atlas

UNDERSTANDING DEEP ATLANTIC ECOSYSTEMS

D3.3 Part 3: Develop case study HSM models for VME indicator taxa and key deep-sea fish species under current environmental conditions

ATLAS GA, Mallorca, 2nd April 2019

David Stirling & too many to list (credits given on slides)

marinescotland science

The Scottish Government

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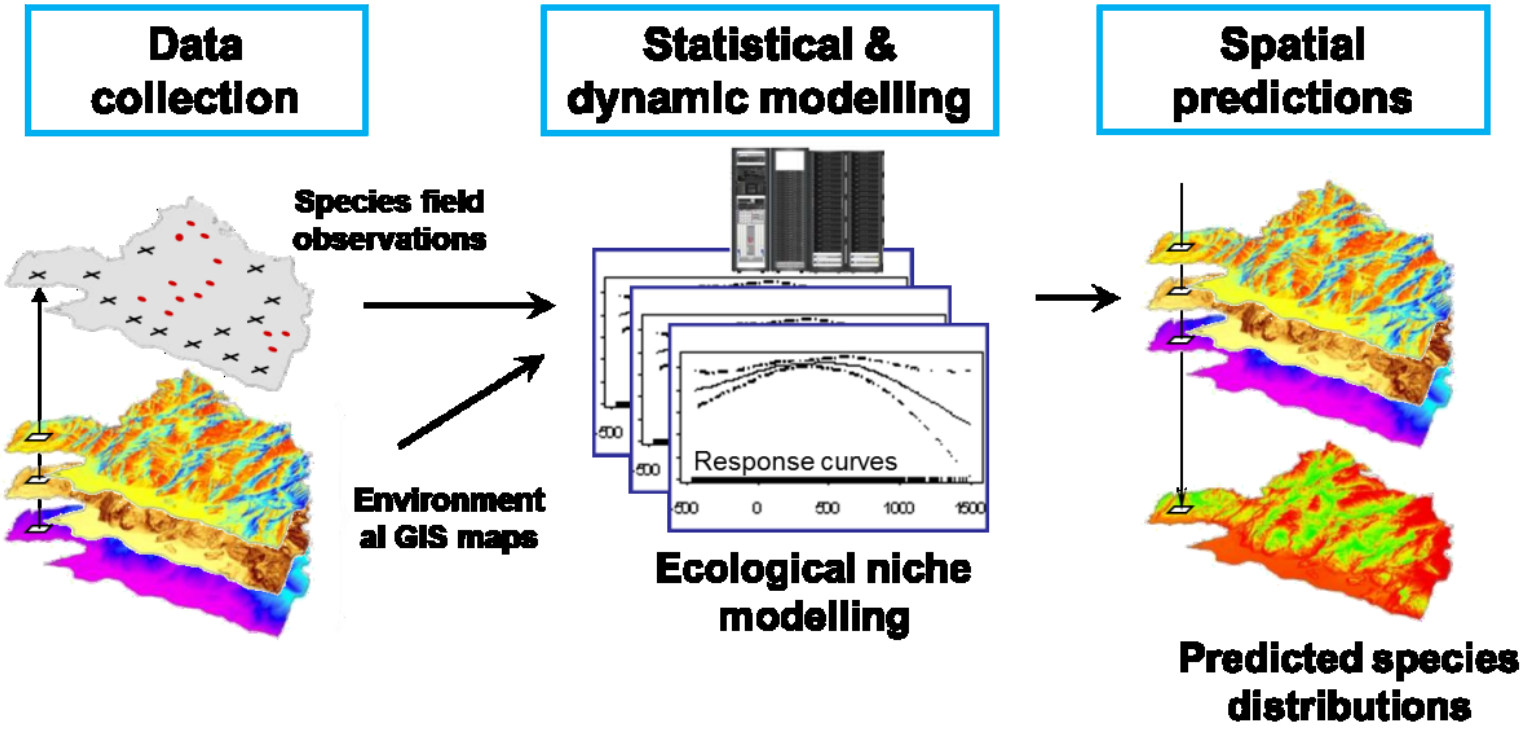
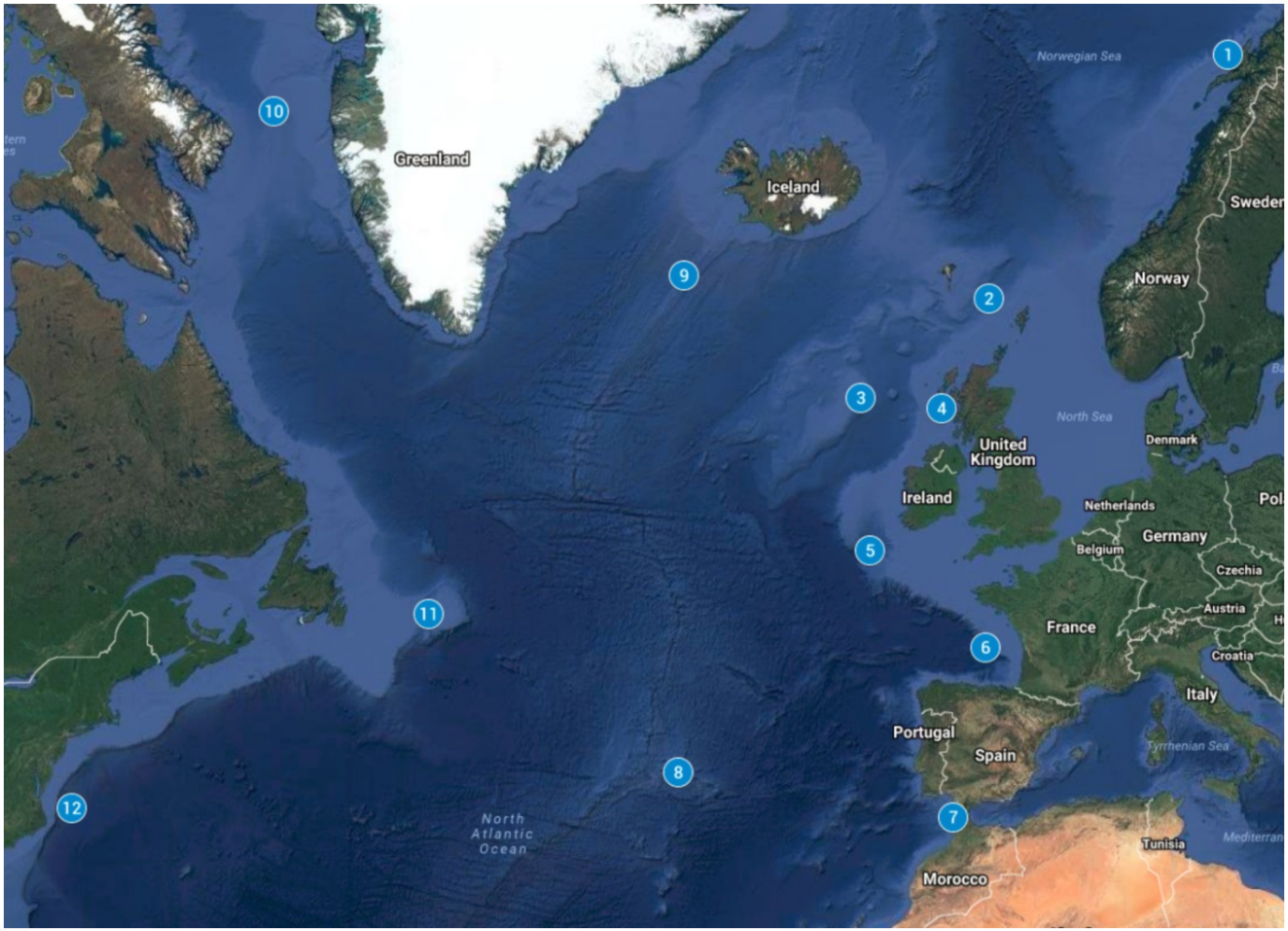
Predictive distribution models

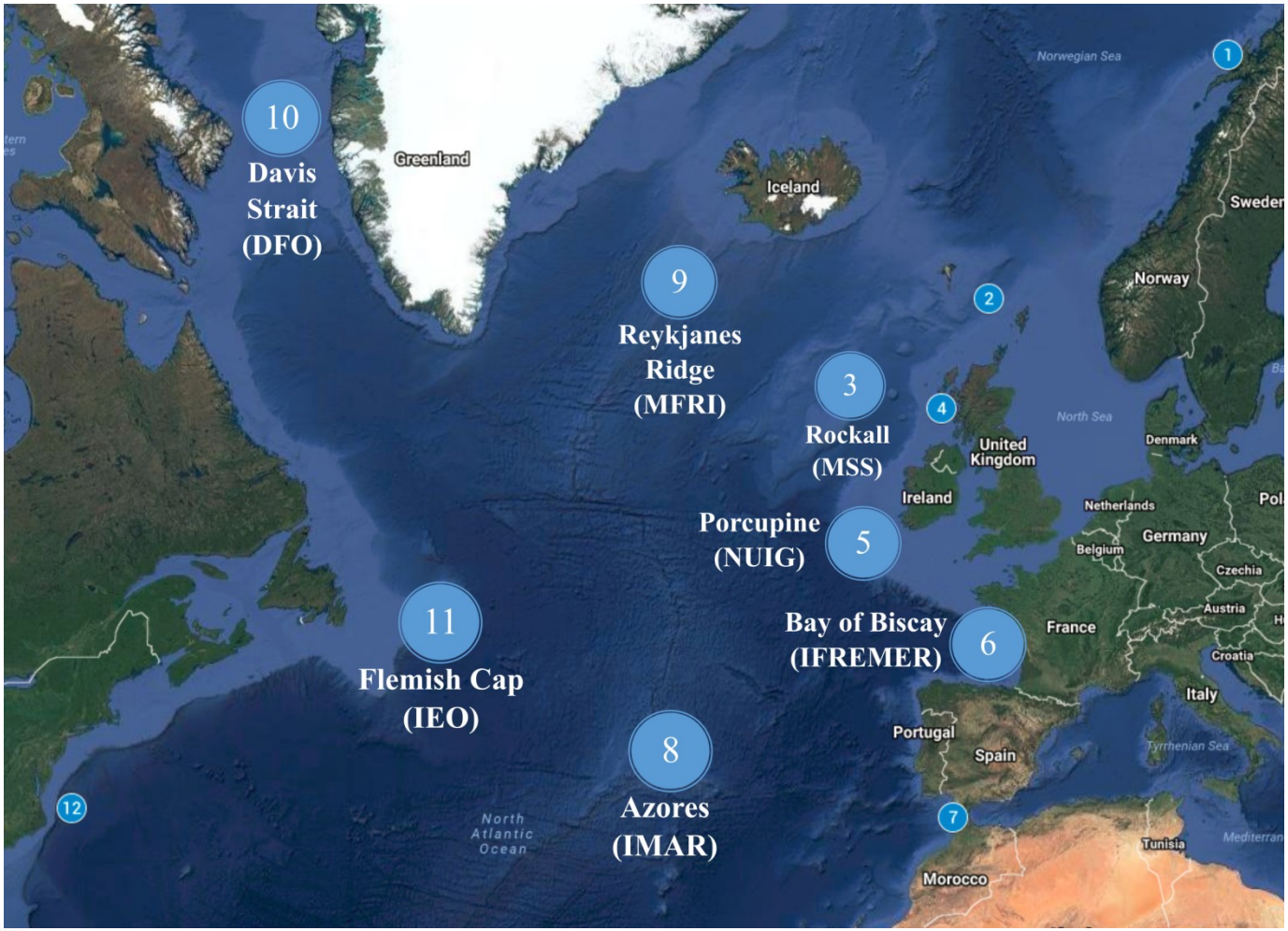


http://www.unil.ch/idyst/en/home/menuinst/research-poles/geoinformatics-and-spatial-m/predictive-biogeography/advancing-the-science-of-eco.html

