AZTI
MEMBER OF
BASQUE RESEARCH
& TECHNOLOGY ALLIANCE

www.azti.es

Spatial assessment of the interplay between fishing activity and marine protected areas during the Atlantic phase of the critically endangered Balearic shearwater

Maite Louzao[1,], David García[2], Gemma Carrasco[2], Isabel García-Barón[1], Marina Ramírez[1], Pep Arcos[3]*

[1]AZTI, Marine Research, Basque Research and Technology Alliance (BRTA), Pasaia, Spain.

[2]Iniciativa de Recerca de Biodiversitat de les Illes (IRBI), Pina, Balearic Islands, Spain

[3]SEO/BirdLife, Barcelona, Spain

IRBI Iniciativa de Recerca de la Biodiversitat de les Illes

SEO BirdLife www.seo.org

INTEMARES

Life

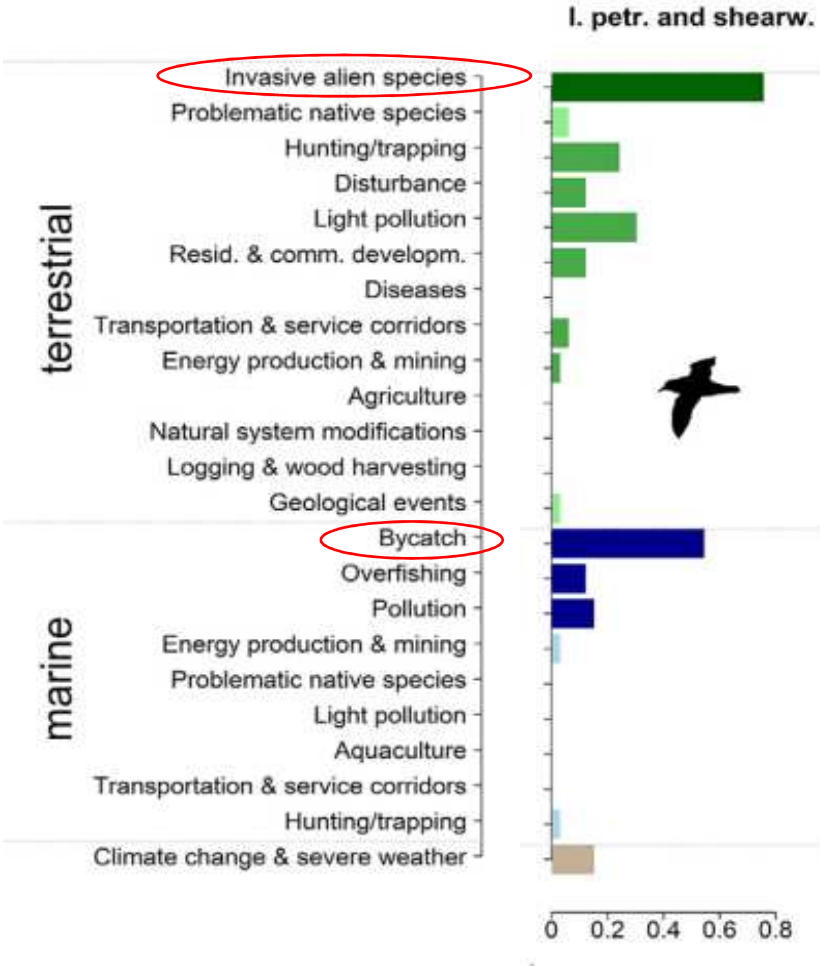
NATURA 2000

AZTI
MEMBER OF BASQUE RESEARCH & TECHNOLOGY ALLIANCE

GENERAL OVERVIEW

- **Seabirds** are amongst the most threatened of all vertebrate groups.

- **Mean threats**: introduced predators on land and fisheries bycatch at sea.

