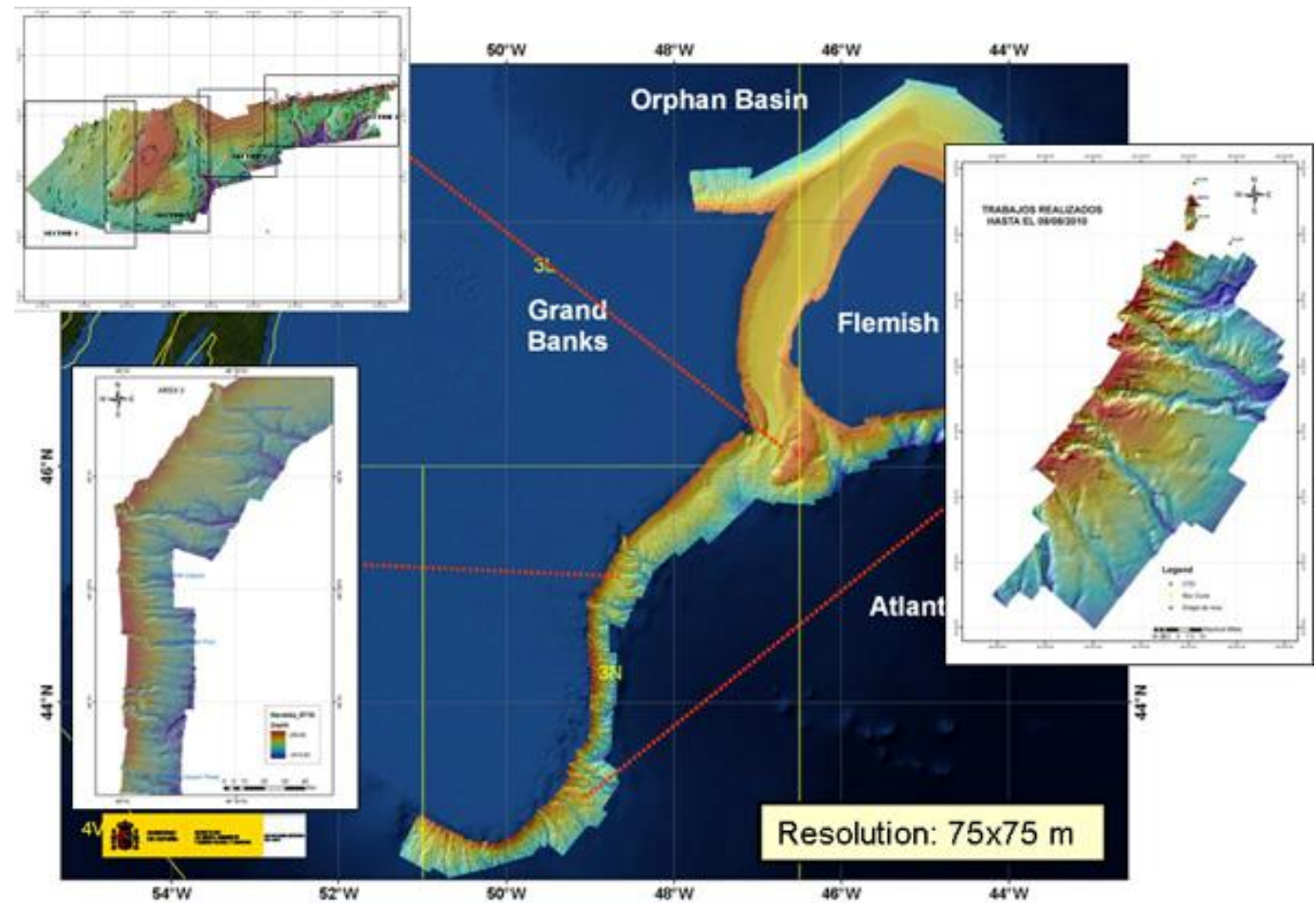
# NEREIDA project: Cartography



Multibeam echosounder  
Parametric sub bottom  
profiler (TOPAS)

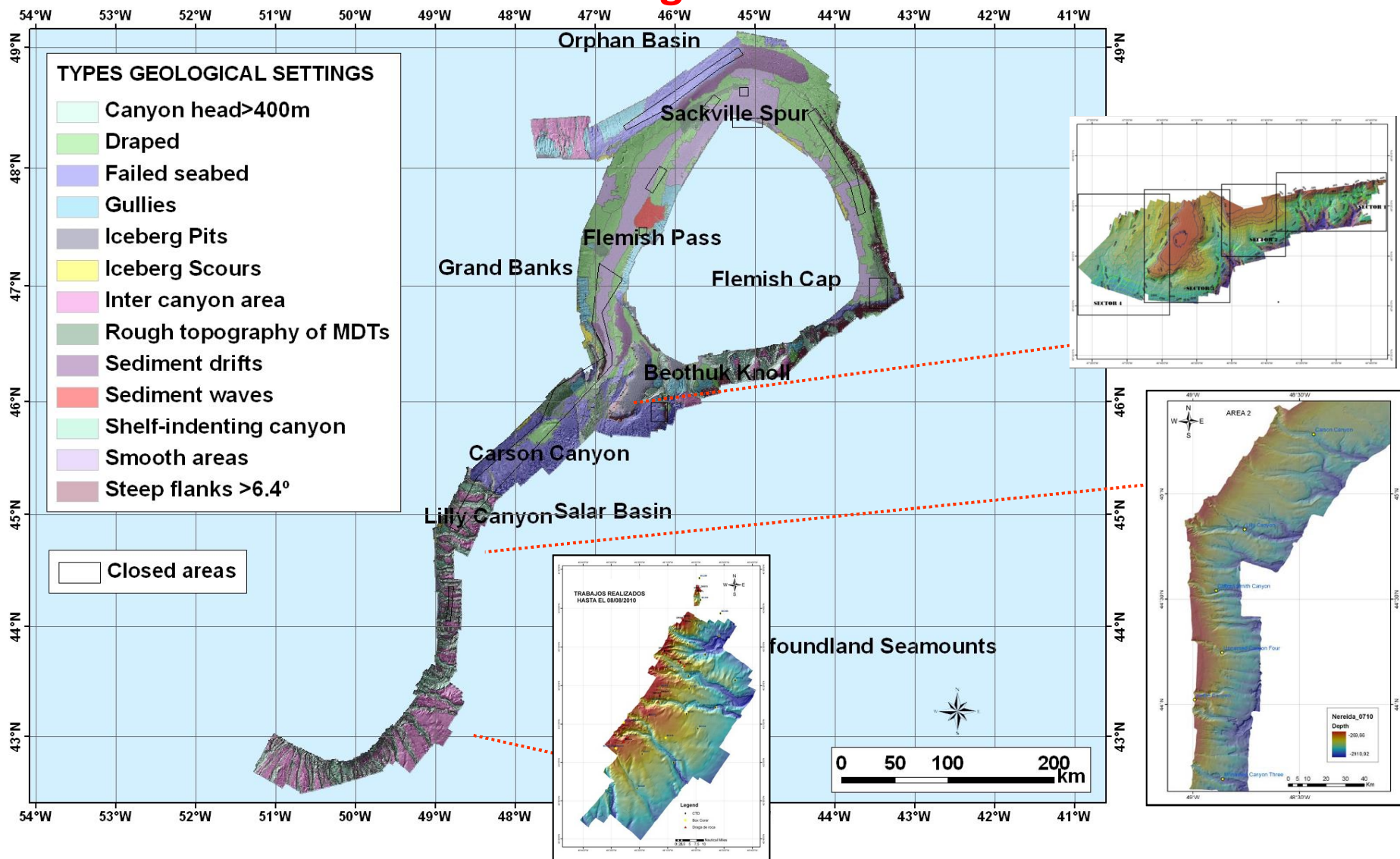


**Multibeam prospected area: 68,950 km<sup>2</sup>**  
**TOPAS lines: 28,113 km**



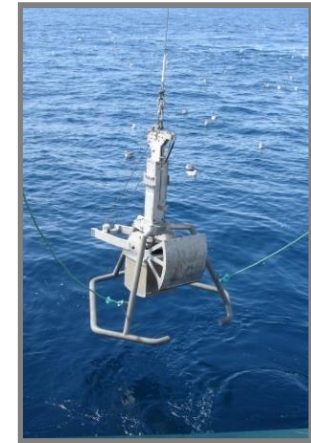
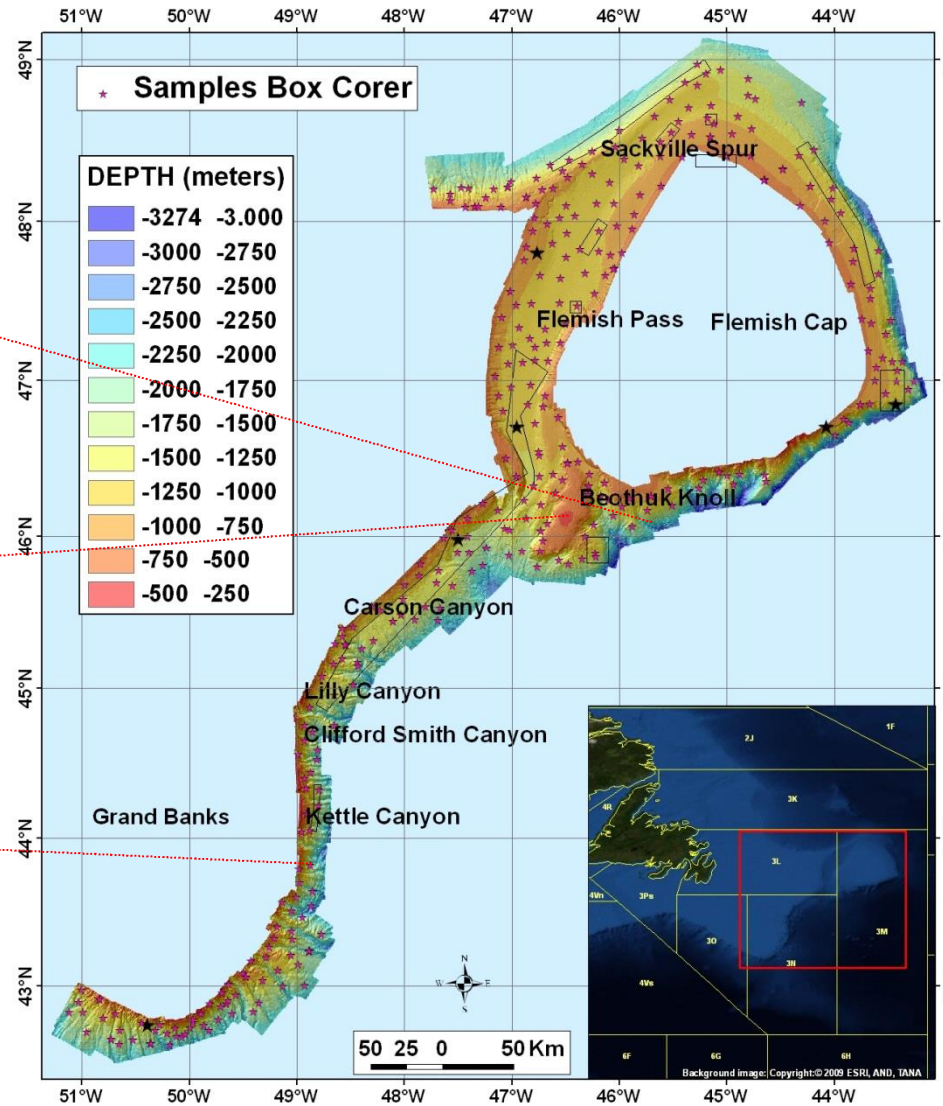
# NEREIDA: Seabed features