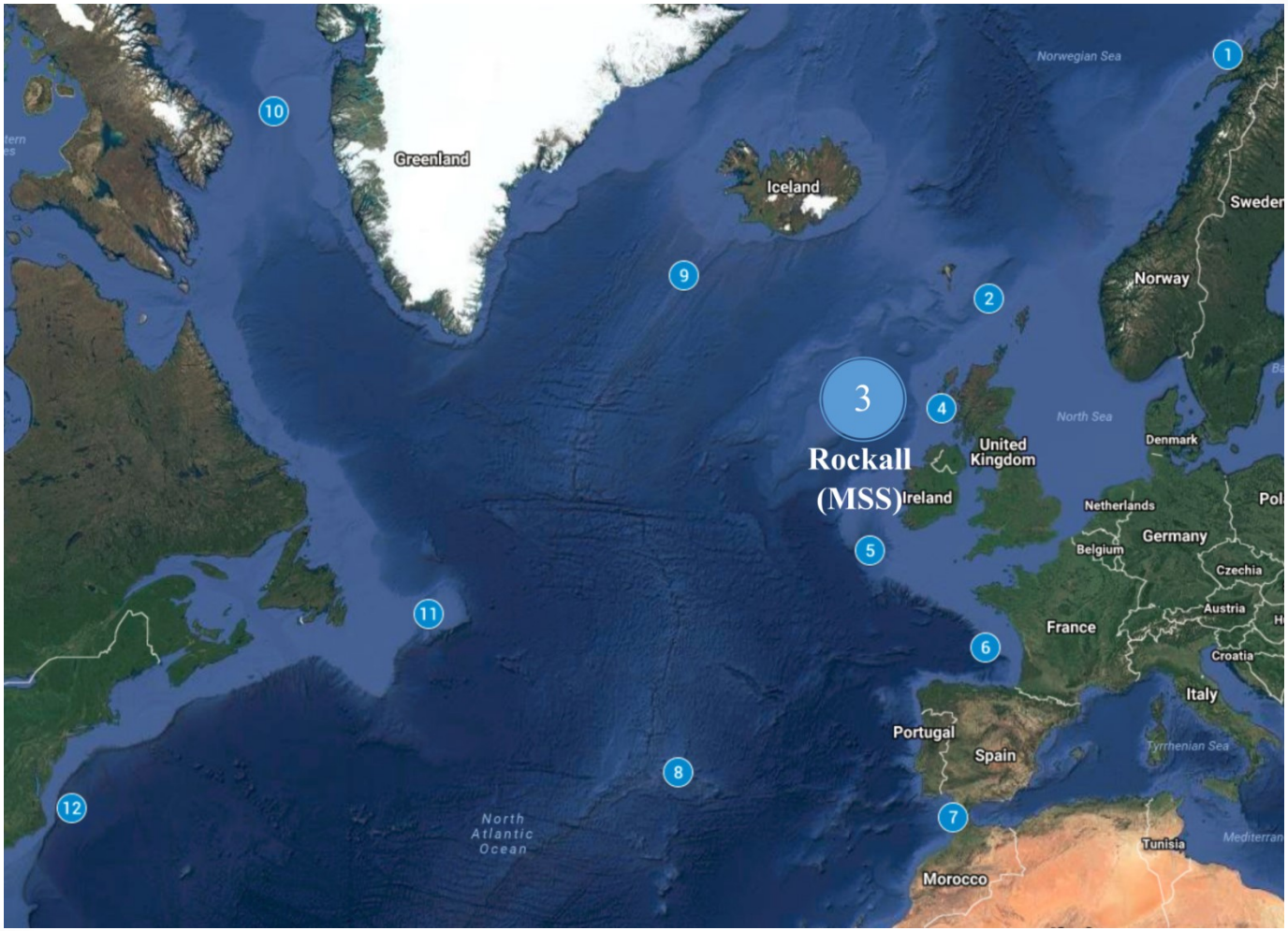
Case studies



Case studies

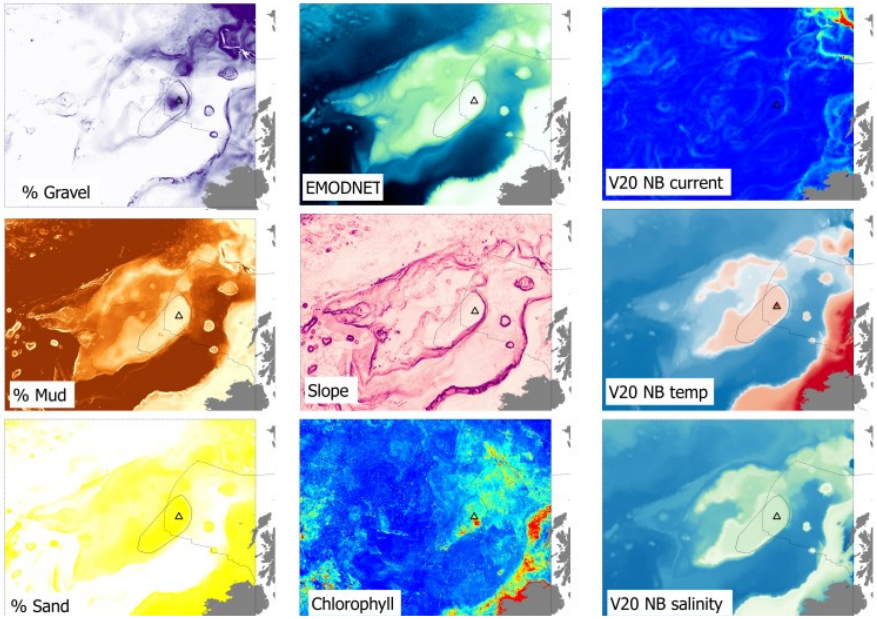


CS3 Rockall (MSS)

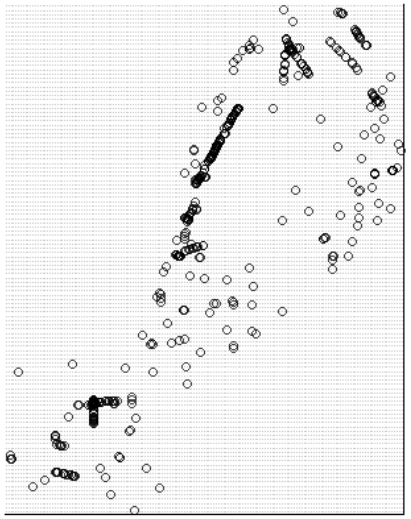


David Stirling

CS3 Data sources & Methods



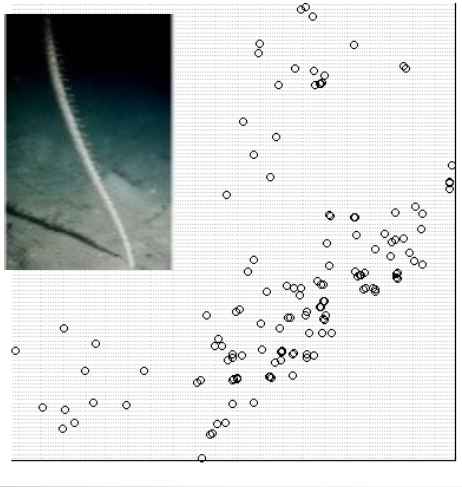
Environmental variables: 1st order polynomials & crosses & 2nd order polynomials (n = 67)



L. Pertusa Presences & quad scheme

Species: *L. pertusa, F. quadrangularis, new sea pen species*

Modelling methods: Gibb's Process Models (Hybrid Geyer point process models to account for dependence between points)

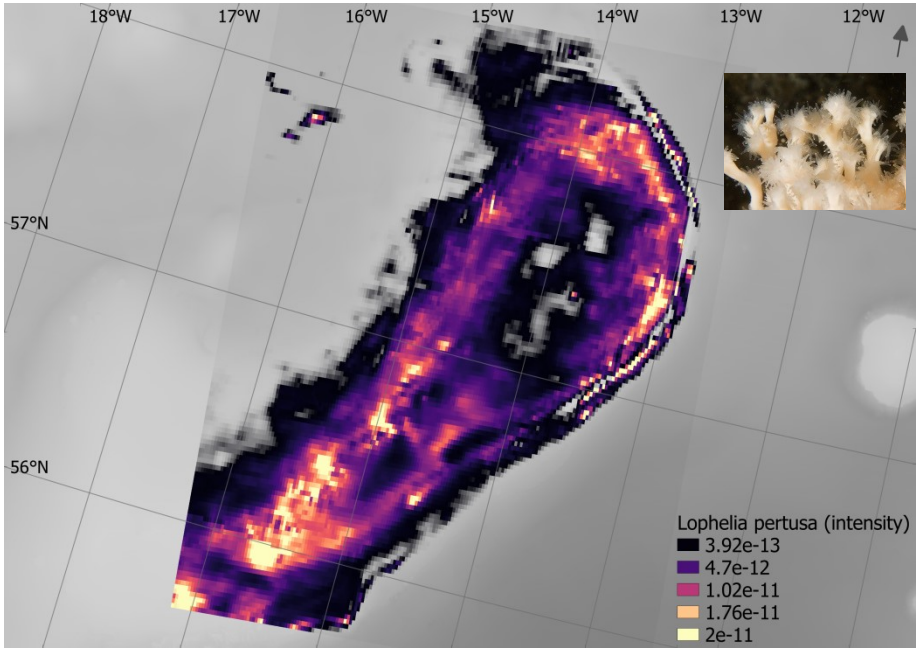


F. quadrangularis Presences & quad scheme

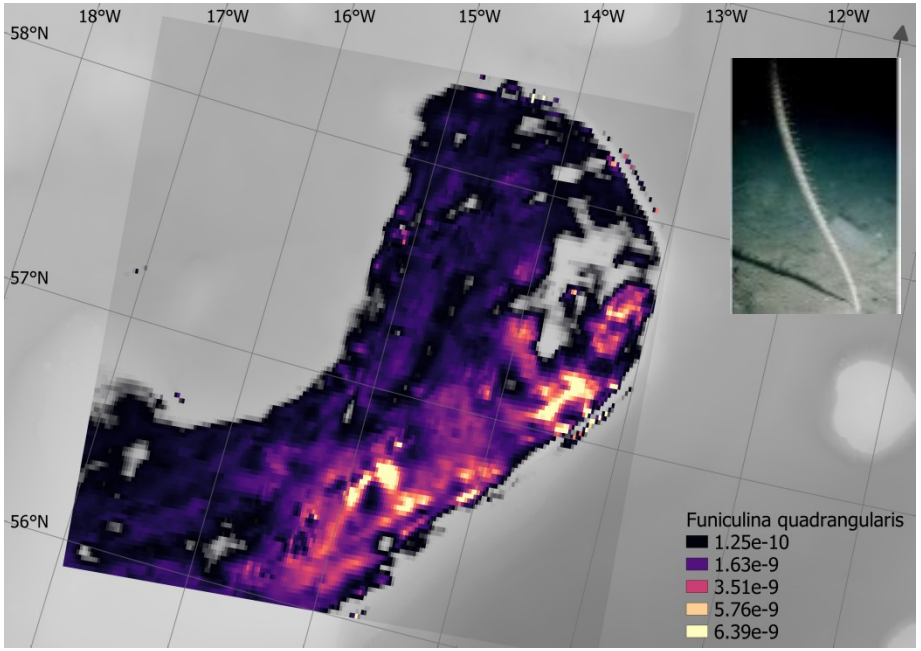
Occurrences from ICES and OSPAR VME DBs (PO)

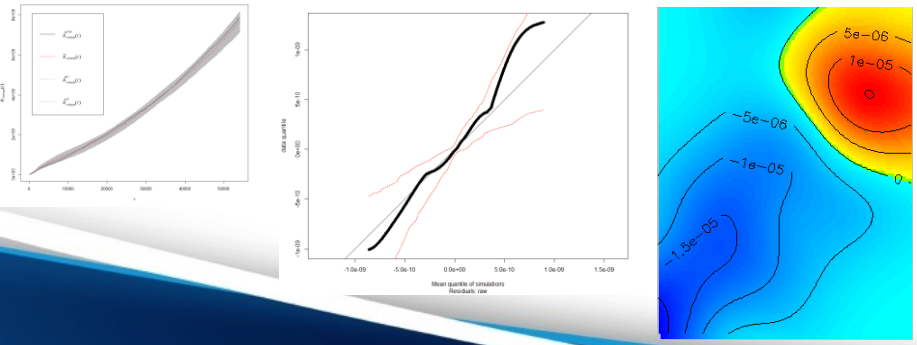
CS3 Maps & Results

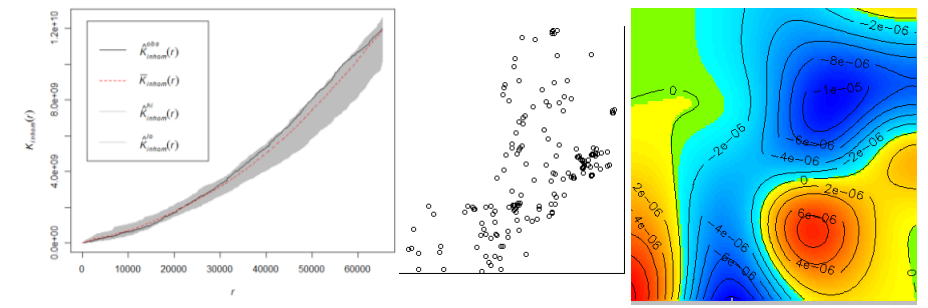
Lophelia pertusa predicted intensity



Funiculina quadrangularis predicted intensity

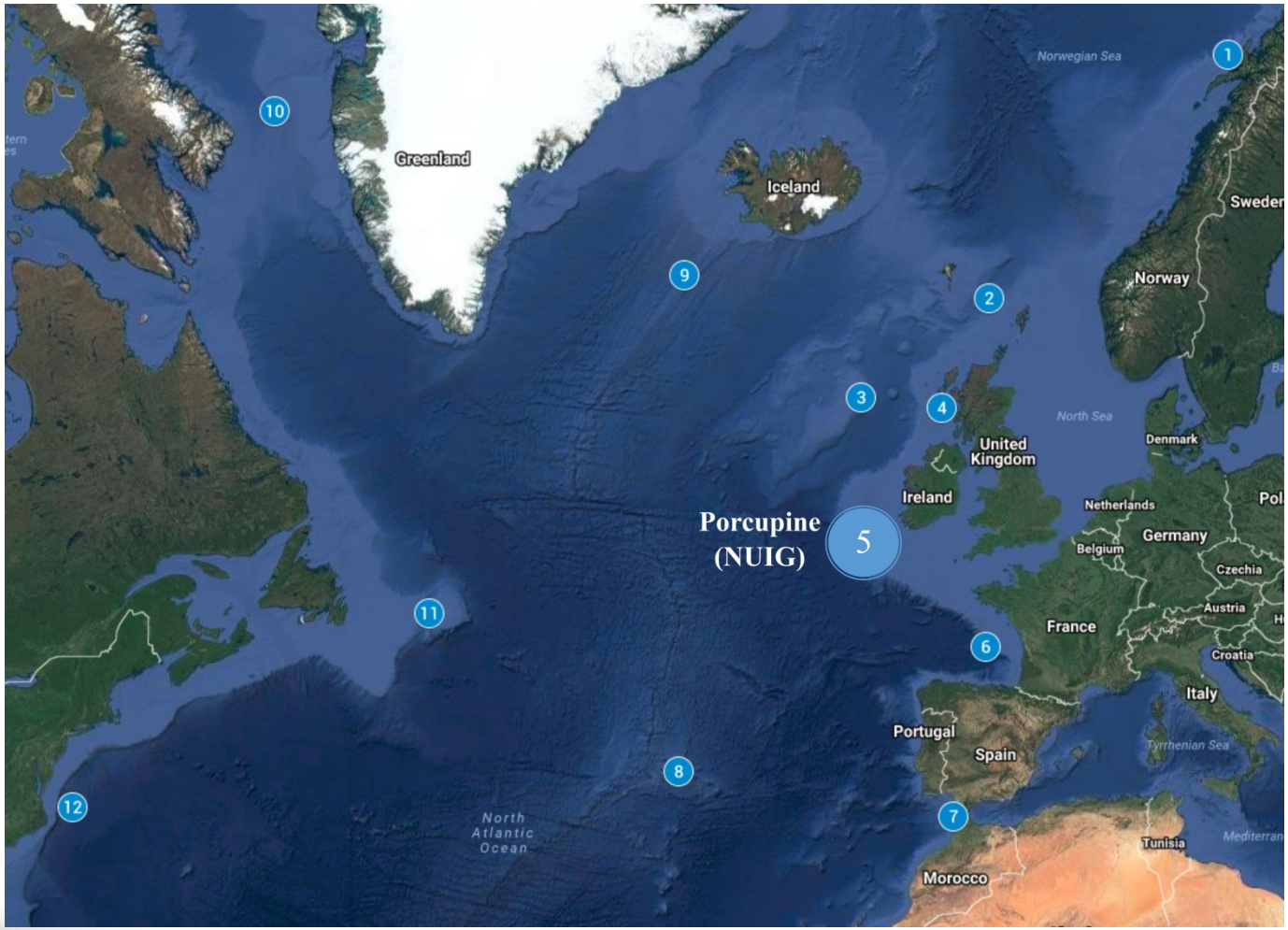






Diagnostic plots

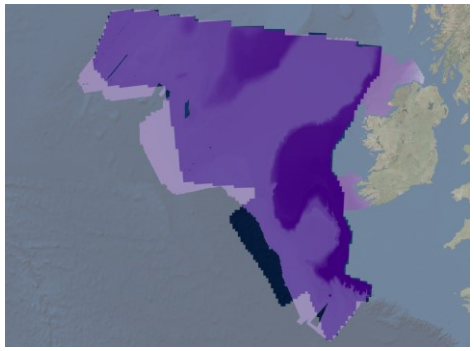
CS5 Porcupine (NUIG)