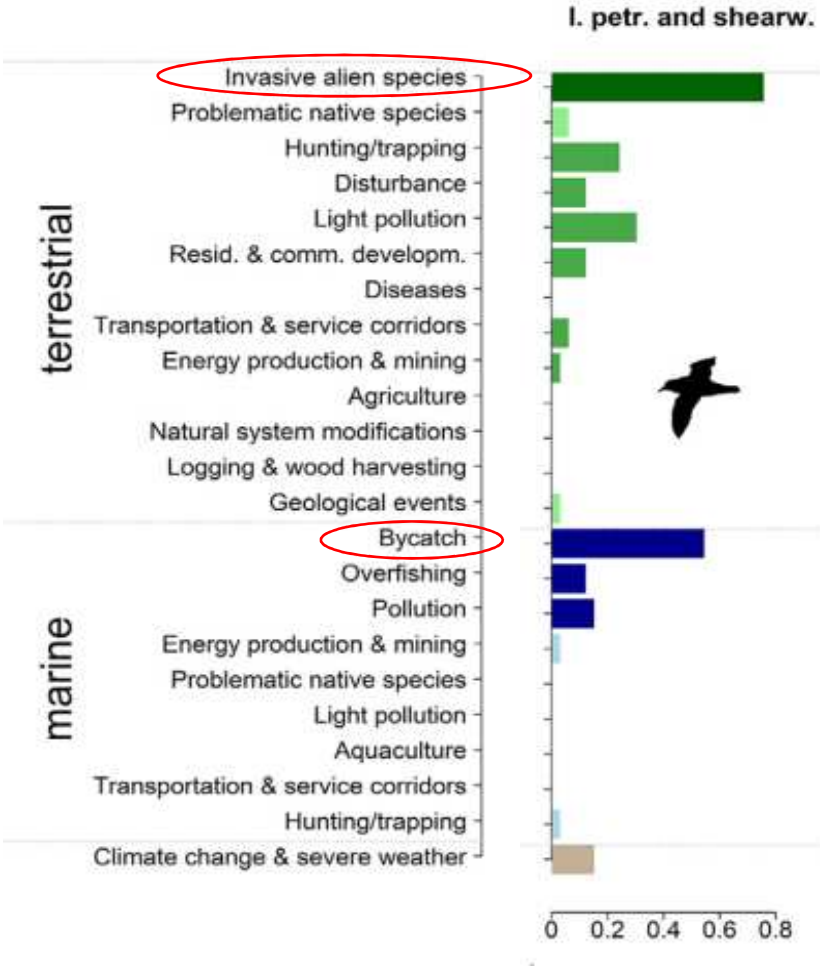


Dias et al. 2019

AZTI
MEMBER OF BASQUE RESEARCH & TECHNOLOGY ALLIANCE

GENERAL OVERVIEW

- **Seabirds** are amongst the most threatened of all vertebrate groups.
- **Mean threats**: introduced predators on land and fisheries bycatch at sea.
- Seabird affected by **multiple threats** with **cumulative** effects, and their population declines requires a suite of management measures.



Dias et al. 2019

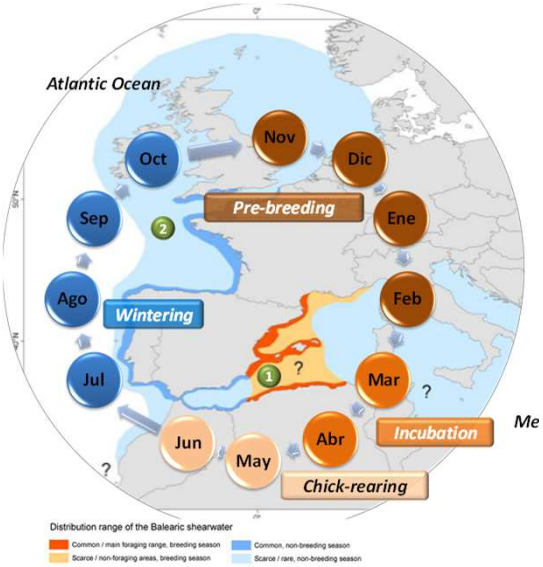
AZTI
MEMBER OF BASQUE RESEARCH & TECHNOLOGY ALLIANCE

BALEARIC SHEARWATER
Puffinus mauretanicus

- The most endangered seabird in Europe: CE (International Union for Conservation of Nature).

- Overall decline of the species (60 years of extinction time) highlights the need for conservation measures.

- Objective: to conduct a **spatial overlap analysis of the most critically endangered European seabird with marine Natura 2000 network and human activities in the NE Atlantic.**



AZTI
MEMBER OF BASQUE RESEARCH & TECHNOLOGY ALLIANCE

GEOLOCATION DATA

- **Biologging** with **Geolocation devices** (recovery required) to track the species distribution during 1-5 years.