## 13 Geological features



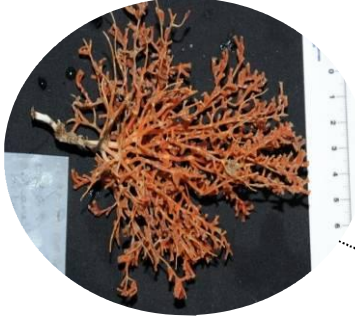
RV Miguel Oliver - SGM (Spain)

# NEREIDA BENTHIC STUDIES: BOX CORERS



# NEREIDA BENTHIC STUDIES: Rock Dredges

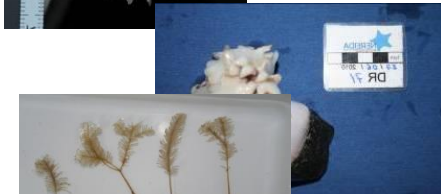
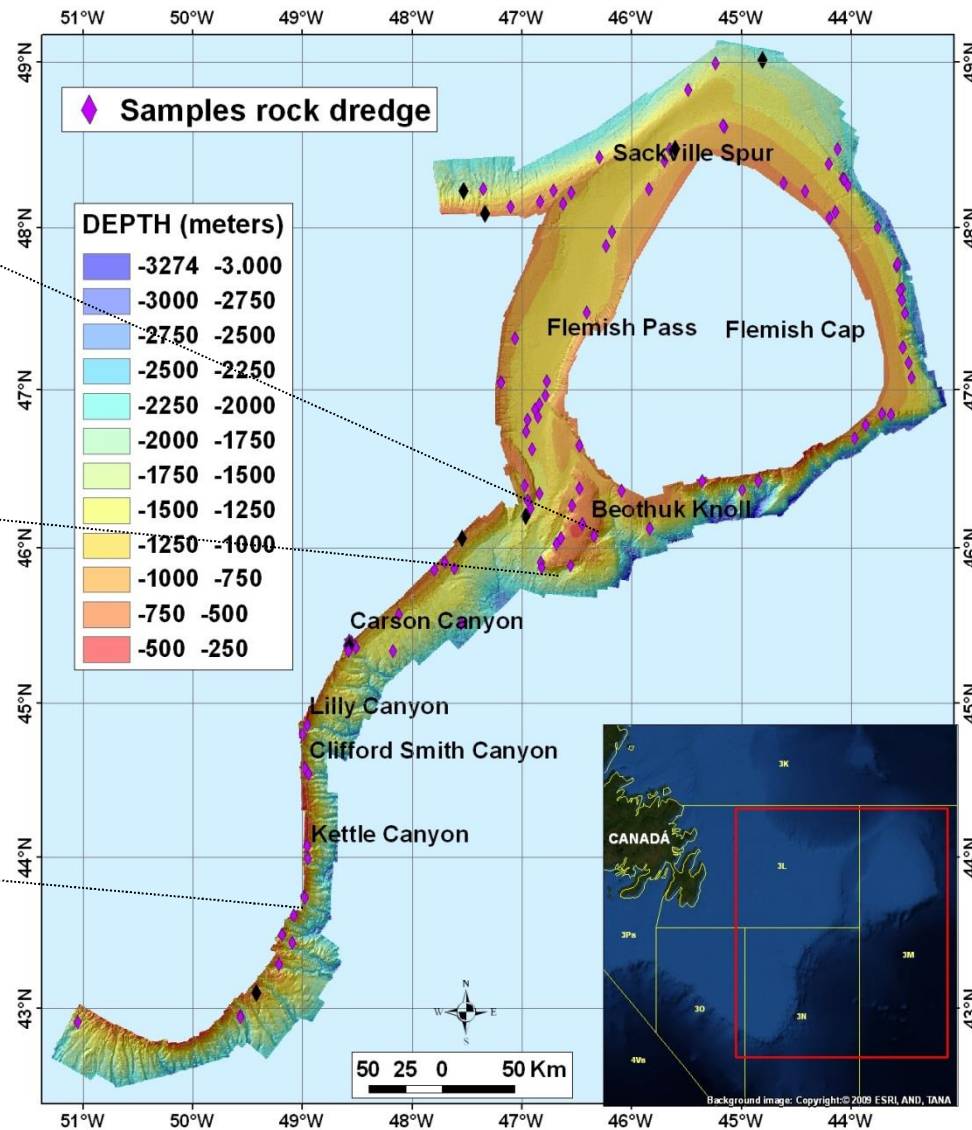
*Acanella arbuscula*



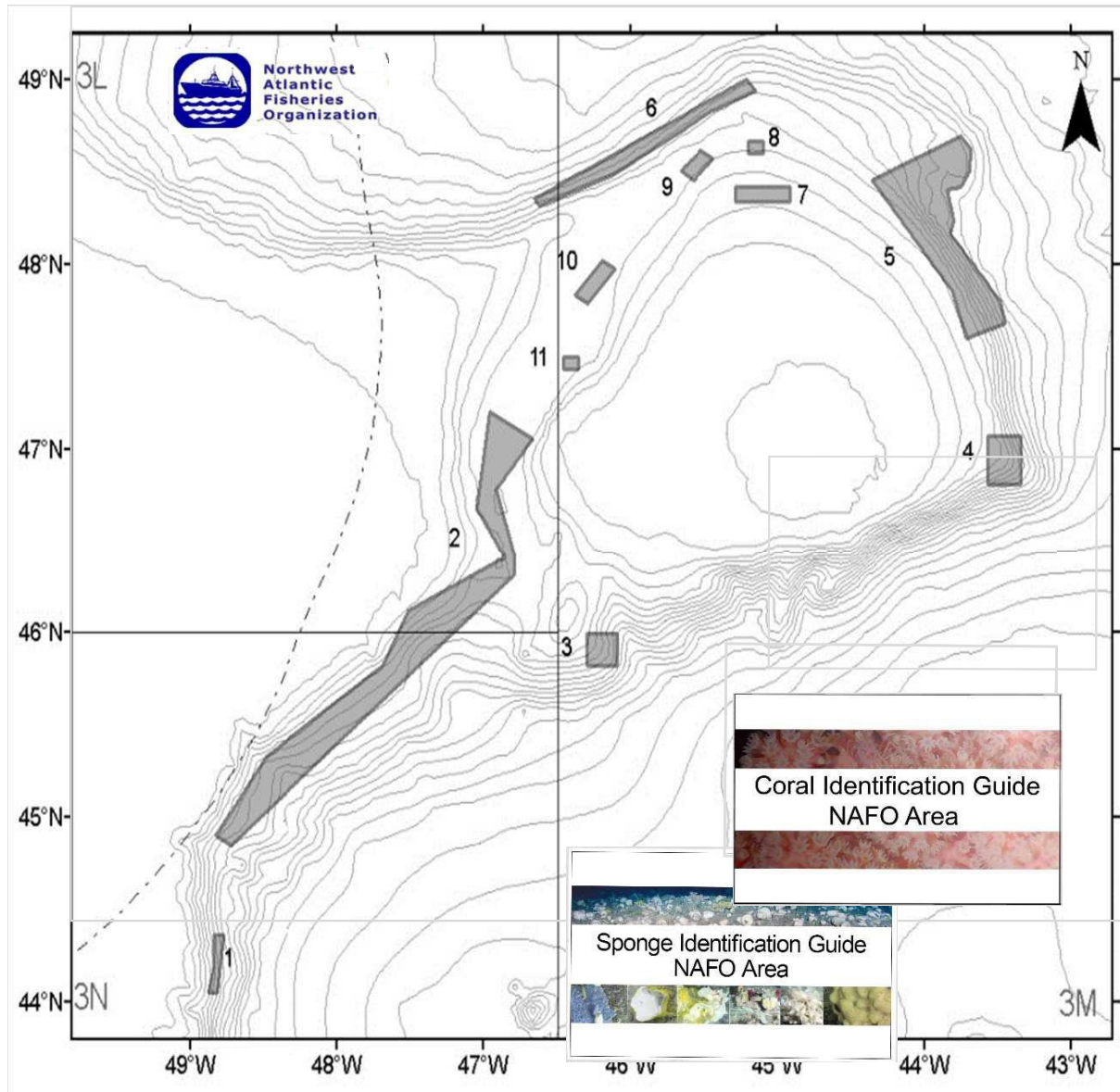
*Geodia macandrewi*



*Mediaster bairdi*



# NEREIDA: NAFO Management measures



## CURRENT SITUATION

**11 closed areas**  
identified by  
groundfish surveys  
(UE, Spain and Canada).  
**Protection of corals and  
sponges**  
  