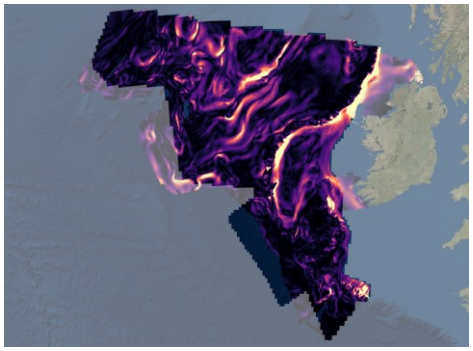
Anthony Grehan & Oisín Callery

CS5 Data sources & Methods

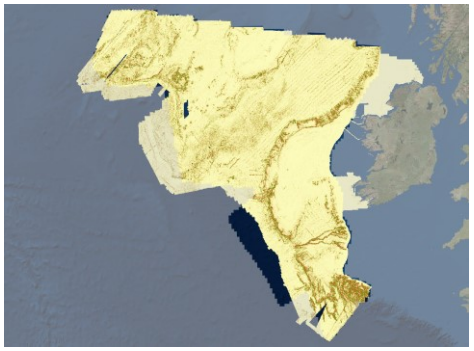
Environmental layers used in final models



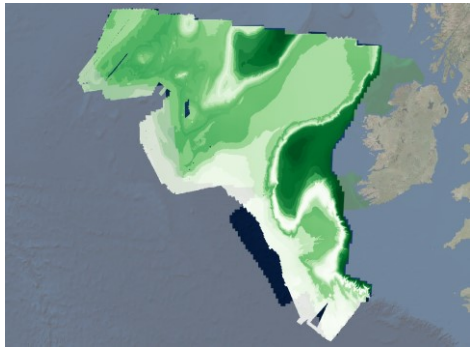
Omega Aragonite



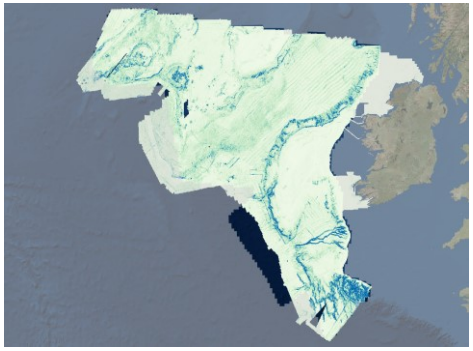
Bottom Stress



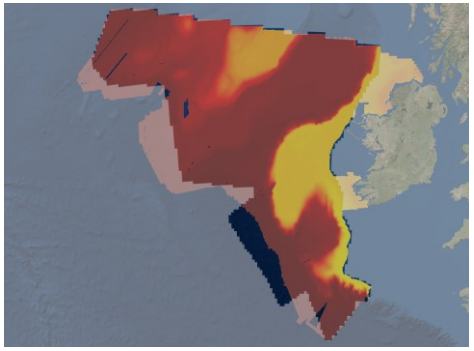
BPI



Oxygen Saturation



Std. Dev. Slope

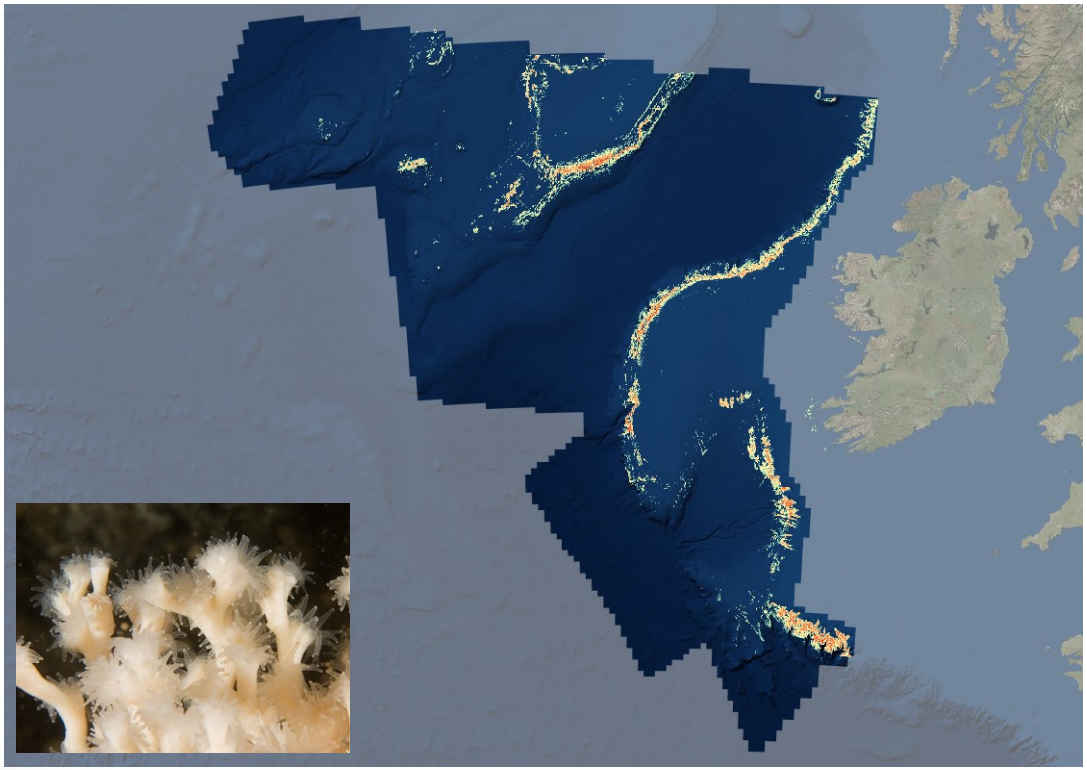


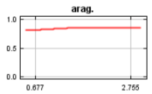
Temperature

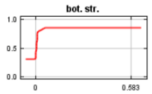
Modelled *Lophelia pertusa* PO records using MaxEnt

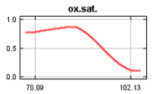
CS5 Maps & Results

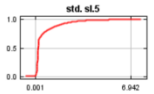
Relative probability of presence

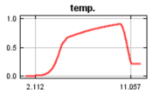


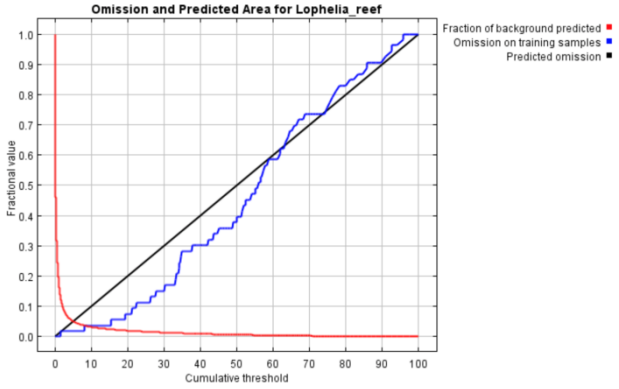


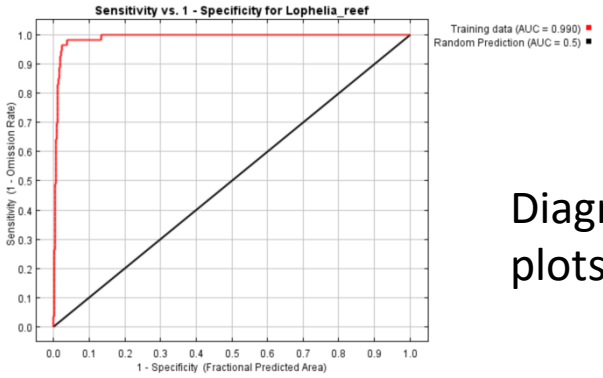






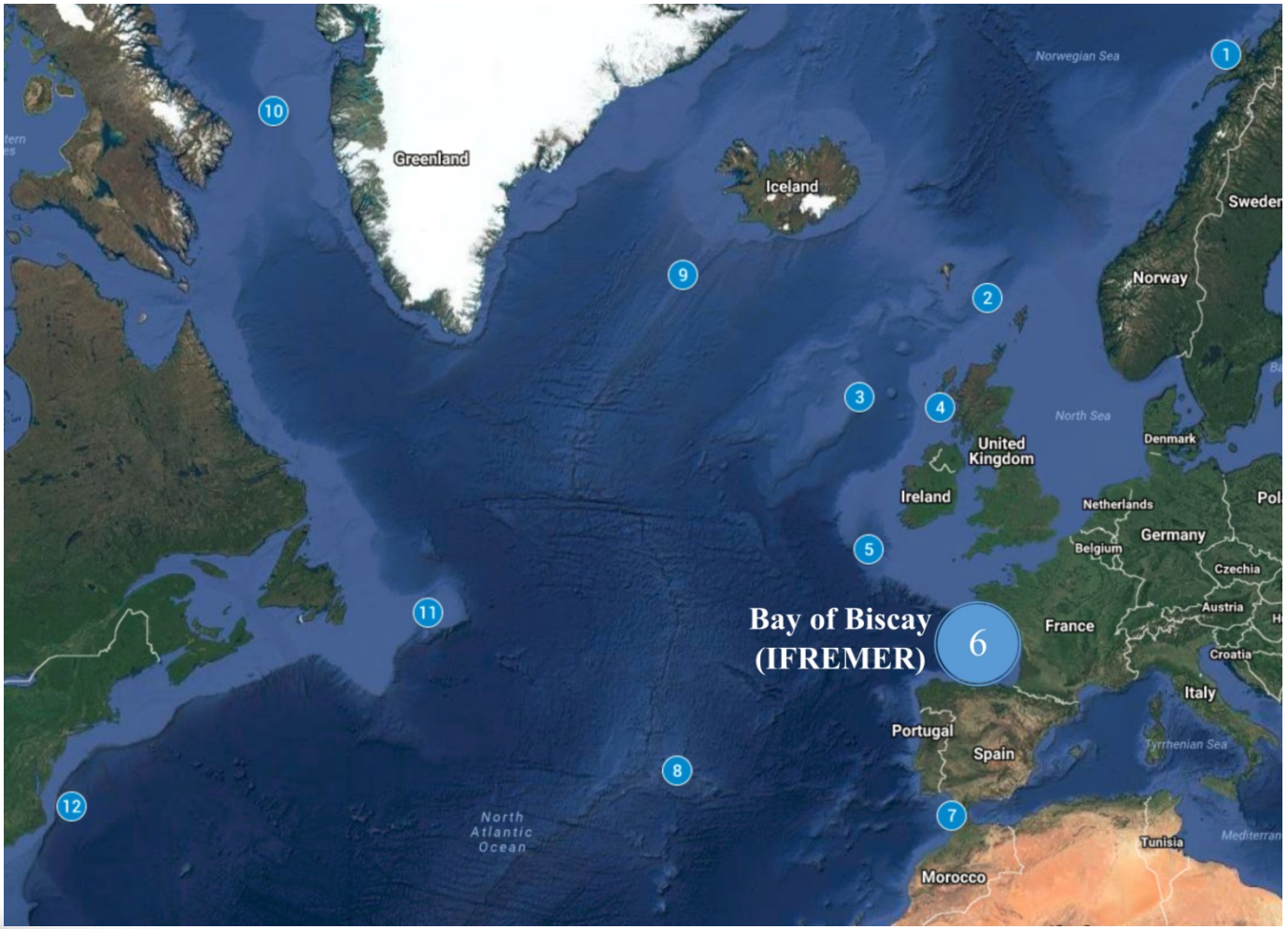






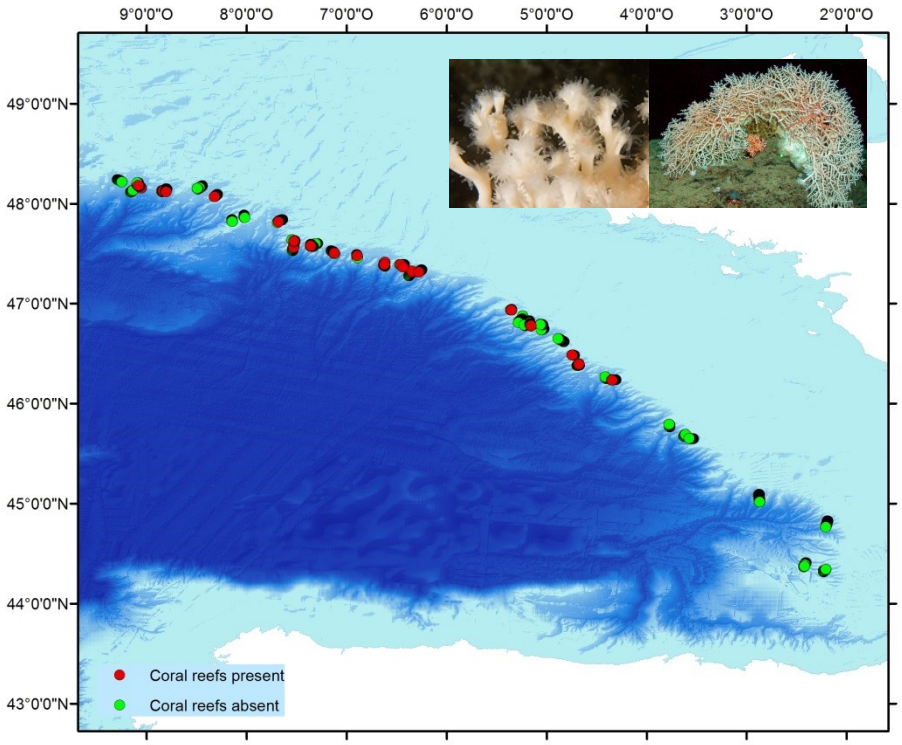
Diagnostic plots

CS6 Bay of Biscay (IFREMER)

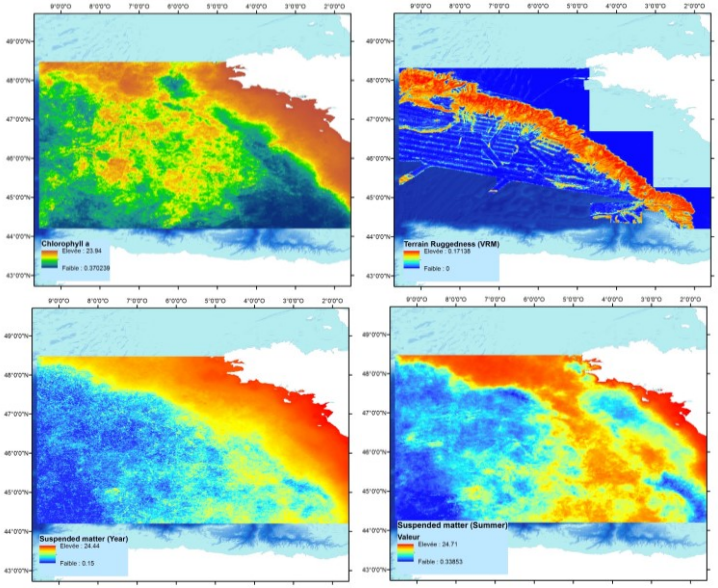


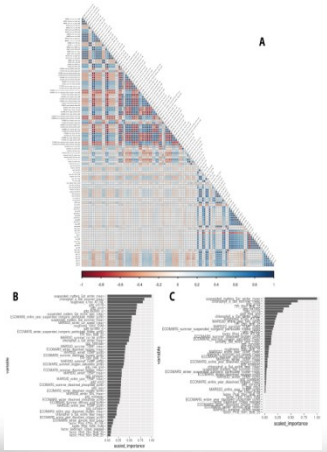
Sandrine Vaz, Pascal Laffargue, Sébastien Rochette, Lenaick Menot