- **Small loggers** (< 2g) attached to the metal ring of birds.

- Data collection: **53 breeders** tagged in 3 breeding colonies, **88 annual cycles (2017-2022):** Ibiza (88%), Mallorca (9%) and Menorca (11%).

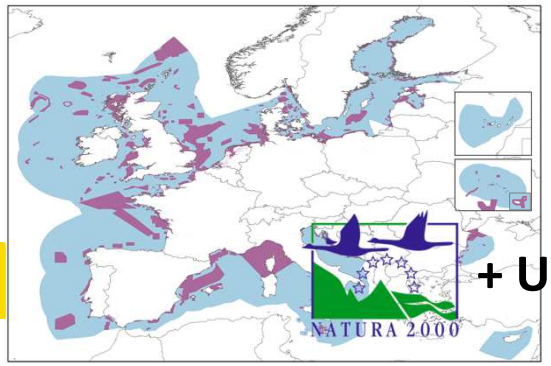
AZTI
MEMBER OF BASQUE RESEARCH & TECHNOLOGY ALLIANCE

DATA ANALYSIS

- **Geolocation data processing:** Light profiles were analysed for each individual bird based on G*eoLight* package.

- **Identification of Atlantic important areas:** overall species level kernel density distributions were generated, *adehabitatHR* package.
  - Utilization functions (UD) 75%: distribution areas
  - Utilization functions (UD) 50 %: core areas.

- **Spatial overlap** of Atlantic importante areas with **Marine Protected Areas (MPAs) and fishing effort.**