~ 8,500 km<sup>2</sup>

These areas are being  
**REFINED** in light of  
the information  
collected through  
**NEREIDA.**

Review by the  
Fisheries Commission  
in  
**2014**

# Northeast Atlantic, Hatton Bank: **ECOVUL/ARPA project**

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Main Researcher: **Dr. Pablo Durán Muñoz**

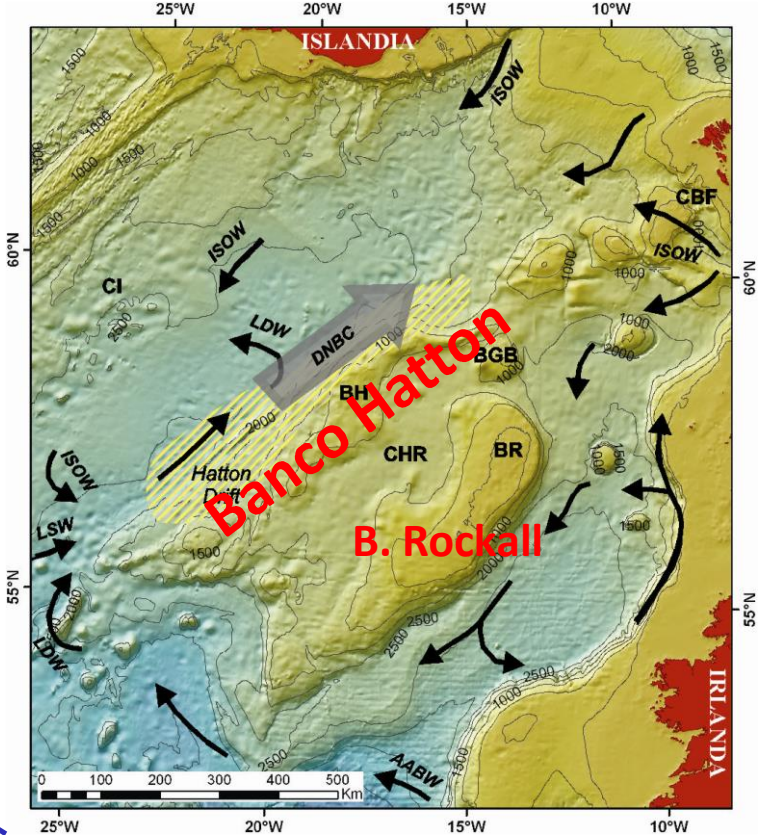
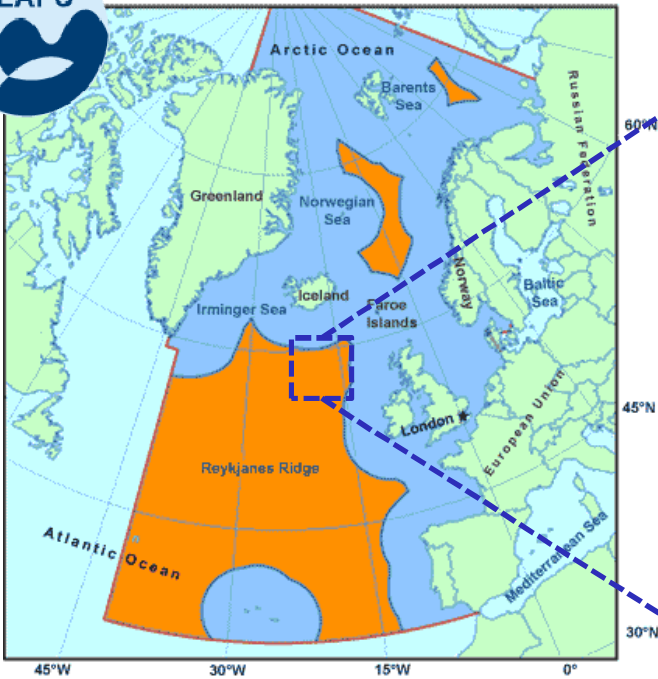
Instituto Español de Oceanografía  
Centro Oceanográfico de Vigo  
Subida a Radio Faro, 50  
36390, Vigo  
España

 [pablo.duran@vi.ieo.es](mailto:pablo.duran@vi.ieo.es)

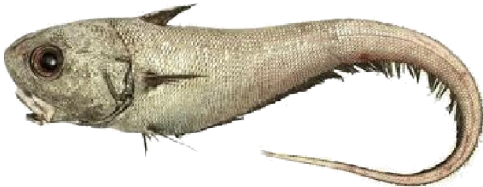


# Study area: Hatton Bank (NE Atlantic)

Source: Sayago-Gil *et al.*, 2010



**Roundnose Grenadier**

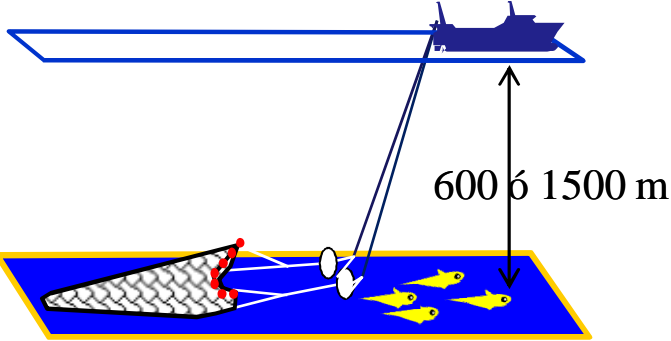


*(Coryphaenoides rupestris)*

**Smoothheads**

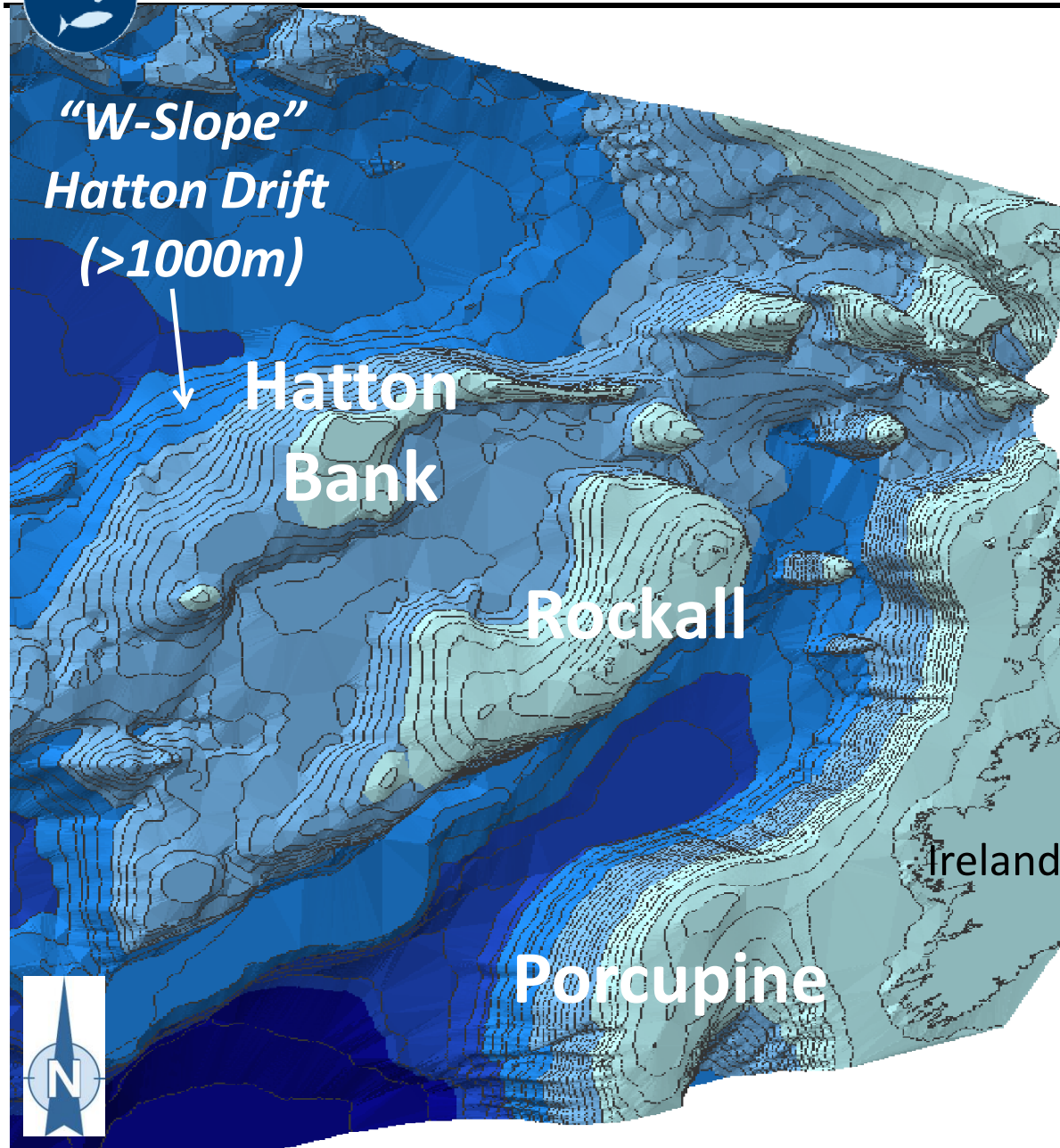


*(Alepocephalus bairdii)*





# Study area: Hatton Bank (NE Atlantic)



**Hatton Bank:**  
Bed rock surface  
(flood basalts)

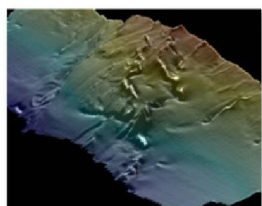
**"W-slope"**  
**Hatton Drift**  
(sand and mud)