CS6 Data sources & Methods



Presence/Absence of *L. pertusa* and *M. oculata* larger than 25 m², from images of 50 video/photo transects in 24 canyons

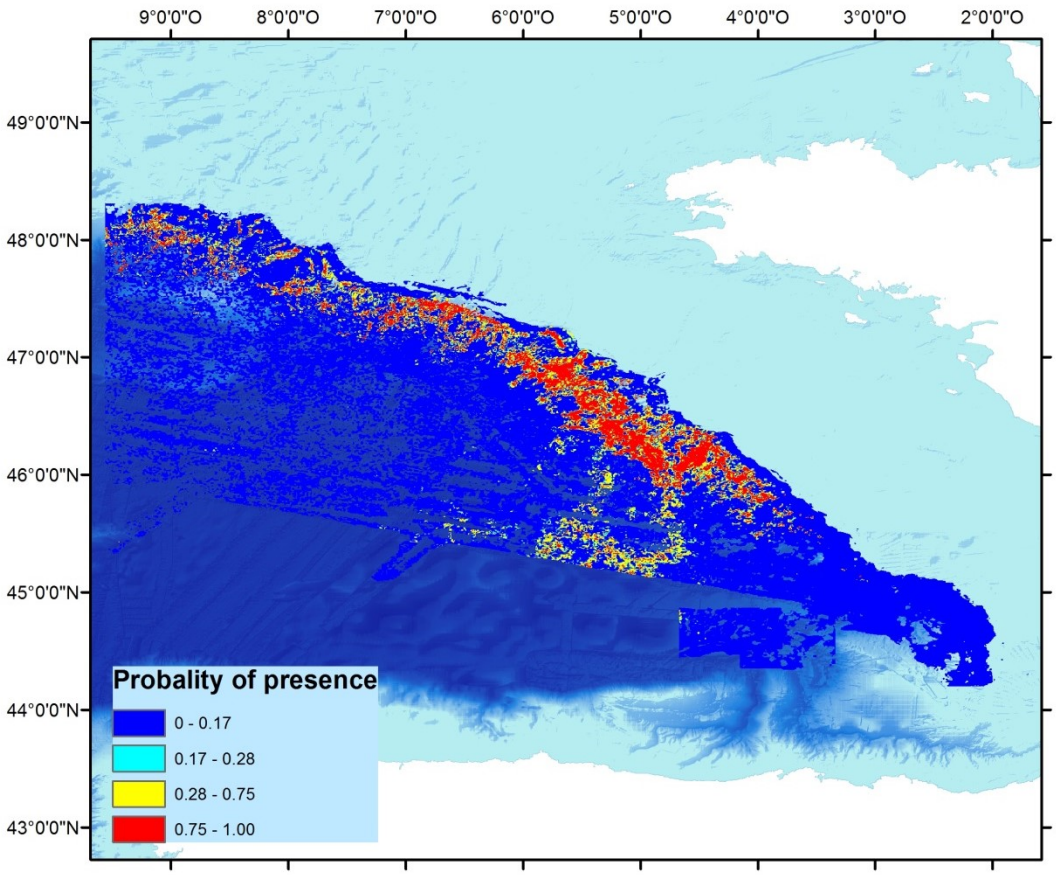


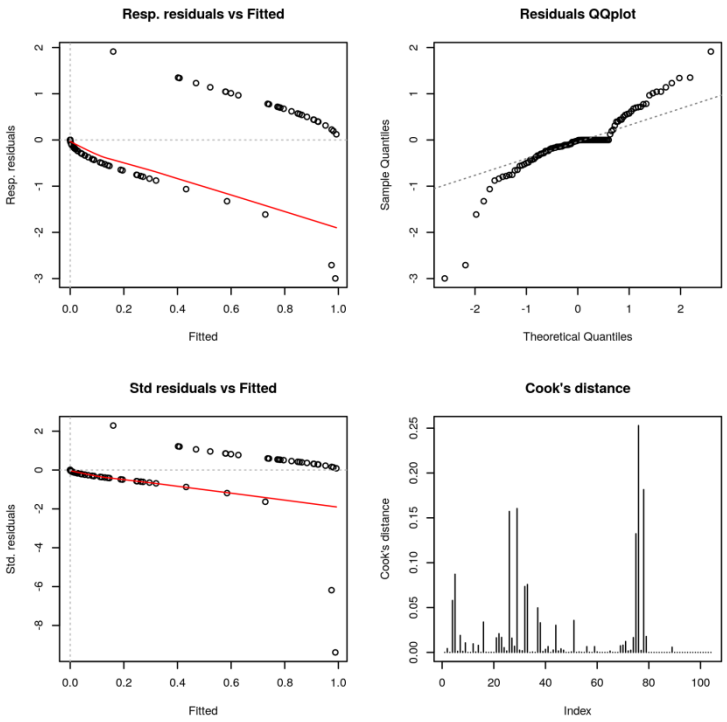


A two-step modelling approach:

1) Variable selection using both RF & BRT
2) GAM/GLM models

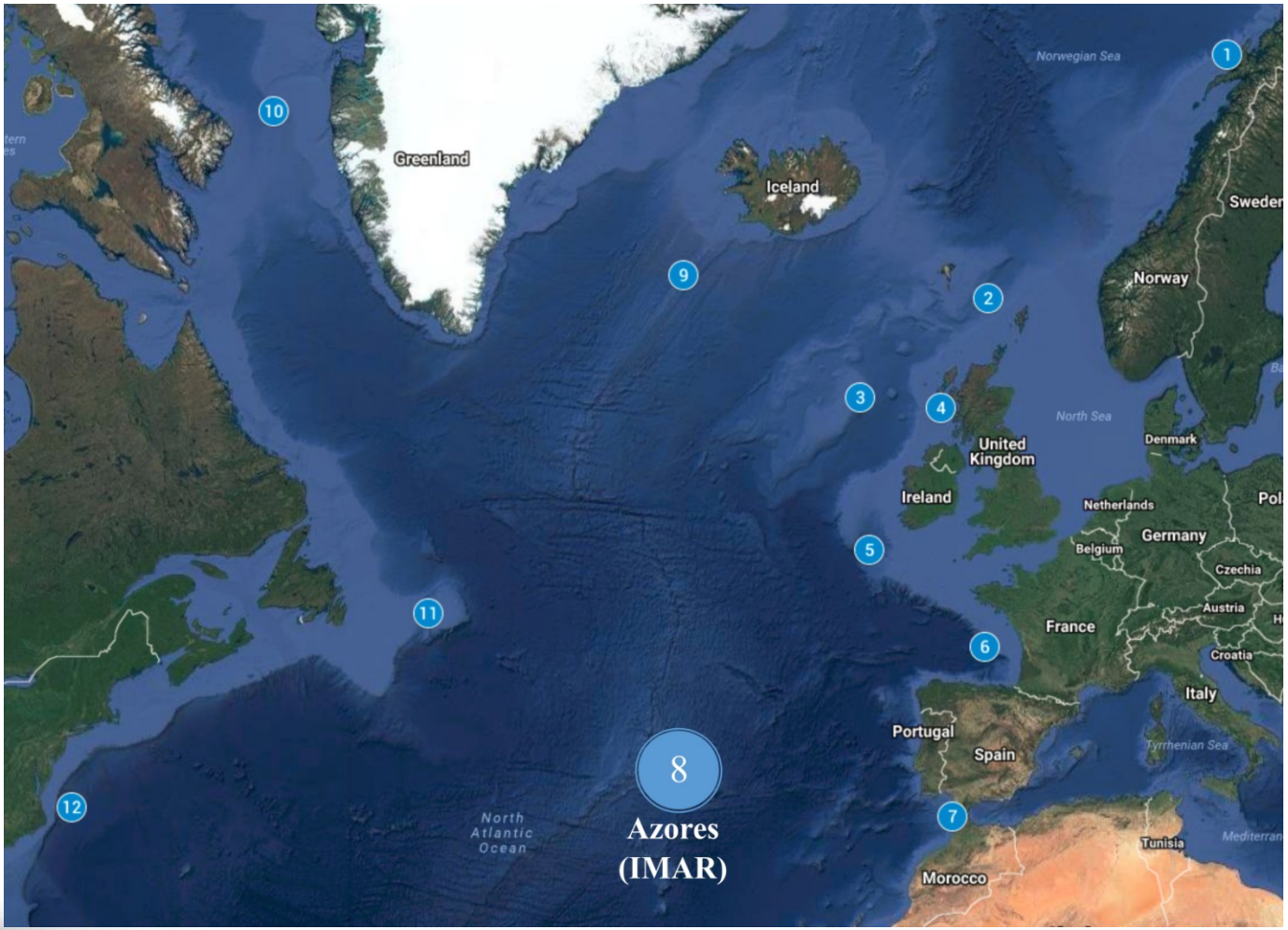
atlas CS6 Maps & Results





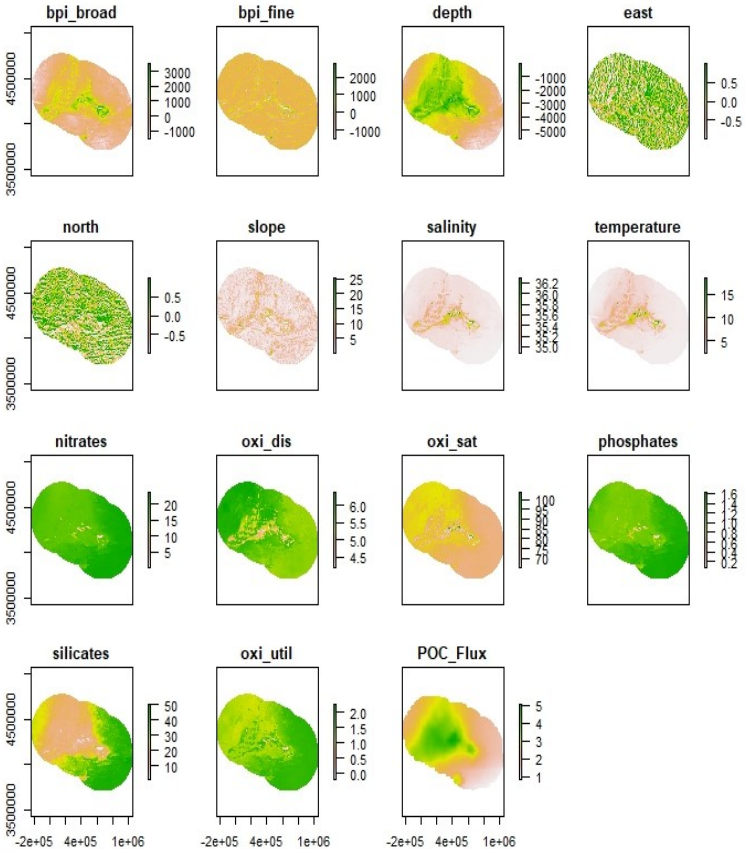
Diagnostic plots

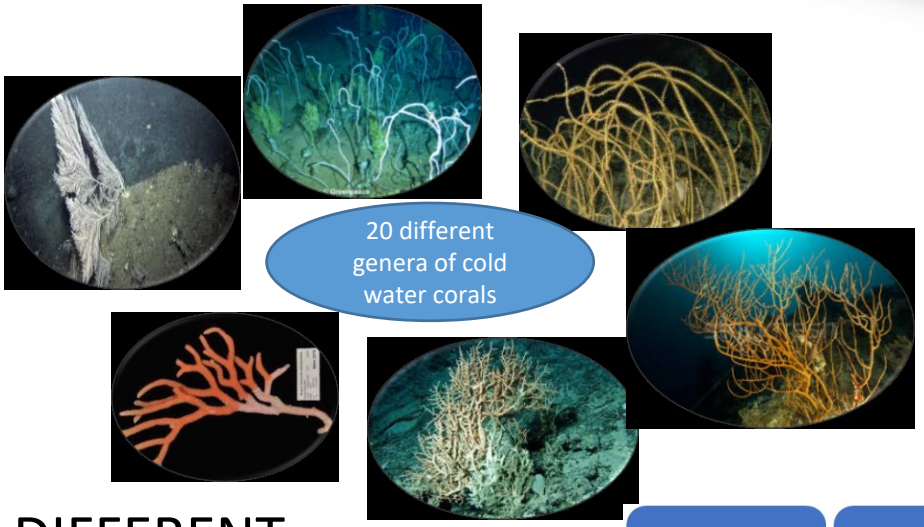
CS8 Azores (IMAR)



Telmo Morato, José Gonzalez-Irusta, Gerald Taranto, et al.