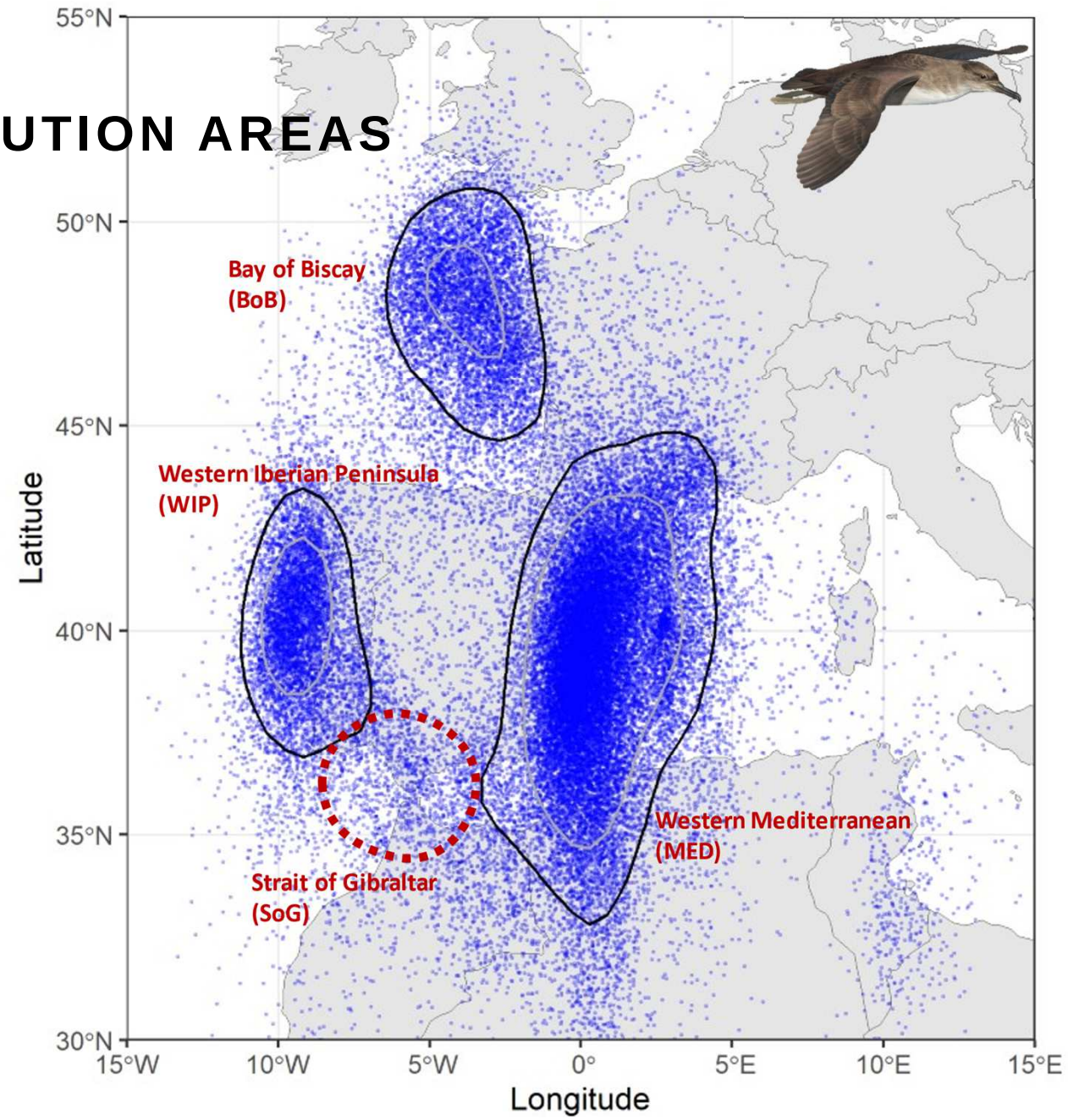
+ UK

EMODnet
European Marine Observation and Data Network

AZTI
MEMBER OF BASQUE RESEARCH & TECHNOLOGY ALLIANCE

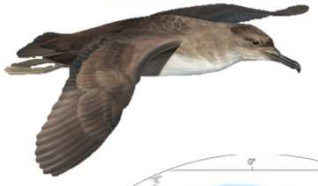
MAIN DISTRIBUTION AREAS

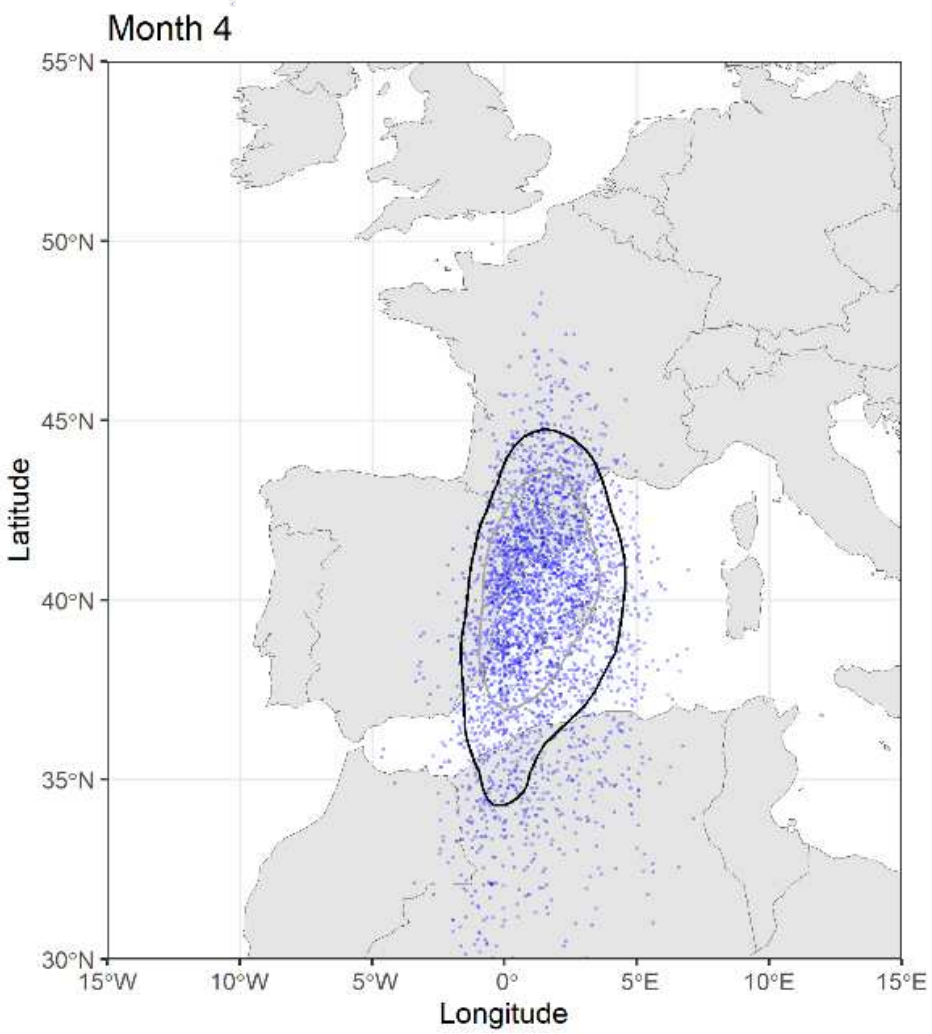
- Two main areas (UD 75%) in the NE Atlantic.
- 54% of the annual cycles visited WIP, 46% visited BoB.