*Spanish fleet operates since 1996*

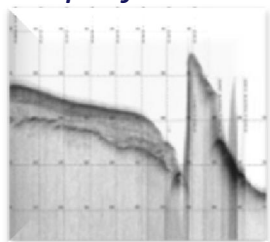
# ECOVUL/ARPA: A multidisciplinary pilot study

## Three multidisciplinary surveys (2005-2007)



18,760 km<sup>2</sup>  
Multibeam  
bathymetry

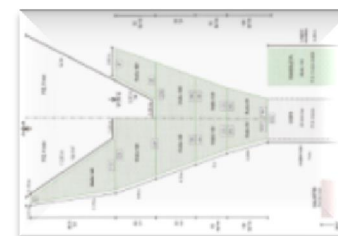
1,112 km  
Sub-bottom  
profiles



13 Boxcorer



22 Dredges



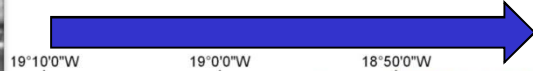
38 Scientific  
trawls

# ECOVUL/ARPA: Identification of the footprint

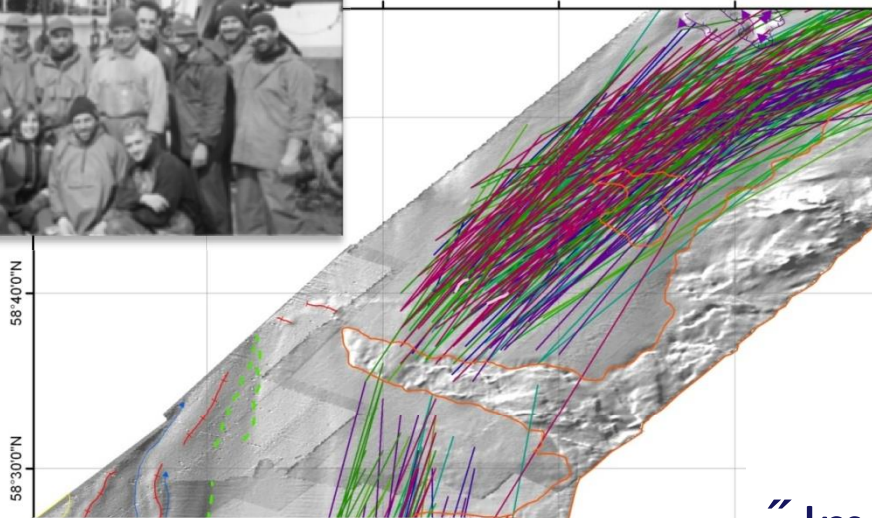
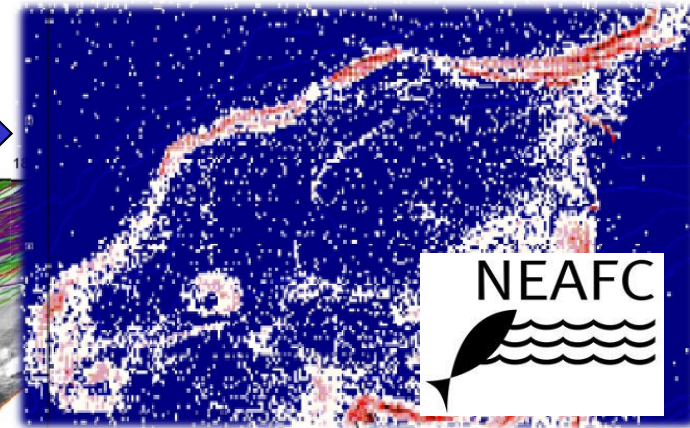
Effort data (Observers)  
1996-2006



**CONSISTENT**

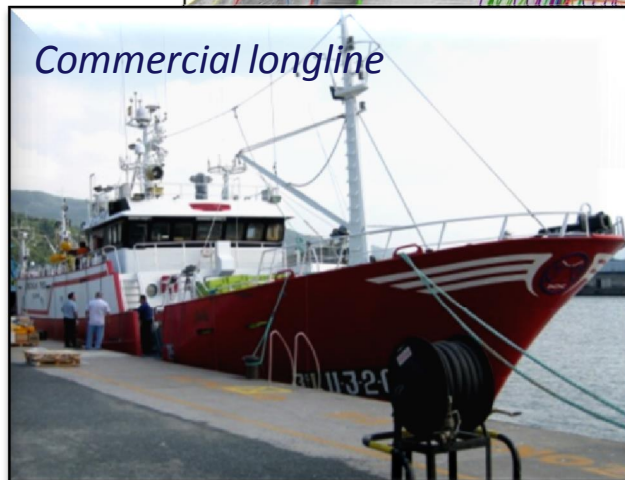


Map from VMS



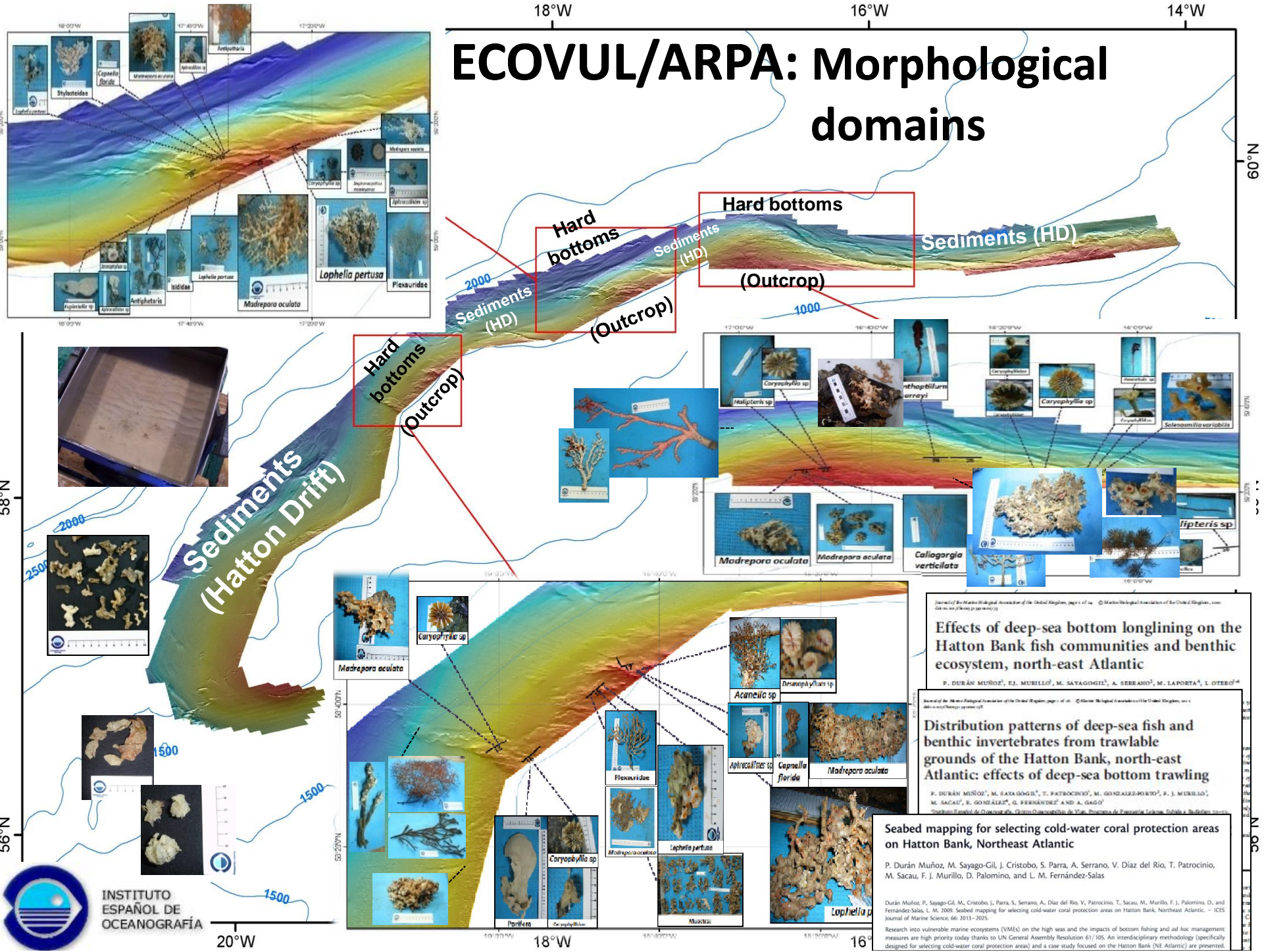
Study:

- “ Impacts of bottom fishing
- “ Distribution of VMEs



**Three cooperative surveys  
(IEO-commercial fisheries)  
(2005-2008)**

# ECOVUL/ARPA: Morphological domains



Journal of the Marine Biological Association of the United Kingdom, page 1 of 11. © Marine Biological Association of the United Kingdom, 2011. doi:10.1017/S0025371810001972  
**Effects of deep-sea bottom longlining on the Hatton Bank fish communities and benthic ecosystem, north-east Atlantic**  
 P. DURÁN MUÑOZ<sup>1</sup>, E. J. MURILLO<sup>2</sup>, M. SAYAGO-GIL<sup>1</sup>, A. SERRANO<sup>3</sup>, M. LAPORTA<sup>4</sup>, I. OTERO<sup>4</sup>