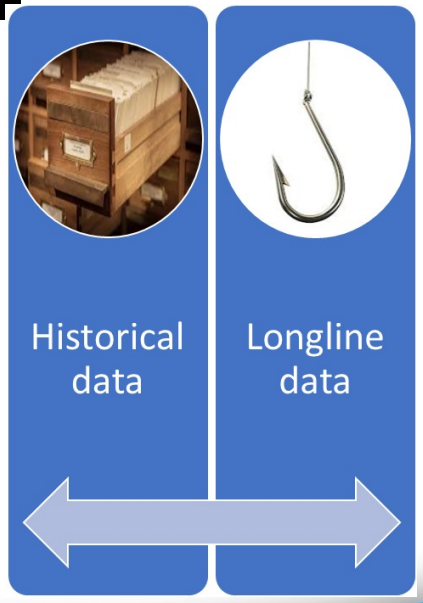
CS8 Data sources & Methods



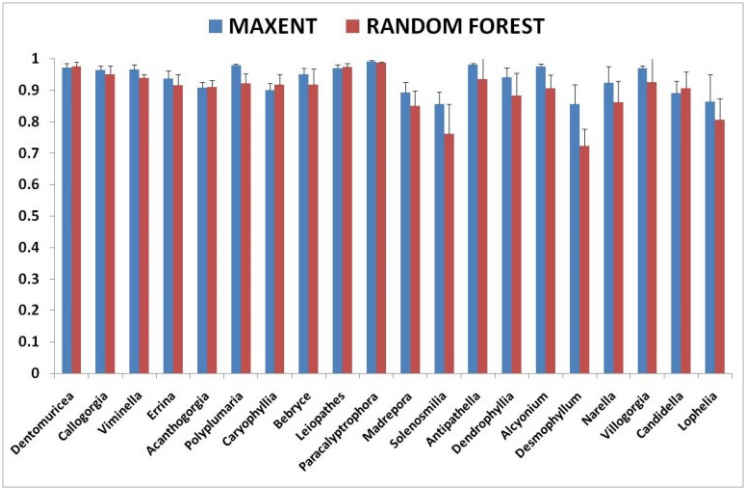


2 DIFFERENT APPROACHES

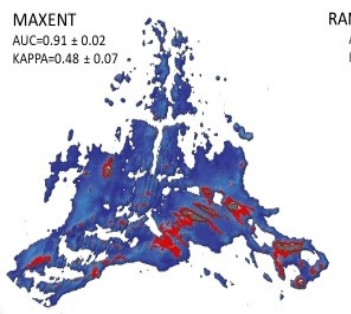
- Random forest using pseudo-absences (10,000 points in rasters with around 14,000 cells avoiding the presence points)
- MaxEnt (using background points)

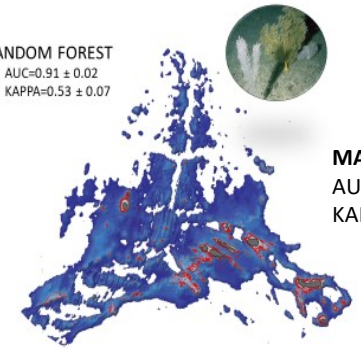


CS8 Maps & Results

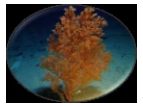


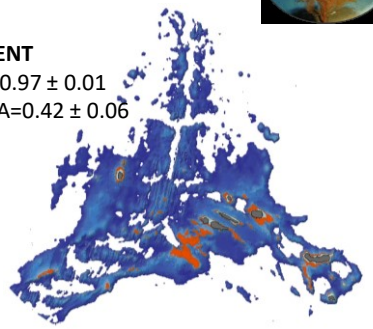
Acanthogorgia



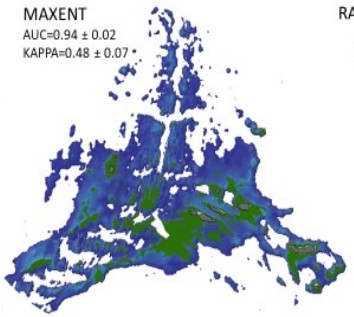


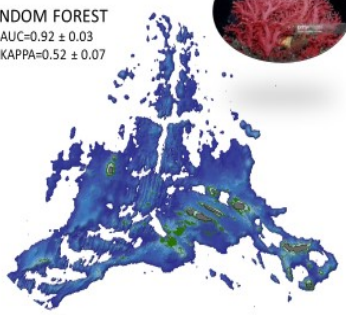
Leiopathes

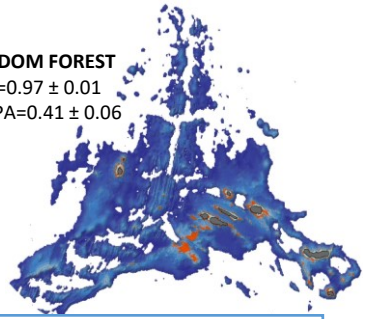




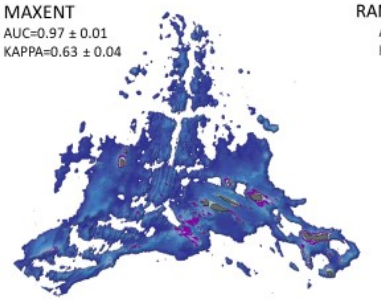
Errina

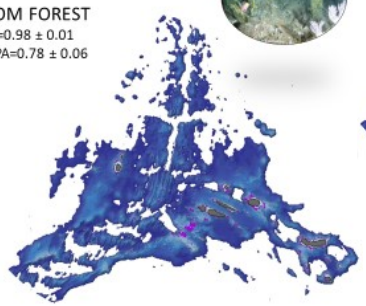






Dentomuricea

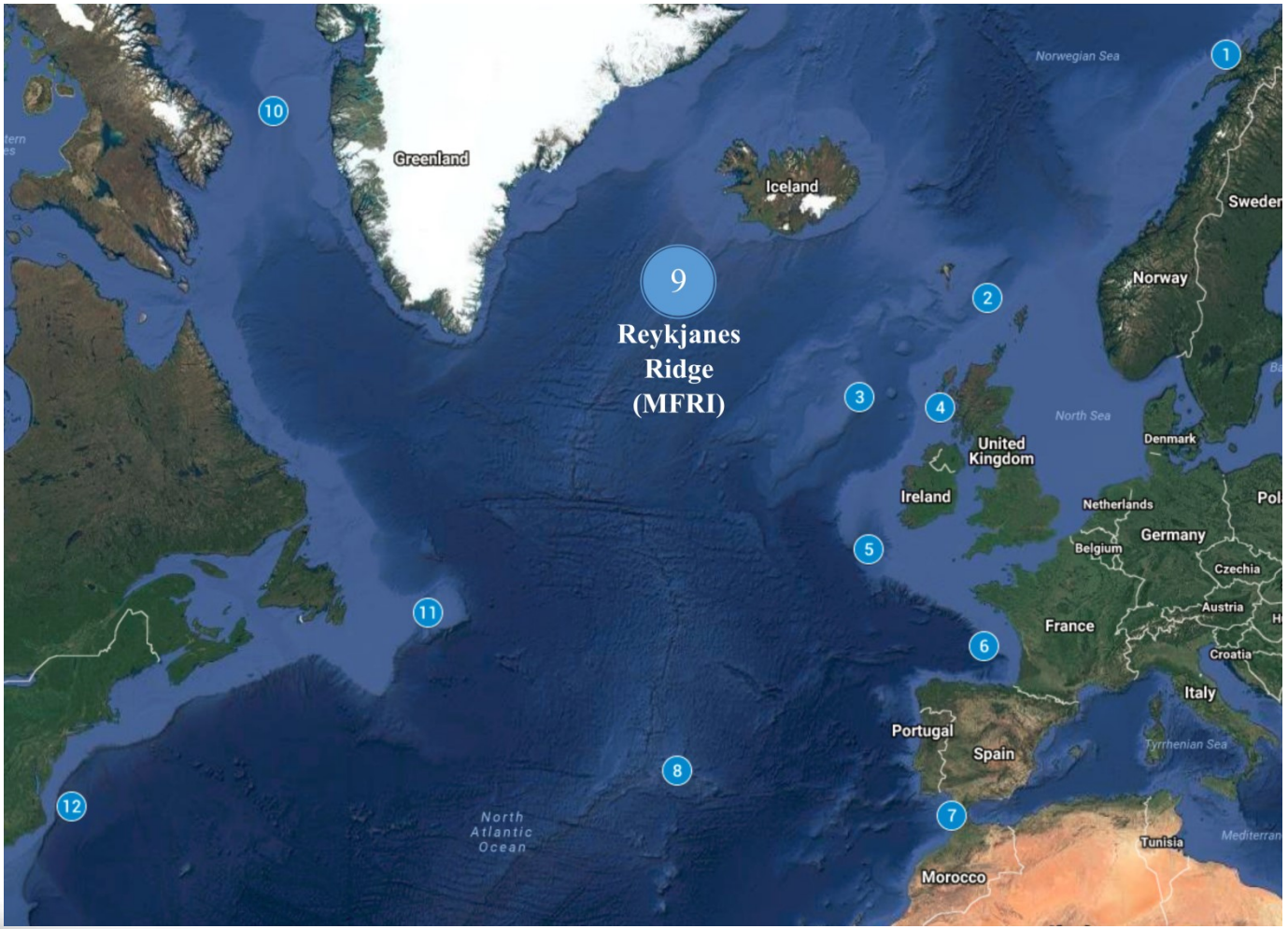




Most of the models showed values of AUC and kappa higher than the threshold for a good performance (0.7 and 0.4 respectively)

Depth was the most important variable for most of the models, followed by oxygen saturation and Particle Organ Carbon (POC) flux

CS9 Reykjanes Ridge (MFRI)



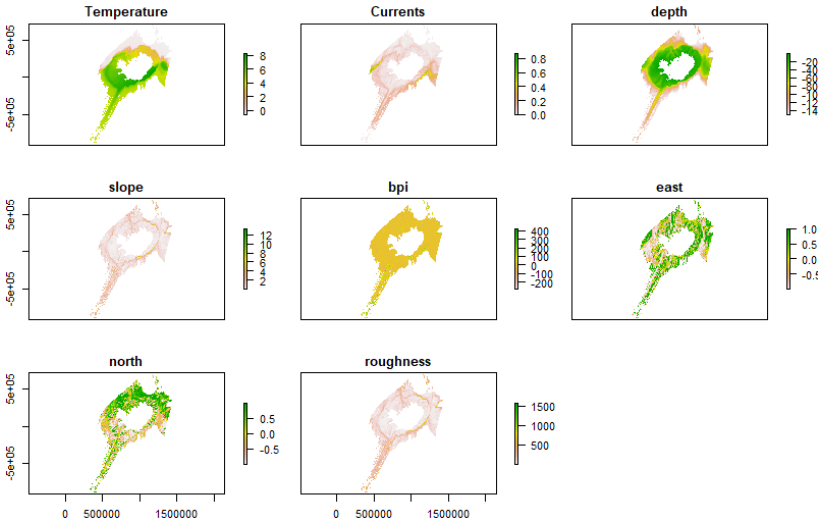
Hrönn Egilsdottir, José Gonzalez-Irusta, Telmo Morato, Stefan Aki Ragnarsson

CS9 Data sources & Methods

Helicolentus dactylopterus

Trawl survey data (1989 – 2009)

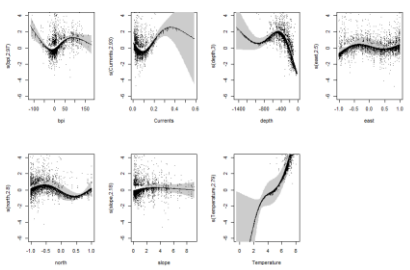
Environmental variables



- Depth & derivatives
- Temperature and Current velocities (avg)

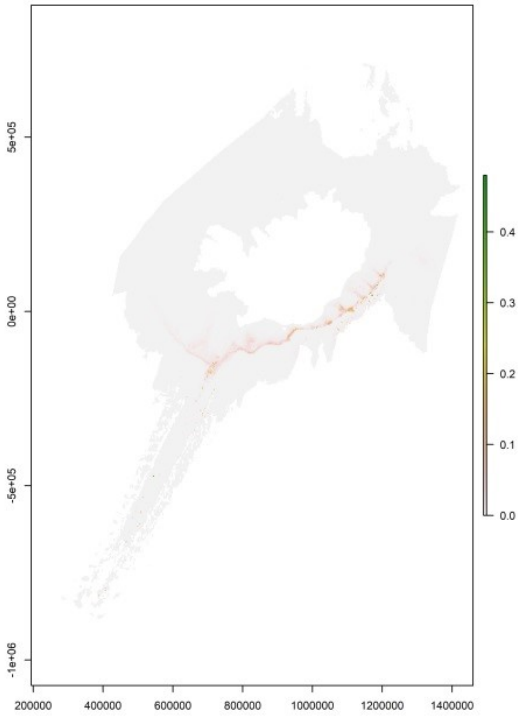
- Predictions made for 2 time periods:
  - 1989 – 1998
  - 1999 - 2009
- Used MaxEnt & GAMs

CS9 Maps & Results

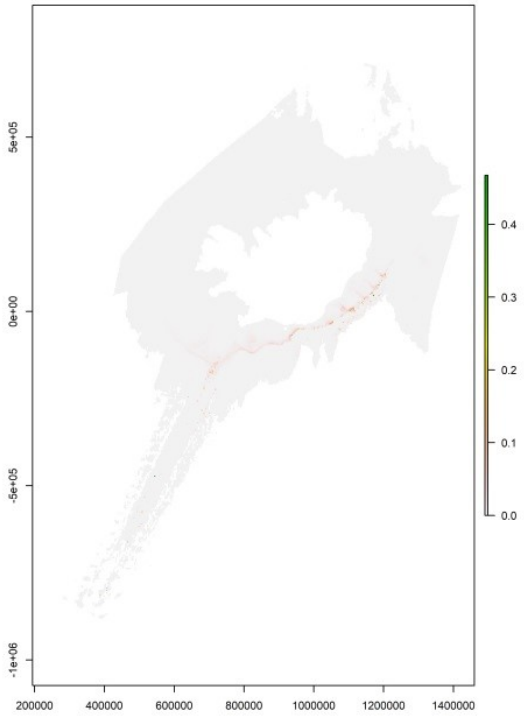


GAM results: the increase in abundance during second period likely related to increase in temperature