AZTI
MEMBER OF
BASQUE RESEARCH
& TECHNOLOGY ALLIANCE

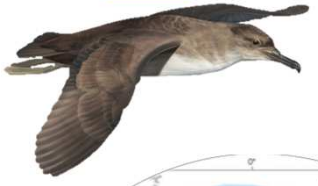
MONTHLY CHANGES IN DISTRIBUTION AREAS

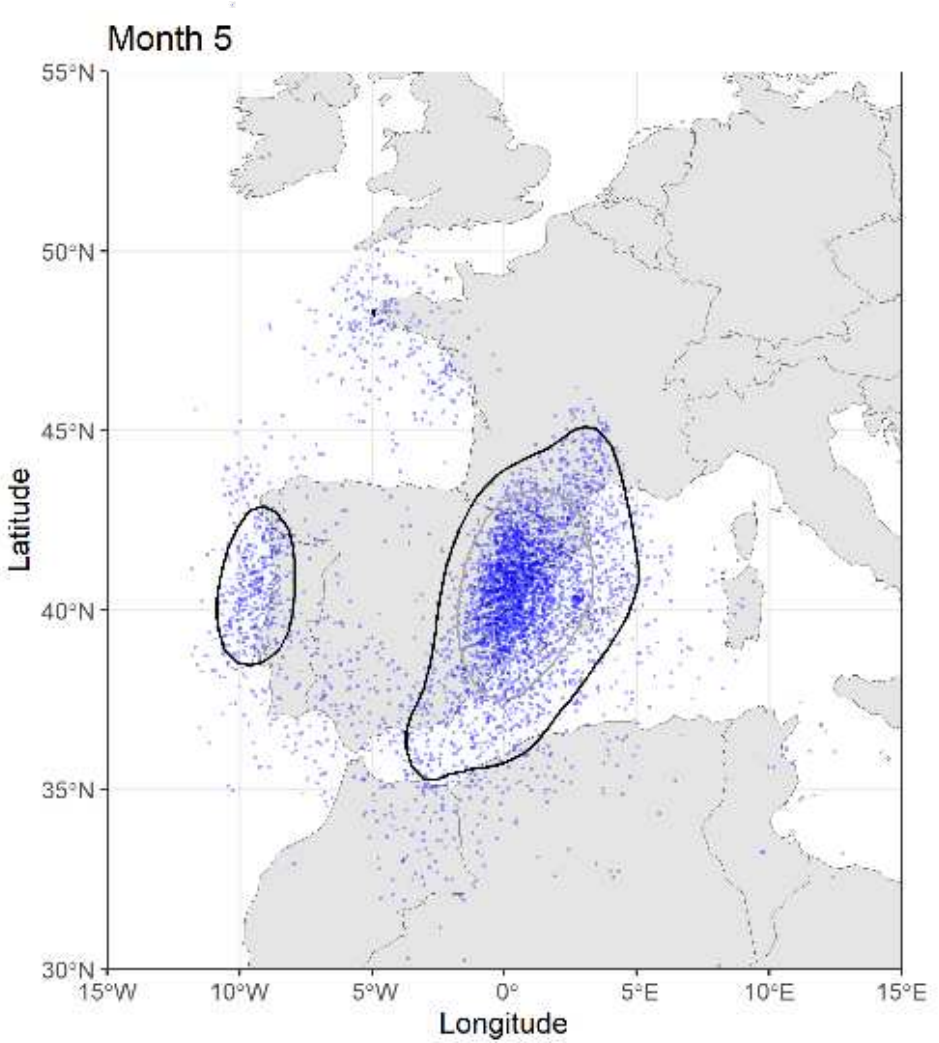




AZTI
MEMBER OF
BASQUE RESEARCH
& TECHNOLOGY ALLIANCE