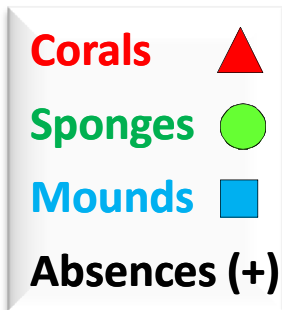
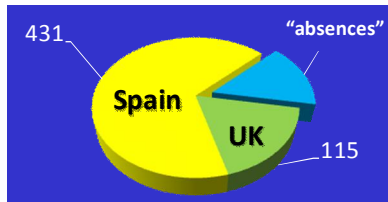
Journal of the Marine Biological Association of the United Kingdom, page 1 of 11. © Marine Biological Association of the United Kingdom, 2011. doi:10.1017/S0025371810001972  
**Distribution patterns of deep-sea fish and benthic invertebrates from trawlable grounds of the Hatton Bank, north-east Atlantic: effects of deep-sea bottom trawling**  
 P. DURÁN MUÑOZ<sup>1</sup>, M. SAYAGO-GIL<sup>1</sup>, T. PATROCINIO<sup>1</sup>, M. GONZÁLEZ-PORTO<sup>2</sup>, P. J. MURILLO<sup>2</sup>, M. SACAU<sup>1</sup>, E. GONZÁLEZ<sup>1</sup>, G. FERNÁNDEZ<sup>1</sup> AND A. GAGÓ<sup>1</sup>  
 Instituto Español de Oceanografía, Centro Oceanográfico de Vigo, Programa de Posgrado en Oceanografía y Biología Marina

**Seabed mapping for selecting cold-water coral protection areas on Hatton Bank, Northeast Atlantic**  
 P. Durán Muñoz, M. Sayago-Gil, J. Cristobo, S. Parra, A. Serrano, V. Díaz del Río, T. Patrocínio, M. Sacau, F. J. Murillo, D. Palomino, and L. M. Fernández-Salas

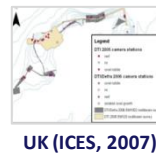
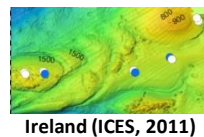
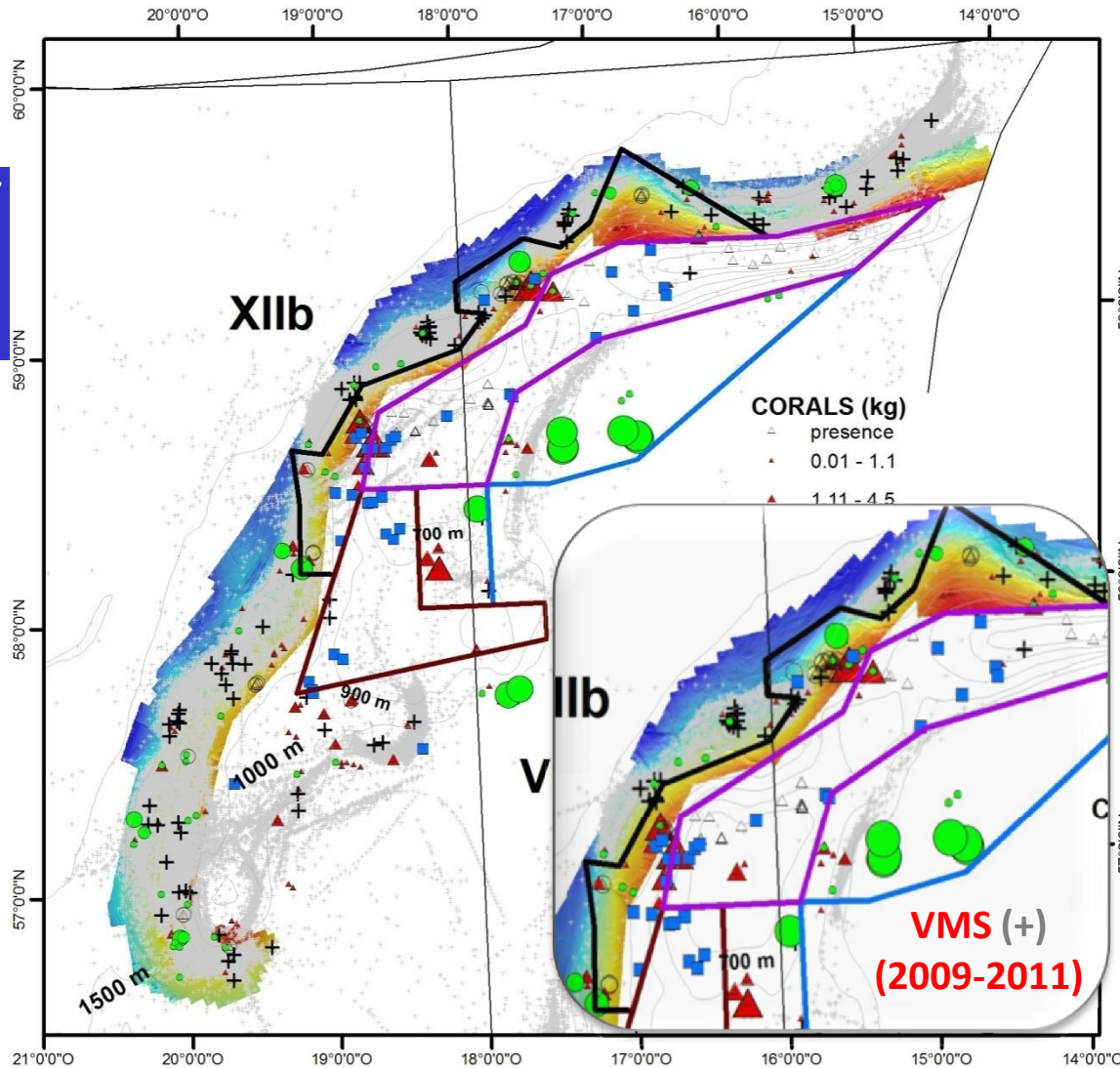
Durán Muñoz, P., Sayago-Gil, M., Cristobo, J., Parra, S., Serrano, A., Díaz del Río, V., Patrocínio, T., Sacau, M., Murillo, F. J., Palomino, D., and Fernández-Salas, L. M. 2009. Seabed mapping for selecting cold-water coral protection areas on Hatton Bank, Northeast Atlantic. – ICES Journal of Marine Science, 66: 2013–2025.  
 Research into vulnerable marine ecosystems (VMEs) on the high seas and the impacts of bottom fishing and ad hoc management measures are high priority today thanks to UN General Assembly Resolution 61/105. An interdisciplinary methodology (specifically designed for selecting cold-water coral protection areas) and a case study focused on the Hatton Bank (NE Atlantic) are presented.

# Current Situation: Data & Closed Areas

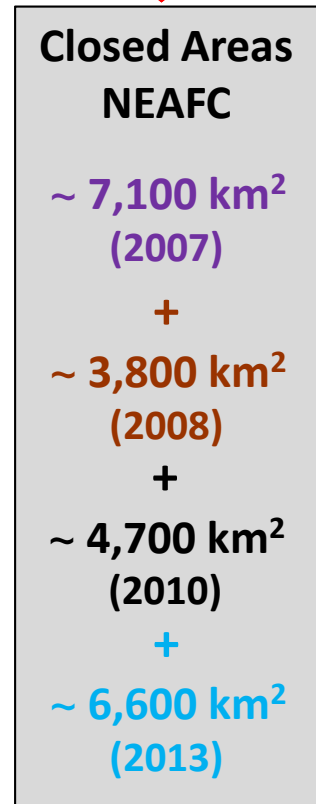
**ICES DATABASE**  
[Established in 2012]