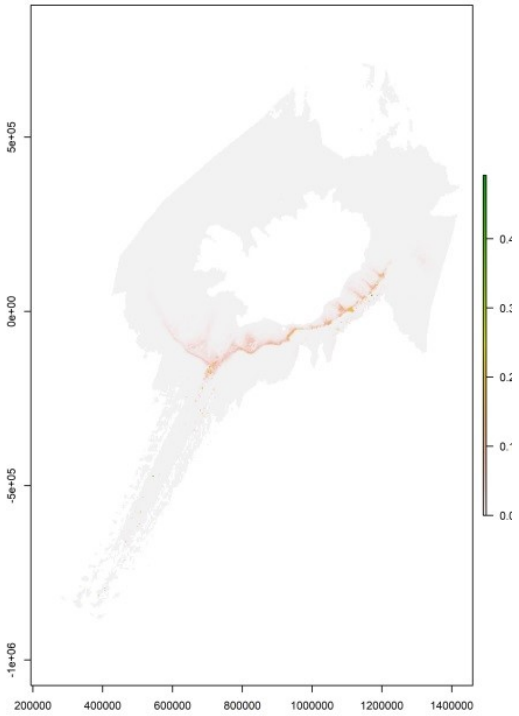
1989 - 2009



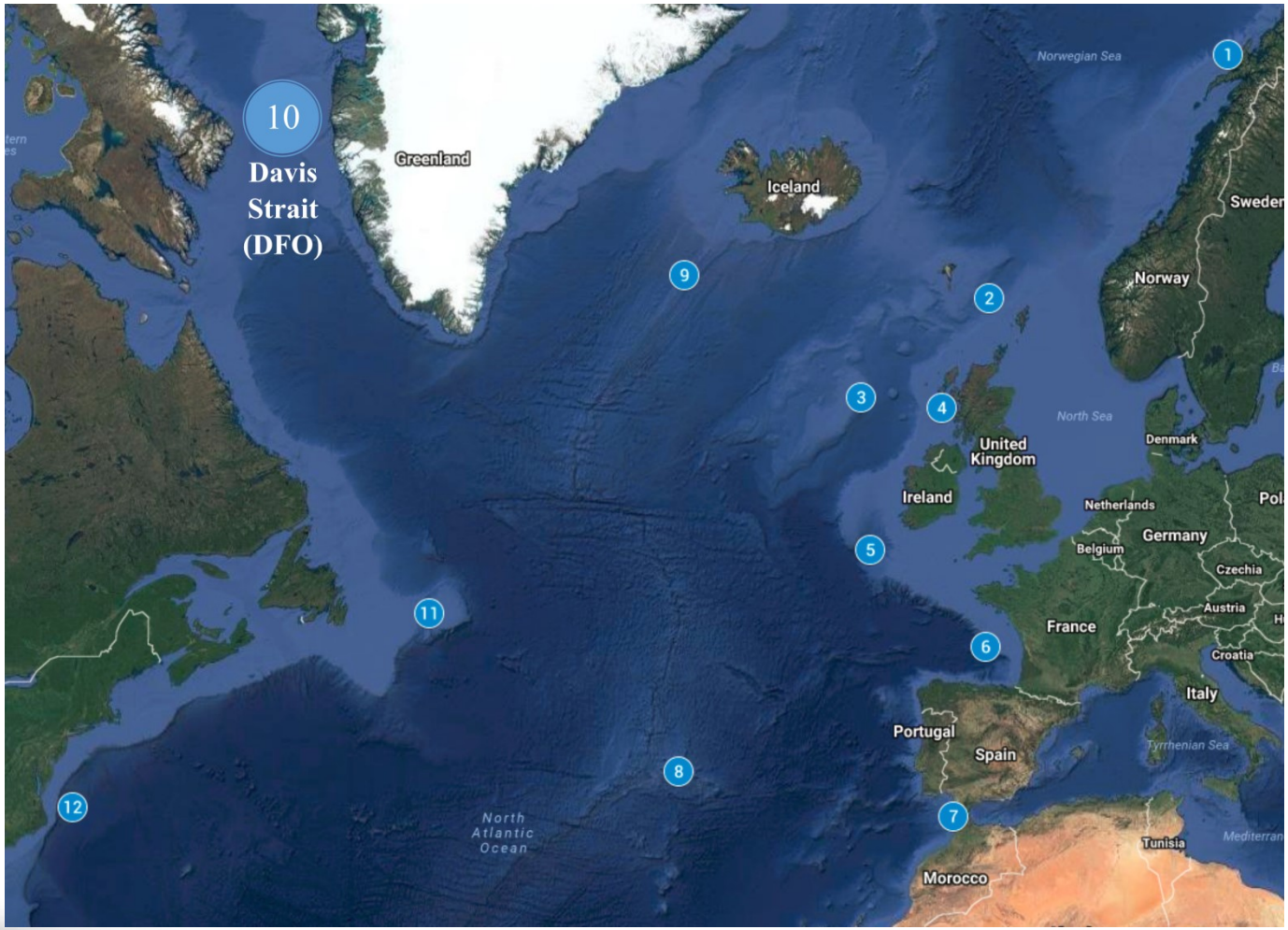
1989 - 1998



1999 - 2009

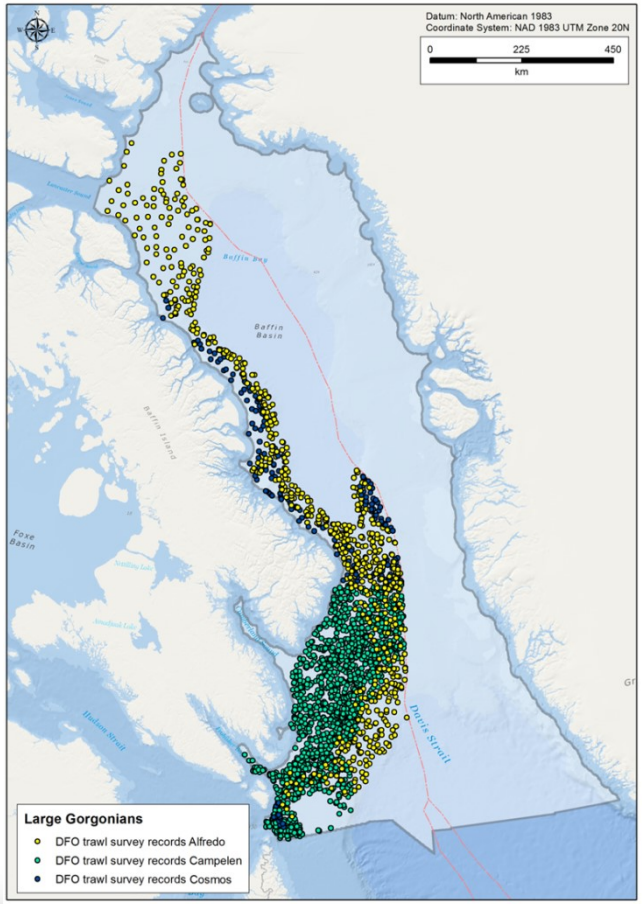


CS10 Davis Strait (DFO)



Ellen Kenchington, Lindsay Beazley, Javier Murillo

CS10 Data sources & Methods



Environmental layers used as predictor variables (n = 58)

Occurrence data from DFO trawl surveys (PA)

Species groups:

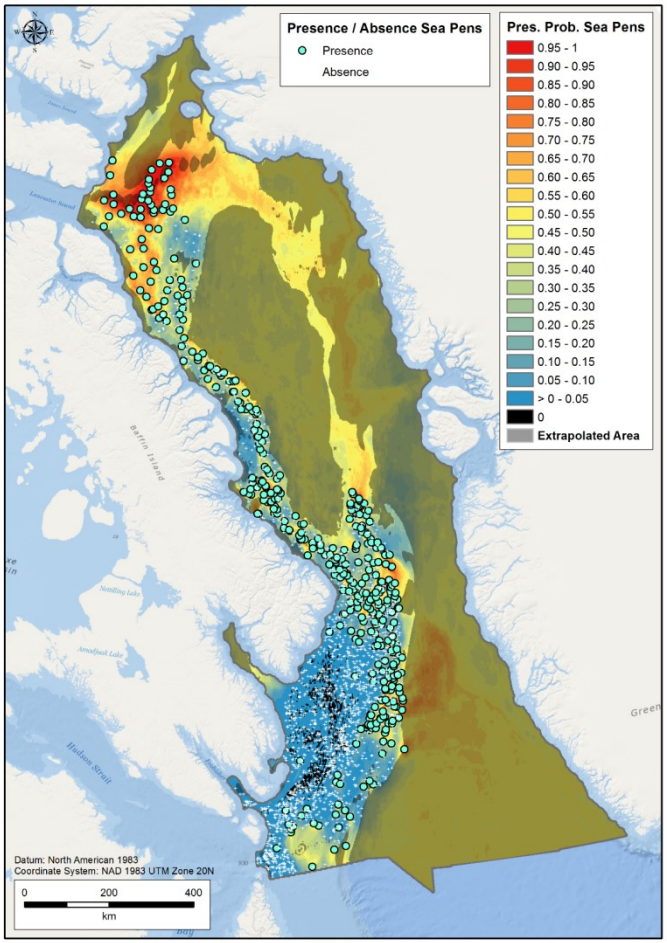
- Sea pens
- Small gorgonians
- Large Gorgonians

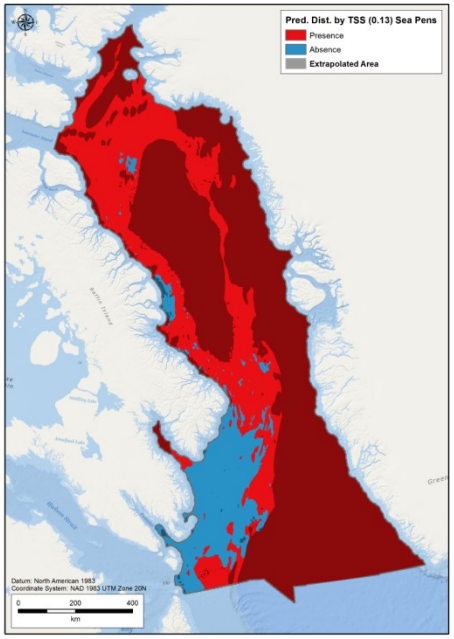
Modelling methods:

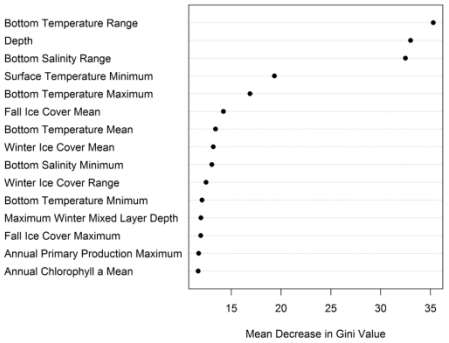
- Random Forest (classification)

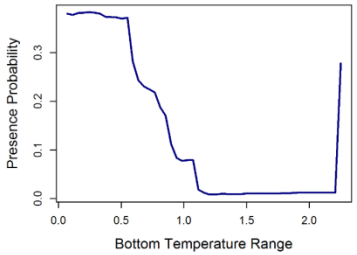
Variable	Data Source	Temporal Range	Unit	Native Resolution
Depth	GEBCO	N/A	metres	30 arc-sec.
Slope	GEBCO	N/A	degrees	30 arc-sec.
Bottom Salinity Mean	GLORYS2V1	1993 - 2011	N/A	¼ º
Bottom Salinity Minimum	GLORYS2V1	1993 - 2011	N/A	¼ º
Bottom Salinity Maximum	GLORYS2V1	1993 - 2011	N/A	¼ º
Bottom Salinity Range	GLORYS2V1	1993 - 2011	N/A	¼ º
Bottom Temperature Mean	GLORYS2V1	1993 - 2011	ºC	¼ º
Bottom Temperature Minimum	GLORYS2V1	1993 - 2011	ºC	¼ º
Bottom Temperature Maximum	GLORYS2V1	1993 - 2011	ºC	¼ º
Bottom Temperature Range	GLORYS2V1	1993 - 2011	ºC	¼ º
Bottom Current Speed Mean	GLORYS2V1	1993 - 2011	m s-1	¼ º
Bottom Current Speed Minimum	GLORYS2V1	1993 - 2011	m s-1	¼ º
Bottom Current Speed Maximum	GLORYS2V1	1993 - 2011	m s-1	¼ º
Bottom Current Speed Range	GLORYS2V1	1993 - 2011	m s-1	¼ º
Bottom Shear Mean	GLORYS2V1	1993 - 2011	Pa	¼ º
Bottom Shear Minimum	GLORYS2V1	1993 - 2011	Pa	¼ º
Bottom Shear Maximum	GLORYS2V1	1993 - 2011	Pa	¼ º
Bottom Shear Range	GLORYS2V1	1993 - 2011	Pa	¼ º
Surface Salinity Mean	GLORYS2V1	1993 - 2011	N/A	¼ º
Surface Salinity Minimum	GLORYS2V1	1993 - 2011	N/A	¼ º
Surface Salinity Maximum	GLORYS2V1	1993 - 2011	N/A	¼ º
Surface Salinity Range	GLORYS2V1	1993 - 2011	N/A	¼ º
Surface Temperature Mean	GLORYS2V1	1993 - 2011	ºC	¼ º
Surface Temperature Minimum	GLORYS2V1	1993 - 2011	ºC	¼ º
Surface Temperature Maximum	GLORYS2V1	1993 - 2011	ºC	¼ º
Surface Temperature Range	GLORYS2V1	1993 - 2011	ºC	¼ º
Surface Current Speed Mean	GLORYS2V1	1993 - 2011	m s-1	¼ º
Surface Current Speed Minimum	GLORYS2V1	1993 - 2011	m s-1	¼ º
Surface Current Speed Maximum	GLORYS2V1	1993 - 2011	m s-1	¼ º
Surface Current Speed Range	GLORYS2V1	1993 - 2011	m s-1	¼ º
Maximum Fall Mixed Layer Depth	GLORYS2V1	1993 - 2011	metres	¼ º
Maximum Winter Mixed Layer Depth	GLORYS2V1	1993 - 2011	metres	¼ º
Maximum Spring Mixed Layer Depth	GLORYS2V1	1993 - 2011	metres	¼ º
Maximum Summer Mixed Layer Depth	GLORYS2V1	1993 - 2011	metres	¼ º
Summer Chlorophyll a Mean	SeaWiFS Level-3, NASA's OceanColor	2001 - 2010	mg m-3	9 km
Summer Chlorophyll a Minimum	SeaWiFS Level-3, NASA's OceanColor	2001 - 2010	mg m-3	9 km
Annual Chlorophyll a Mean	SeaWiFS Level-3, NASA's OceanColor	2001 - 2010	mg m-3	9 km
Annual Chlorophyll a Minimum	SeaWiFS Level-3, NASA's OceanColor	2001 - 2010	mg m-3	9 km
Summer Primary Production Mean	SeaWiFS Level-3 with other input parameters	2006 - 2010	mg C m-2 day-1	9 km
Summer Primary Production Minimum	SeaWiFS Level-3 with other input parameters	2006 - 2010	mg C m-2 day-1	9 km
Summer Primary Production Maximum	SeaWiFS Level-3 with other input parameters	2006 - 2010	mg C m-2 day-1	9 km
Summer Primary Production Range	SeaWiFS Level-3 with other input parameters	2006 - 2010	mg C m-2 day-1	9 km
Annual Primary Production Mean	SeaWiFS Level-3 with other input parameters	2006 - 2010	mg C m-2 day-1	9 km
Annual Primary Production Minimum	SeaWiFS Level-3 with other input parameters	2006 - 2010	mg C m-2 day-1	9 km
Annual Primary Production Maximum	SeaWiFS Level-3 with other input parameters	2006 - 2010	mg C m-2 day-1	9 km
Annual Primary Production Range	SeaWiFS Level-3 with other input parameters	2006 - 2010	mg C m-2 day-1	9 km
Spring Ice Cover Mean	HadISST	1993-2010	Percent (%)	1°
Spring Ice Cover Minimum	HadISST	1993-2010	Percent (%)	1°
Spring Ice Cover Maximum	HadISST	1993-2010	Percent (%)	1°
Spring Ice Cover Range	HadISST	1993-2010	Percent (%)	1°
Fall Ice Cover Mean	HadISST	1993-2010	Percent (%)	1°
Fall Ice Cover Minimum	HadISST	1993-2010	Percent (%)	1°
Fall Ice Cover Maximum	HadISST	1993-2010	Percent (%)	1°
Fall Ice Cover Range	HadISST	1993-2010	Percent (%)	1°
Winter Ice Cover Mean	HadISST	1993-2010	Percent (%)	1°
Winter Ice Cover Minimum	HadISST	1993-2010	Percent (%)	1°
Winter Ice Cover Maximum	HadISST	1993-2010	Percent (%)	1°
Winter Ice Cover Range	HadISST	1993-2010	Percent (%)	1°