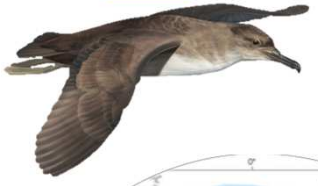
MONTHLY CHANGES IN DISTRIBUTION AREAS

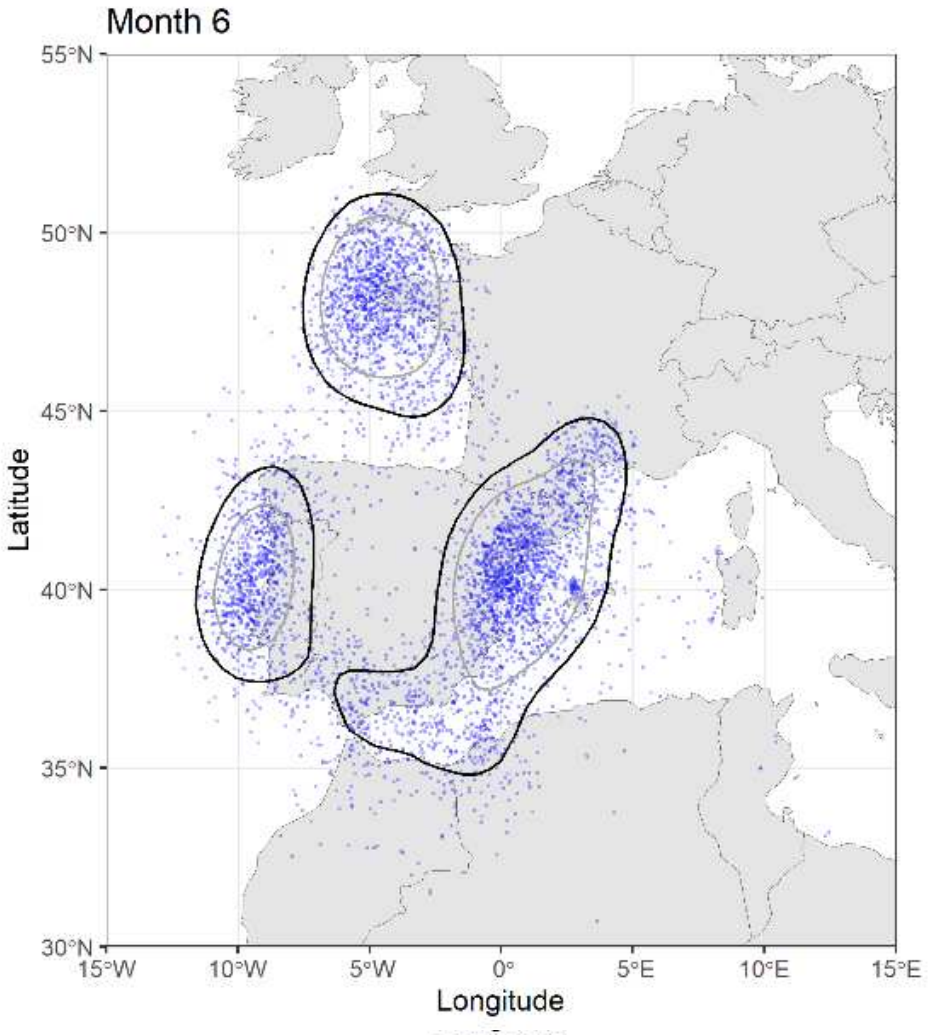




AZTI
MEMBER OF
BASQUE RESEARCH
& TECHNOLOGY ALLIANCE

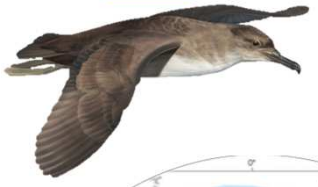
MONTHLY CHANGES IN DISTRIBUTION AREAS