**Spanish VMS (+)**  
**Historic fishery footprint**  
**(2000-2011)**



**Advice**  
**ICES**

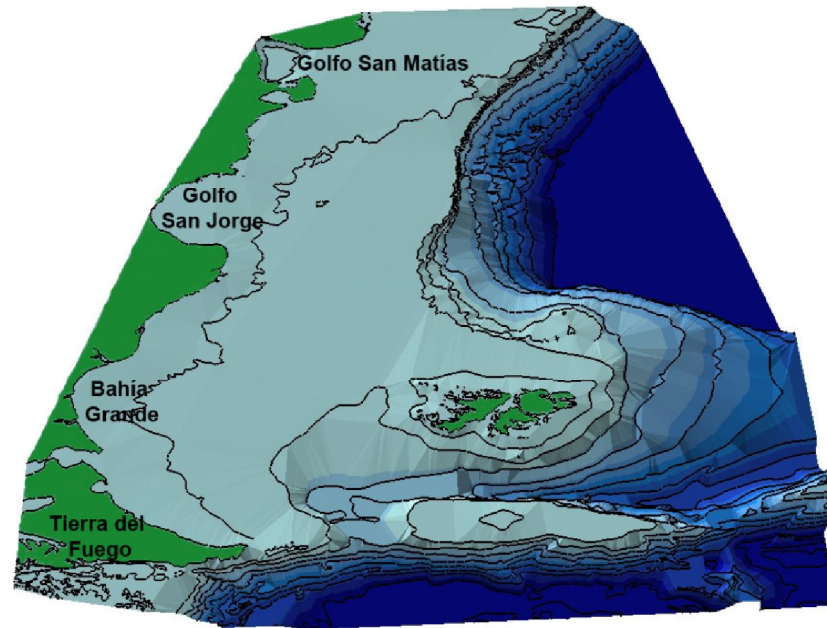


**TOTAL**  
**~ 22,500 km<sup>2</sup>**

# Southwest Atlantic (Patagonian Shelf and Slope):

## ATLANTIS project

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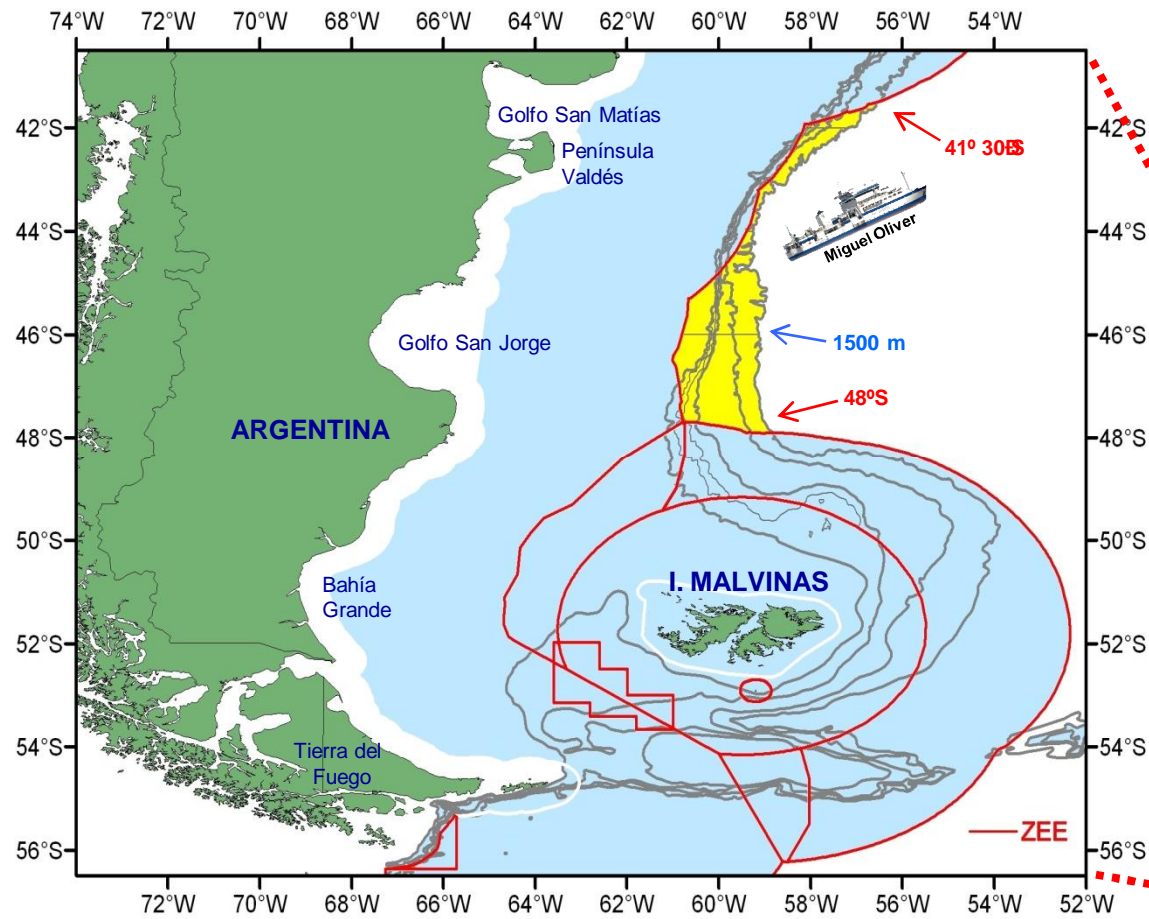


Main Researcher: **José Luis del Río Iglesias**

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36390, Vigo  
España

 [joseluis.delrio@vi.ieo.es](mailto:joseluis.delrio@vi.ieo.es)

# Study area: Southwest Atlantic



## Southwest Atlantic High Seas

Latitude: 41°30' - 48°S

Depth: 200-1500 m



Total prospected area

~ 59,000 km<sup>2</sup>



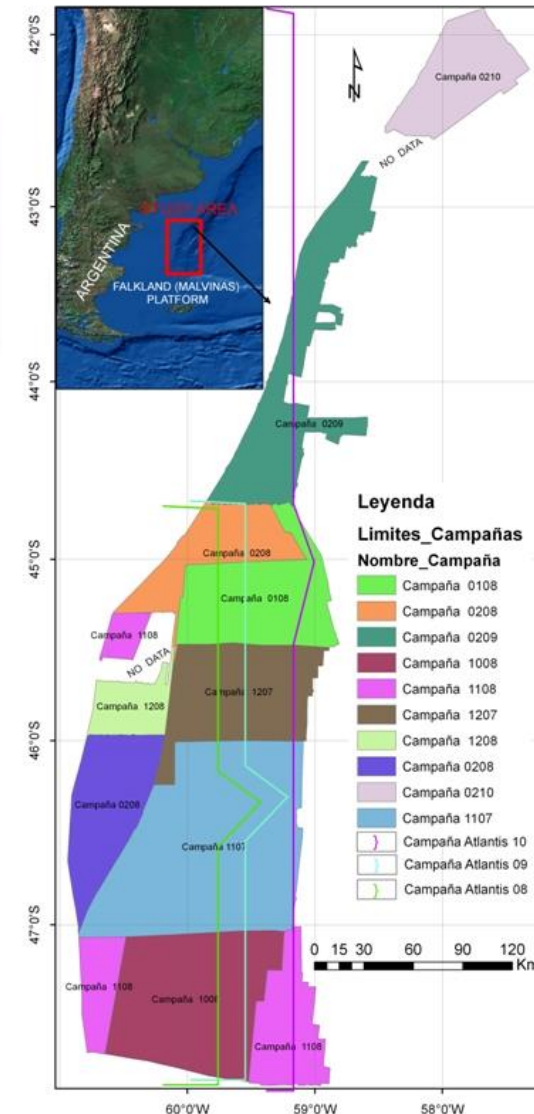
# Multidisciplinary Surveys

## 13 Scientific Multidisciplinary Surveys (2007-2010)

- Cartography and geology
- Benthos
- Fishing
- Imagery (ROV)

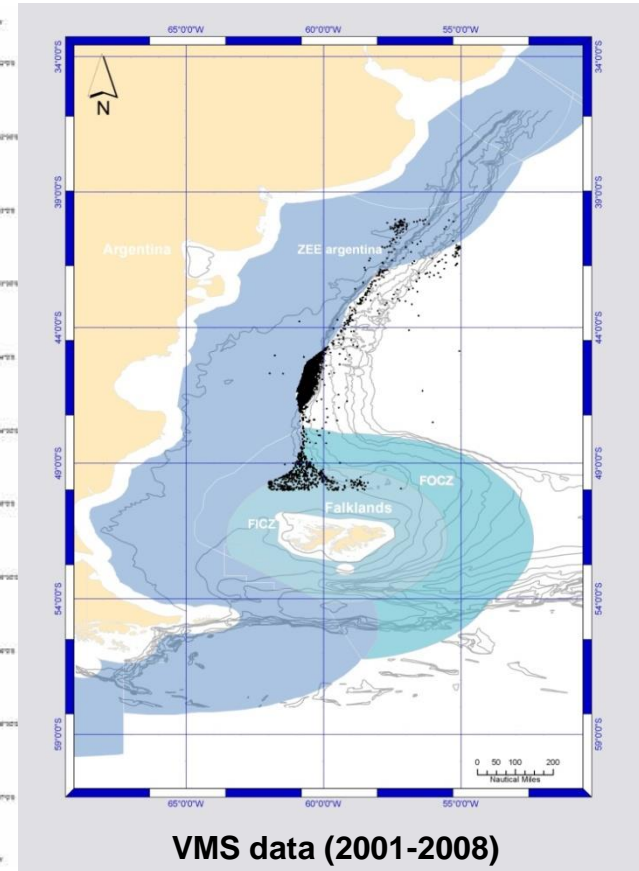
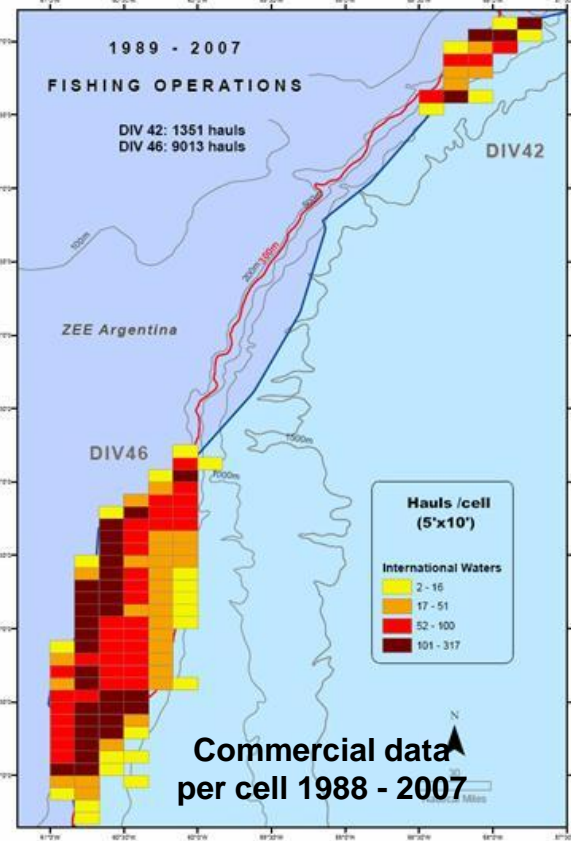
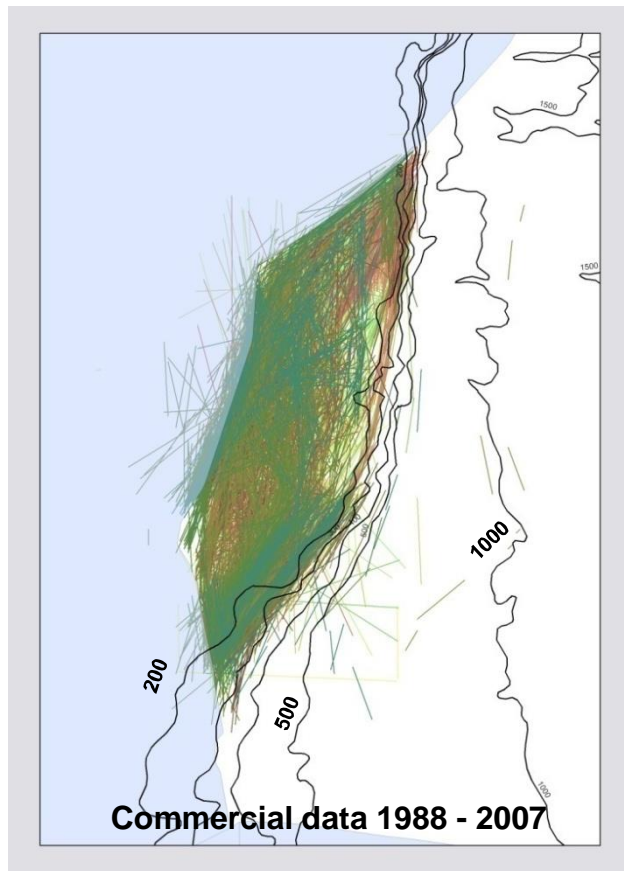