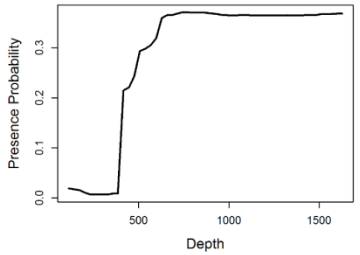
CS10 Davis Strait (DFO)

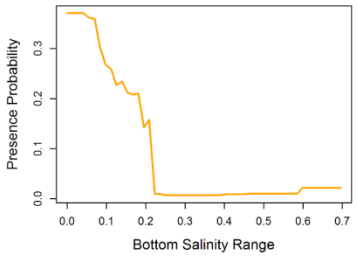


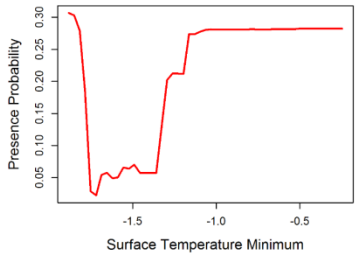


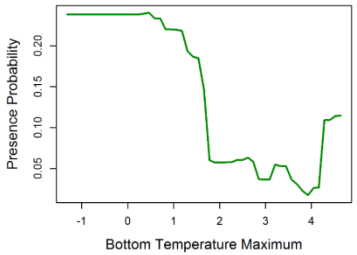


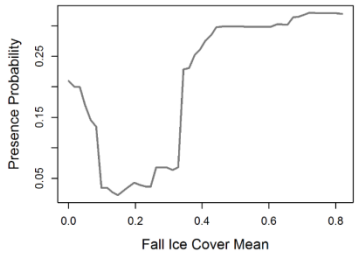






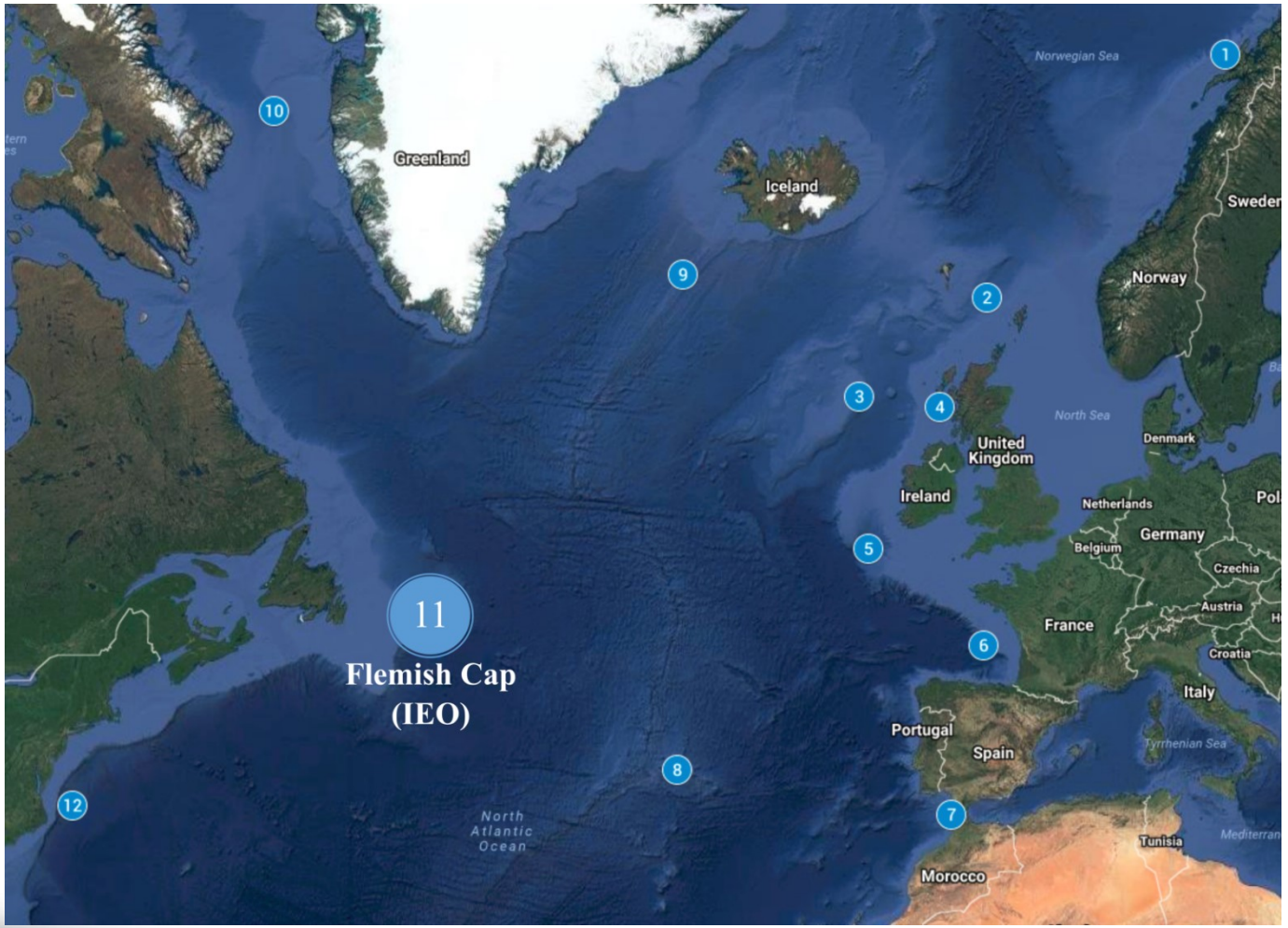






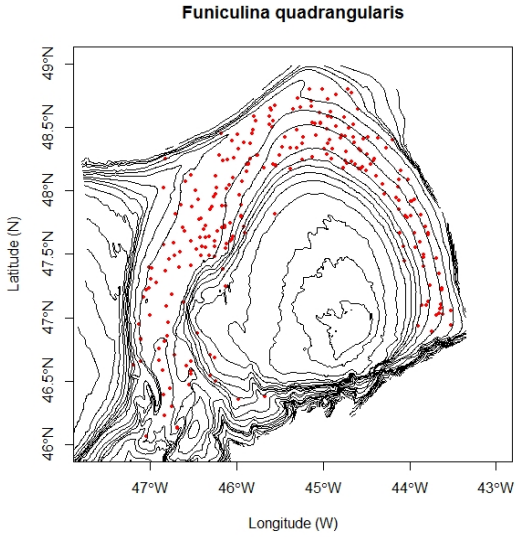
e.g. Sea pens

CS11 Flemish Cap (IEO)



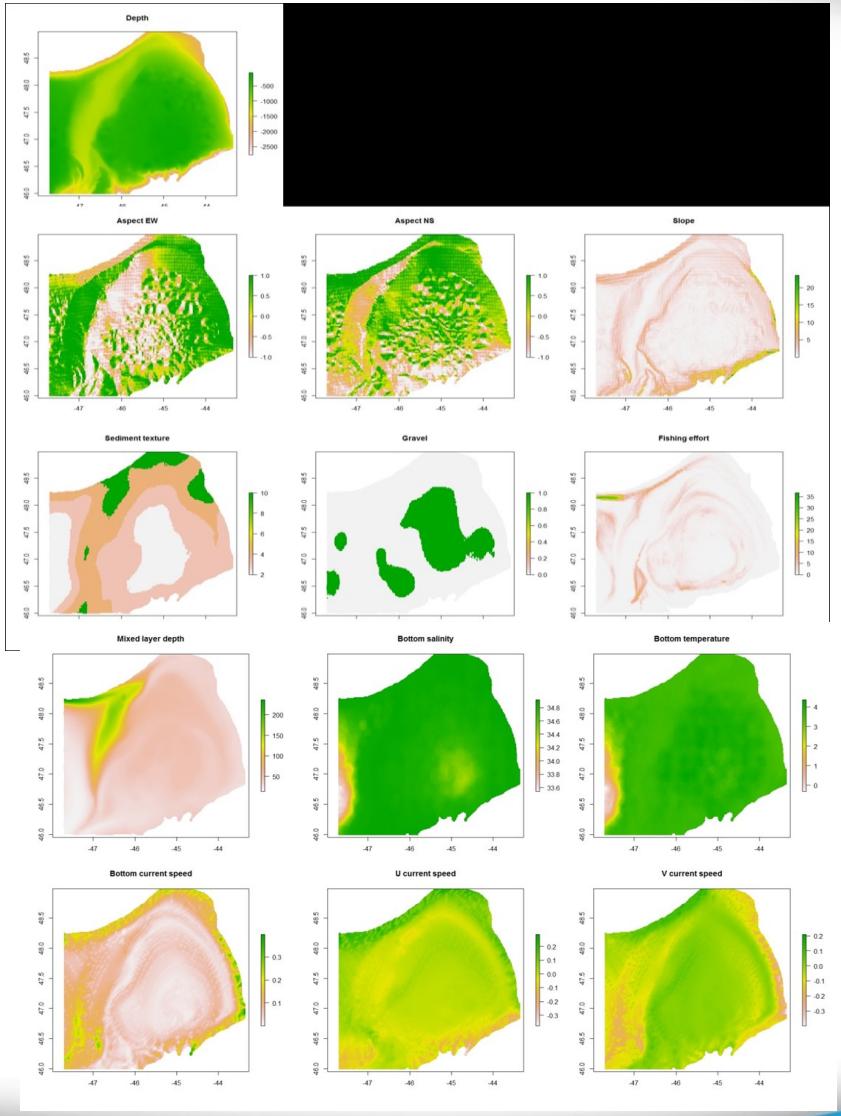
Mar Sacau, Ana García-Alegre, M. G. Pennino, Pablo Durán Muñoz

CS11 Data sources & Methods



Modelling methods:

- GAM
- RF
- MaxEnt
- Ensemble



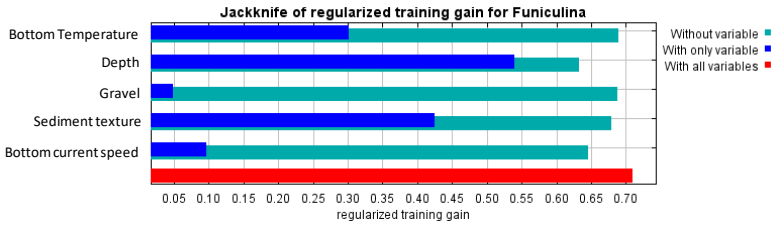
Species (sea pens)
Anthoptilum grandiflorum,
Pennatula aculeata ,
Acanella arbuscula &
Funiculina quadrangularis

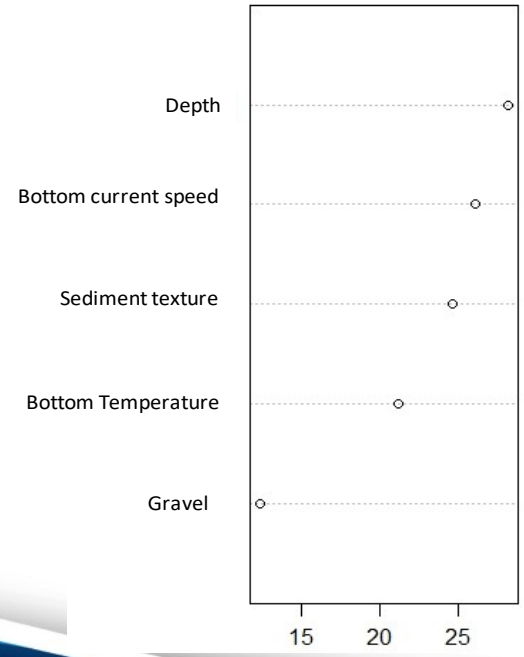
Sea pen occurrence (PA) data (2007-2017) from R/V Vizconde de EZA Groundfish Surveys