- “ 347 survey days
- “ Multibeam bathymetry (~ 59,000 km<sup>2</sup>)
- “ Sub-bottom profiles TOPAS (~ 91,900 km)
- “ 102 rock dredges & 209 boxcorer
- “ 519 CTD stations
- “ 413 bottom trawls & sediment collector samples
- “ High resolution digital images & video (ROV)

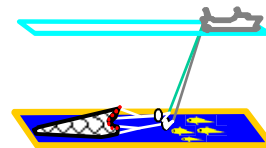


# Fishery footprint

## Scientific Observers data (IEO) and VMS (SGP)



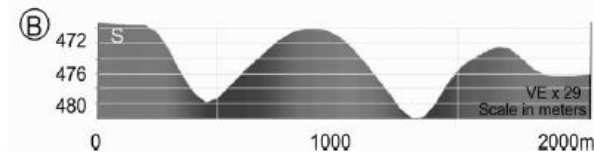
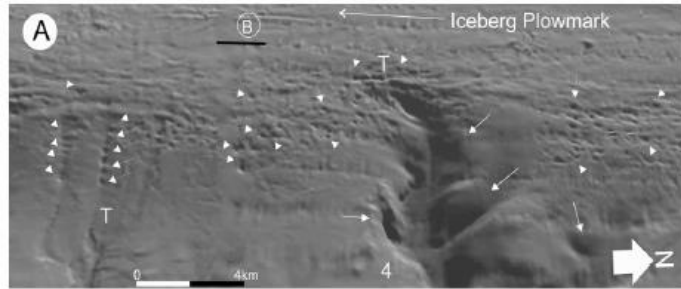
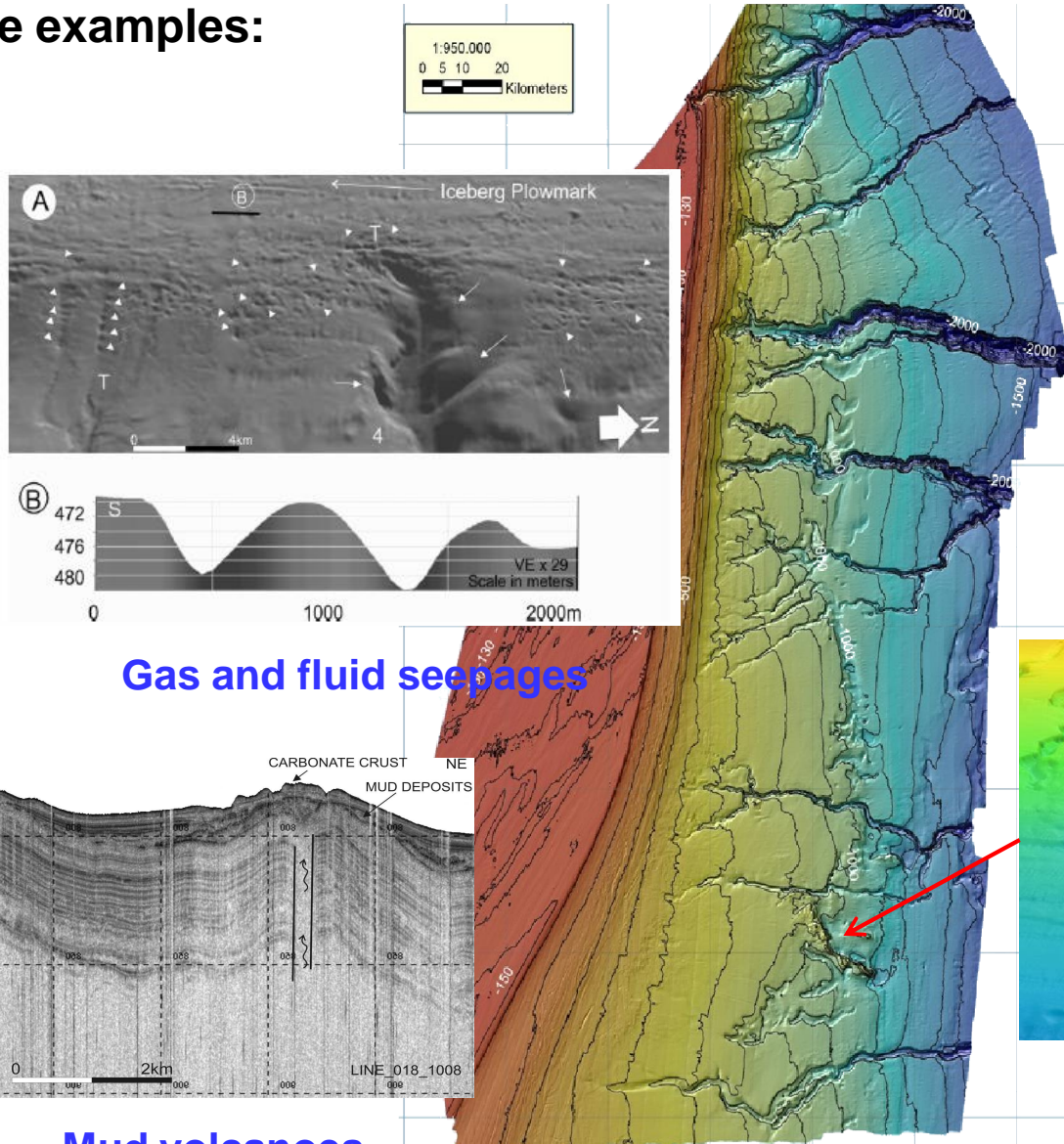
Bottom trawlers  
ATSW – Atlantic High Seas



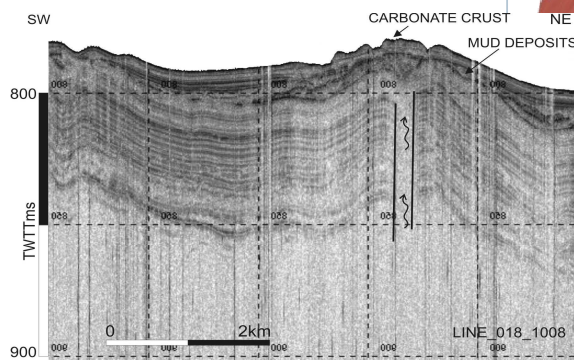
99% fishing effort < 300 m depth

# Multibeam bathymetry

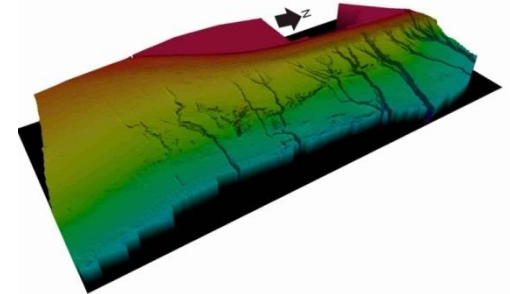
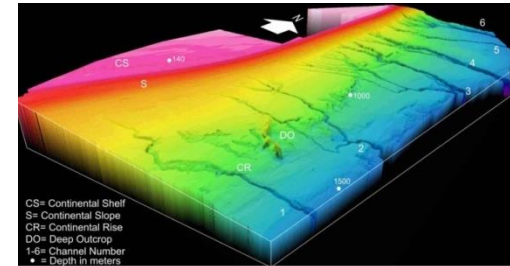
Some examples:



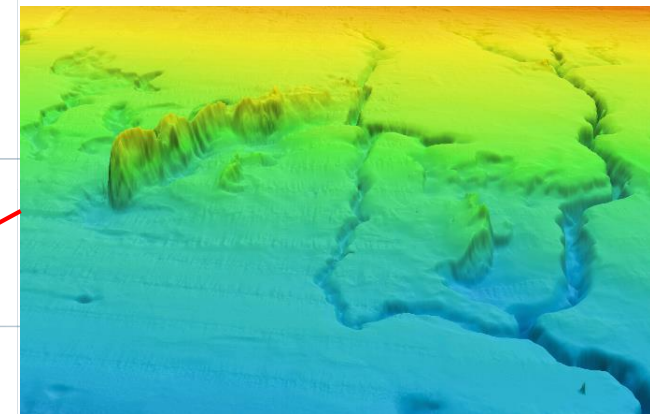
Gas and fluid seepages



Mud volcanoes

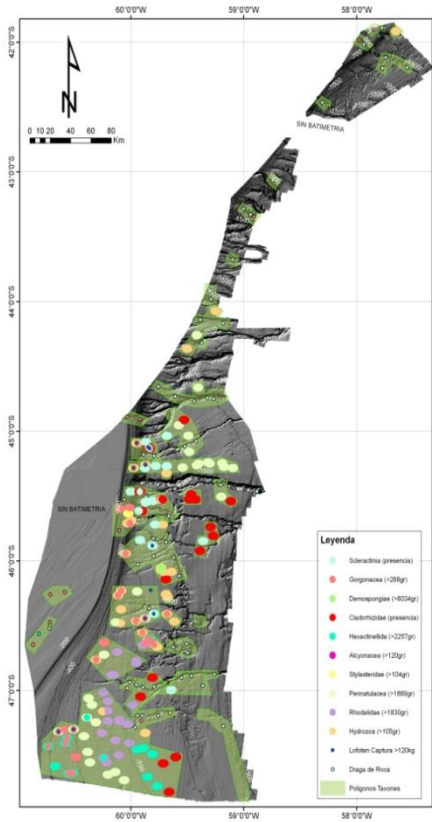


Canyons and trenches



Rocky outcrops

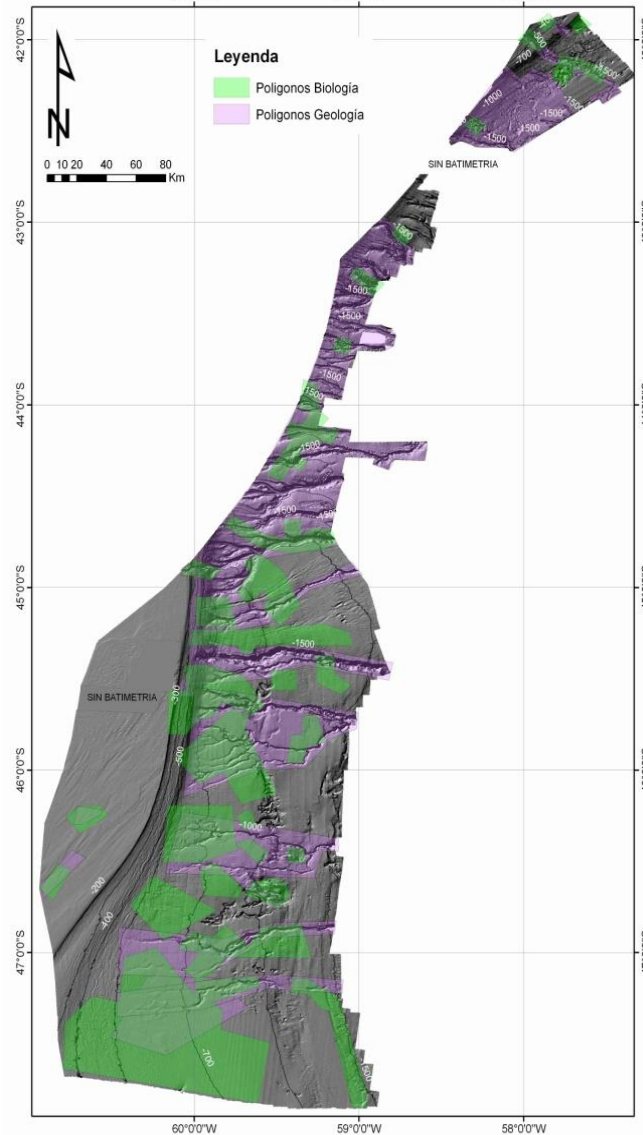
# Southwest Atlantic protection criteria



## Biological criteria

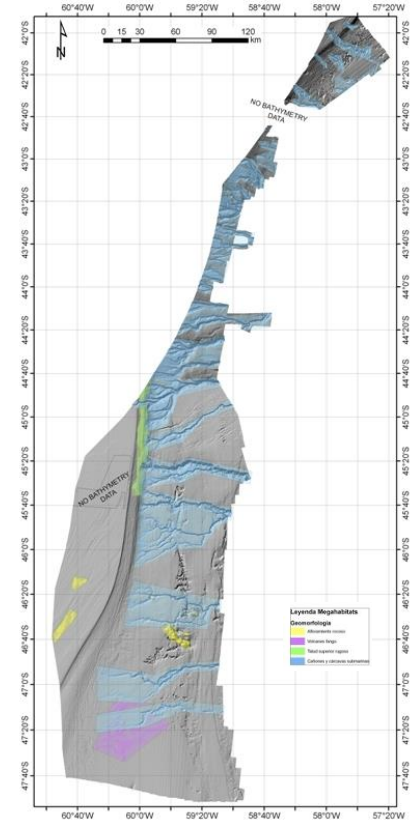
*Sponge fields*  
*Cold-water corals*  
*Coral gardens*

## Biological + Geomorphological



## Geomorphological criteria

*Canyons and trenches*  
*Outcrops*  
*Mud volcanoes*  
*Gas and fluid seepages*



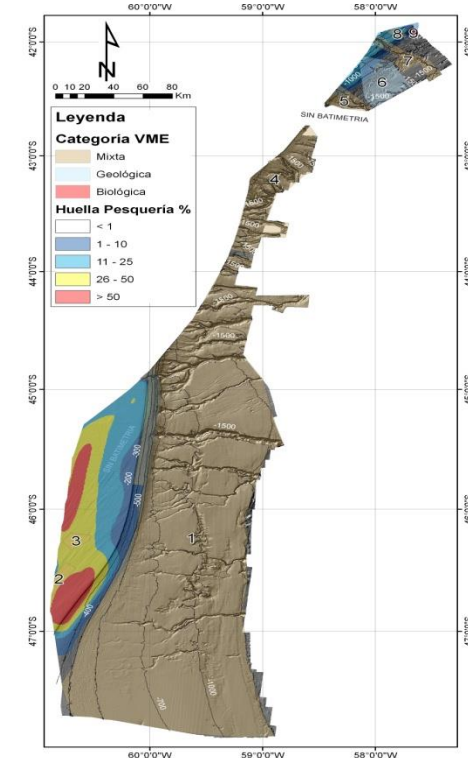
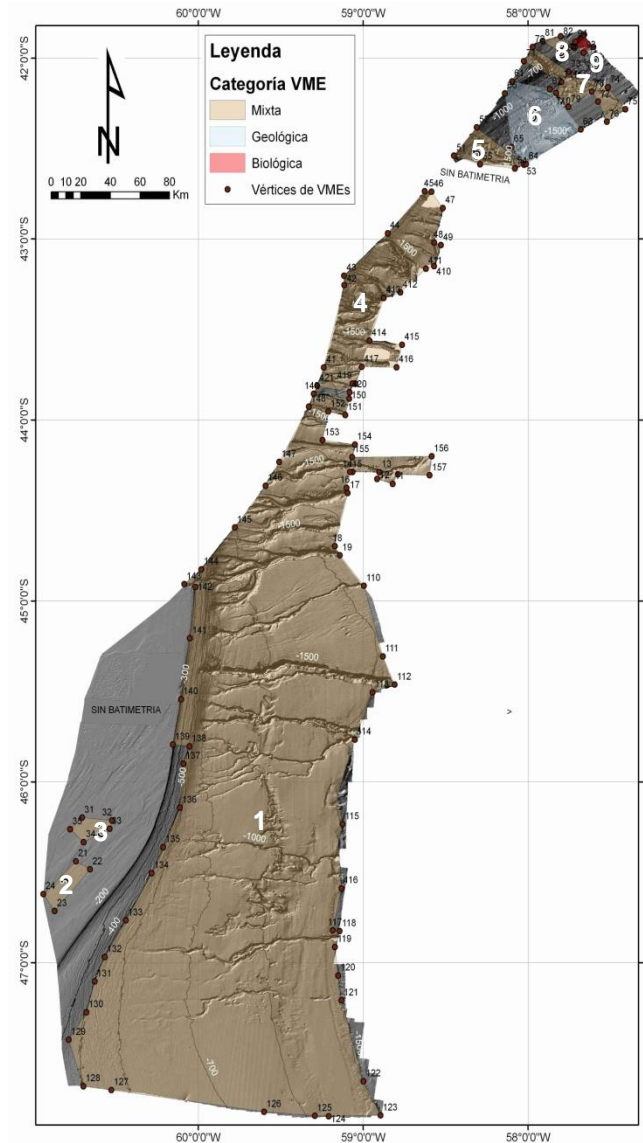
# ATLANTIS Project: Protection Proposal

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VMEs candidate areas were identified for protection in the high-seas (~ 41, 300 km<sup>2</sup>)

This results were presented to the EC and AGNU

1<sup>st</sup> July 2011 SGP banned deep sea fisheries by trawlers



Interaction with fisheries

## Reference

Portela JM, et al. 2010. Preliminary description of the overlap between squid fisheries and VMEs on the high seas of the Patagonian Shelf. Fisheries Research, 106: 229-238

# Conclusions

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- “ UNGA resolution 66/68 adopted in 2011, has recognized the importance of global VME Databases (pa.135) and the utility of seabed mapping programmes (pa. 131) for the management of high seas fisheries;
- “ Fishing Nations are making efforts to compile information with the aim to feed the new international databases on VMEs indicators in the Atlantic Ocean (e.g.: 2012 ICES Database; NAFO Database);
- “ Moreover in recent years, several multidisciplinary mapping programmes have been developed;
- “ Such programmes have resulted in the identification of VMEs within the NEAFC & NAFO Regulatory Areas (as well as within SW Atlantic) and in the adoption of conservation and management measures (in accordance with pa. 119b of UNGA resolution 64/72):



## NEAFC Recommendation 9:2013 - EC Regulation 1288/2009

*Hatton Bank closed area (~ 22,500 km<sup>2</sup>)*

## NAFO Enforcement measures

*Grand Banks, Flemish Pass & Flemish Cap closed areas (~ 8,500 km<sup>2</sup>)*



## Spanish regulations (Spanish vessels)

*SW Atlantic closed area (~ 41,300 km<sup>2</sup>)*



# Thanks for your attention !

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