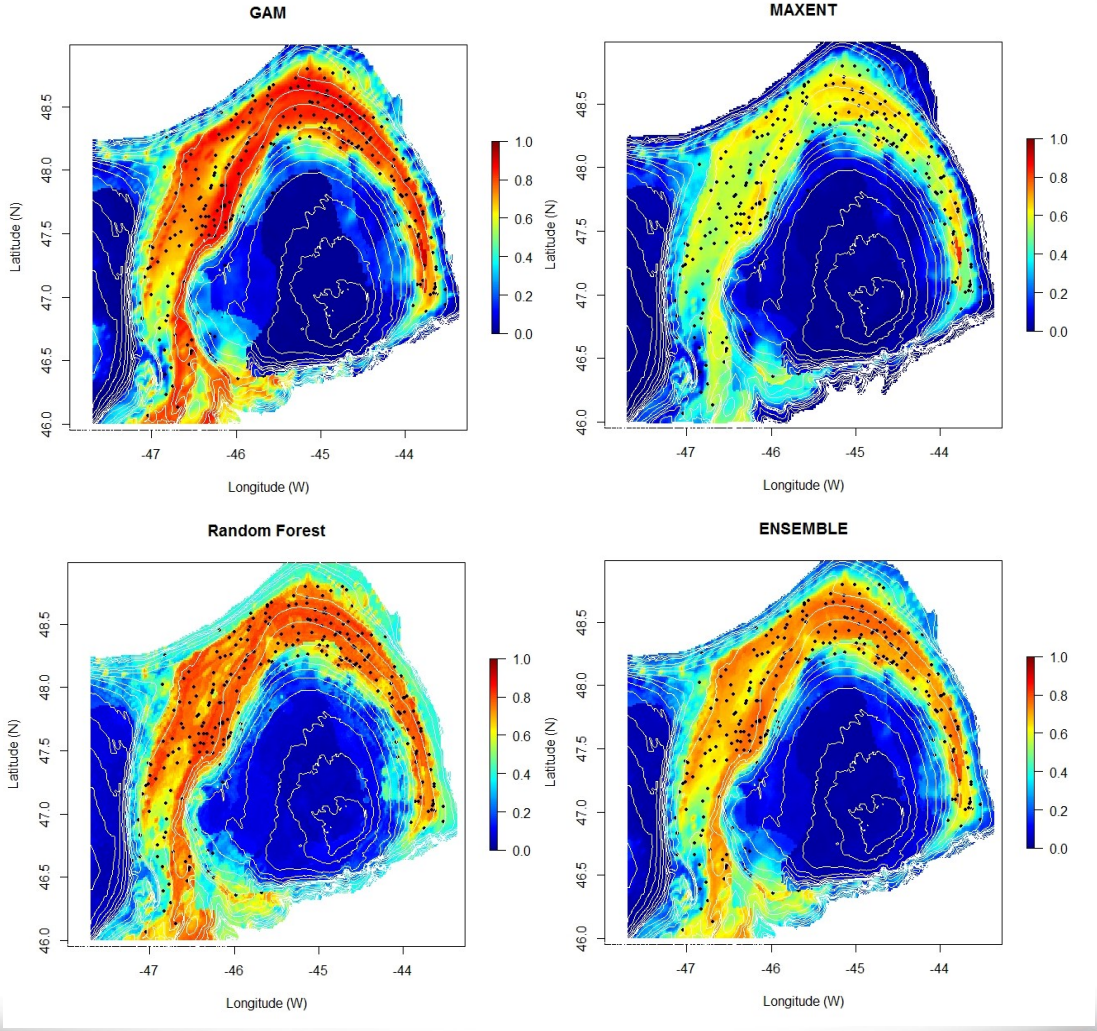
iSEAS

CS11 Maps & Results

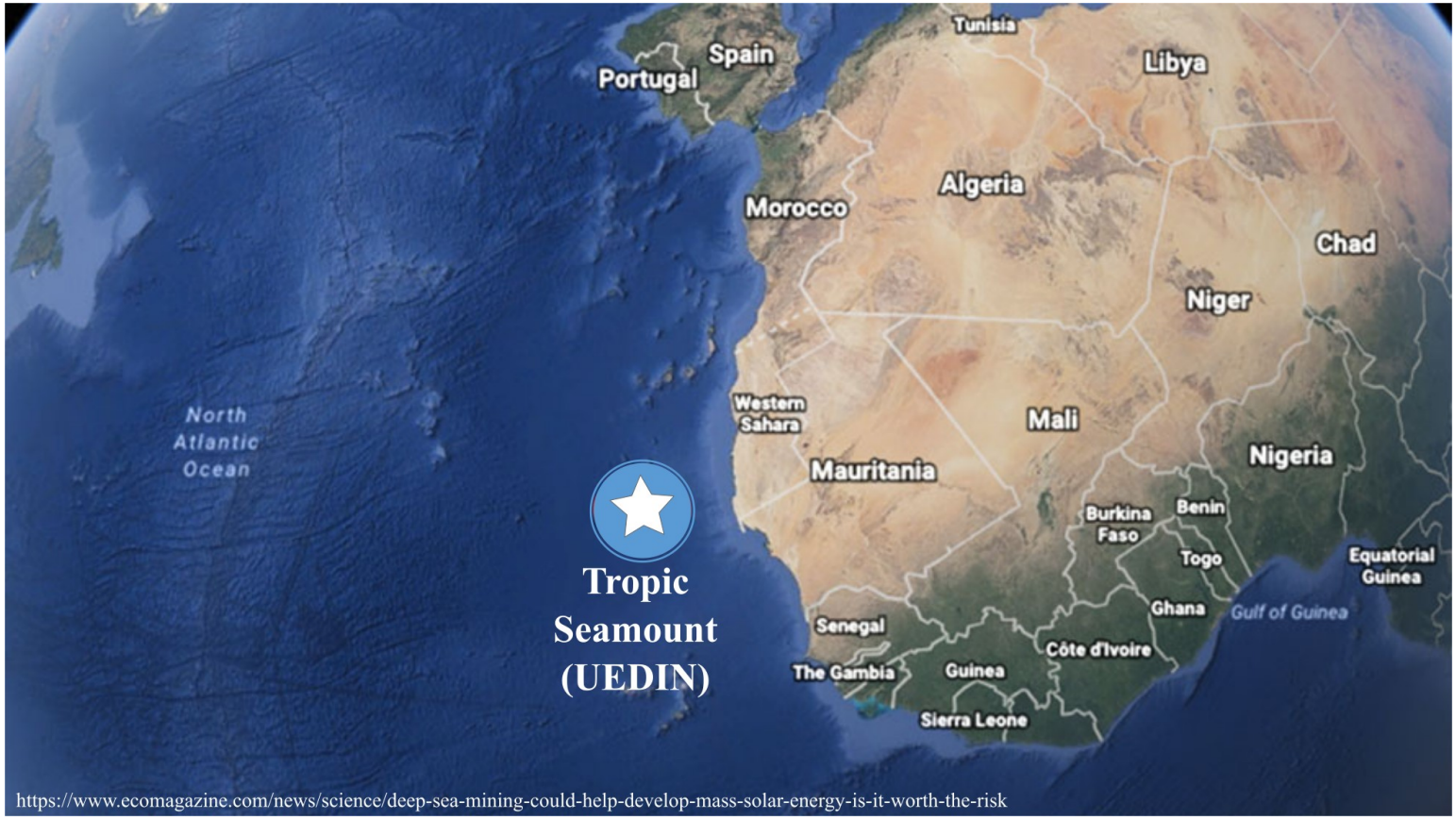
E.g. Funiculina quadrangularis





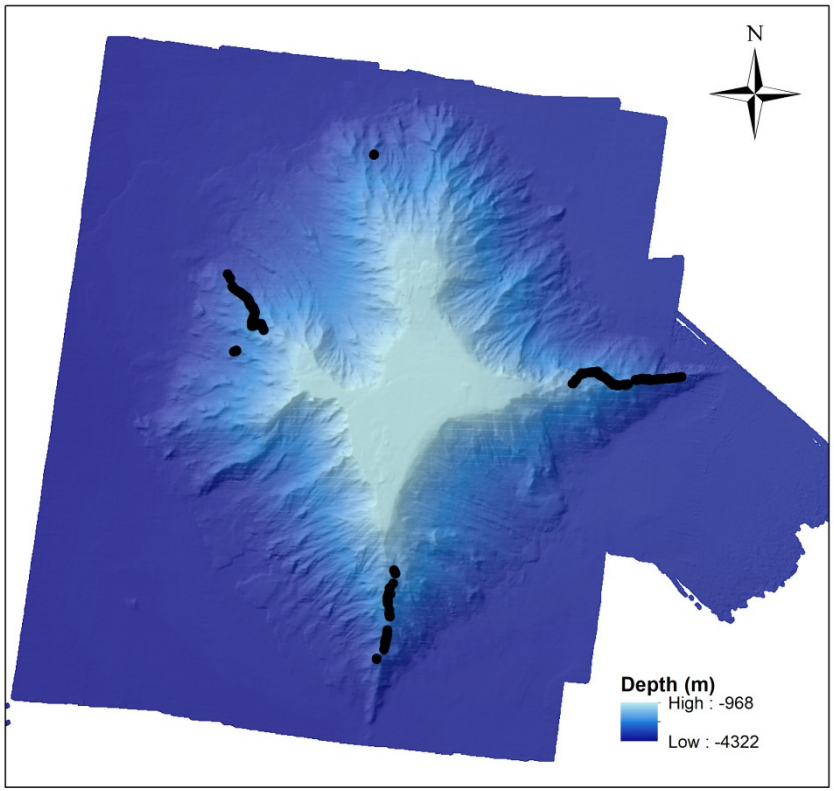


Bonus: Trophic Seamount (UEDIN)



Berta Ramiro-Sanchez, Lea-Anne Henry

TSM: Data sources & Methods



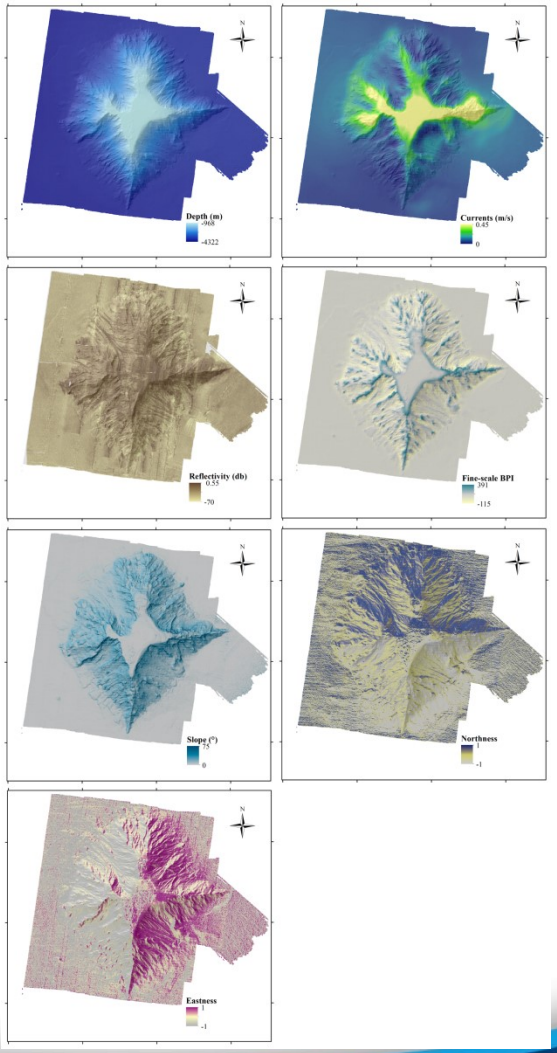
Occurrence: hexactinellid sponge *Poliopogon amadou* (PO)

Environmental layers:

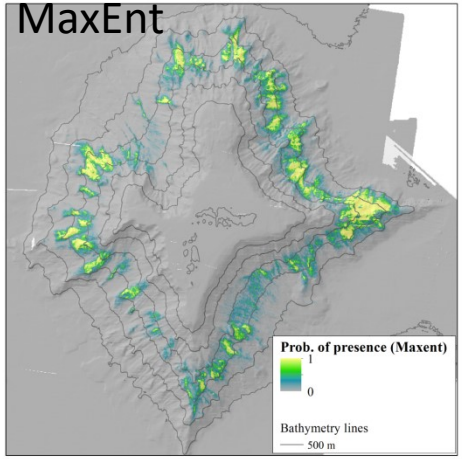
- Depth & derivatives
- Current velocities

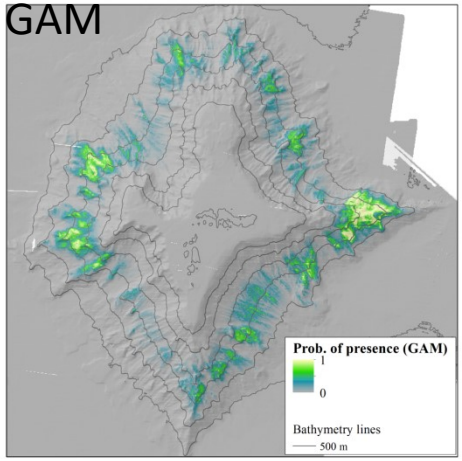
Modelling methods:

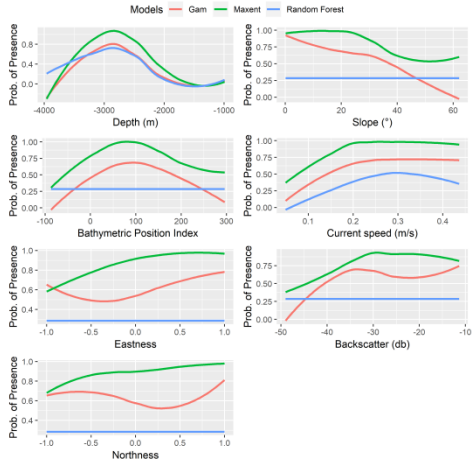
- GAM
- MaxEnt
- RF (regression)
- Ensemble

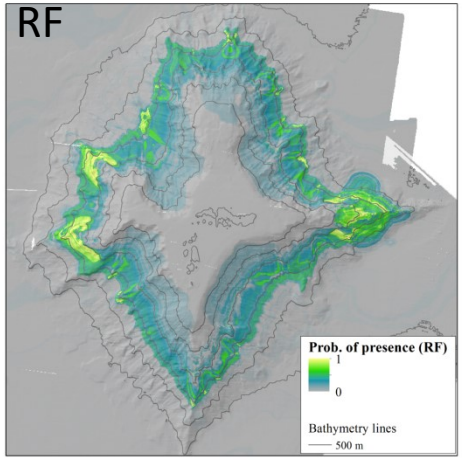


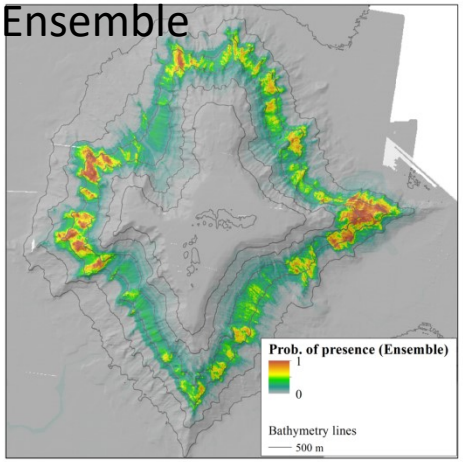
TSM: Maps & Results

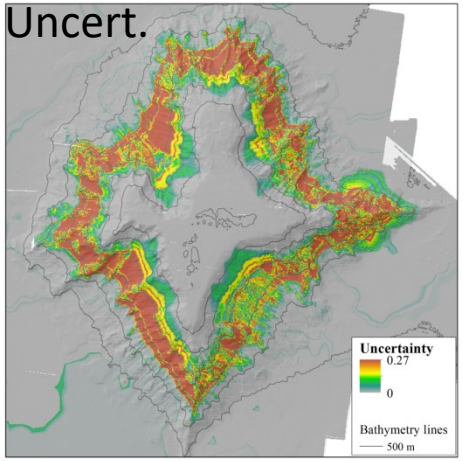


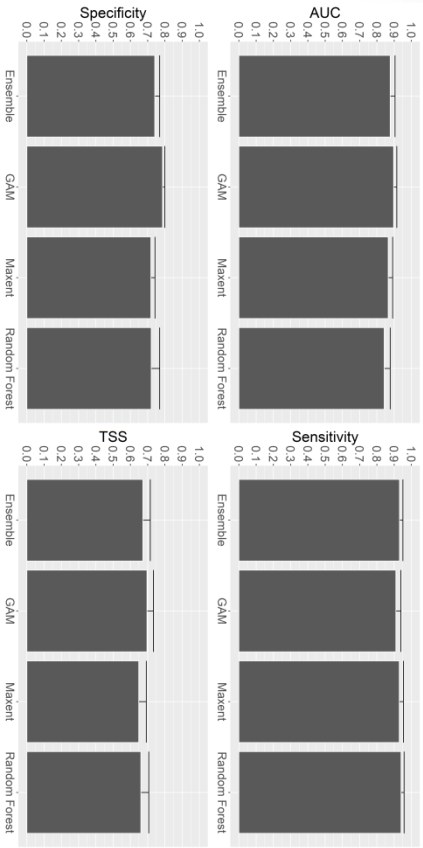












Going forward

Future Directions:

- **CS3:** Extend predicted area over Hatton-Rockall plateau; include chemistry
- **CS6:** potentially improve models by explicitly modelling spatial autocorrelation
- **CS8:** Incorporate new records from videos currently being worked up
- **CS10:** Use Archetype / SAM models for sponges
- **CS11:** Include biomass data, test models at different resolutions of env layers
- **TSM:** Potentially test other variable selection procedures

Thank You!

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