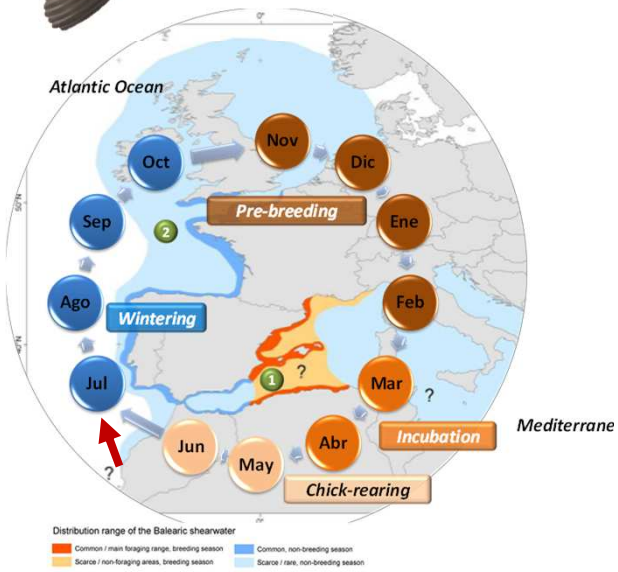


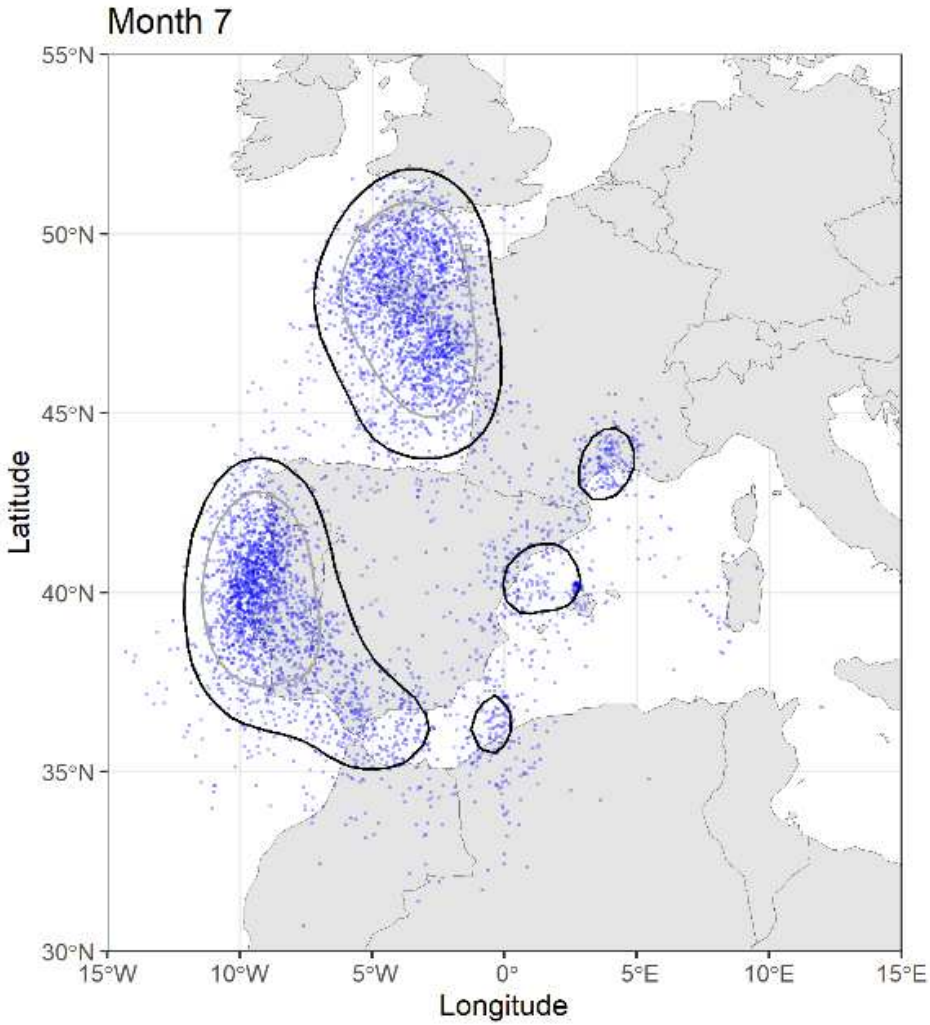


AZTI
MEMBER OF
BASQUE RESEARCH
& TECHNOLOGY ALLIANCE

MONTHLY CHANGES IN DISTRIBUTION AREAS

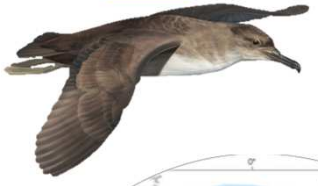


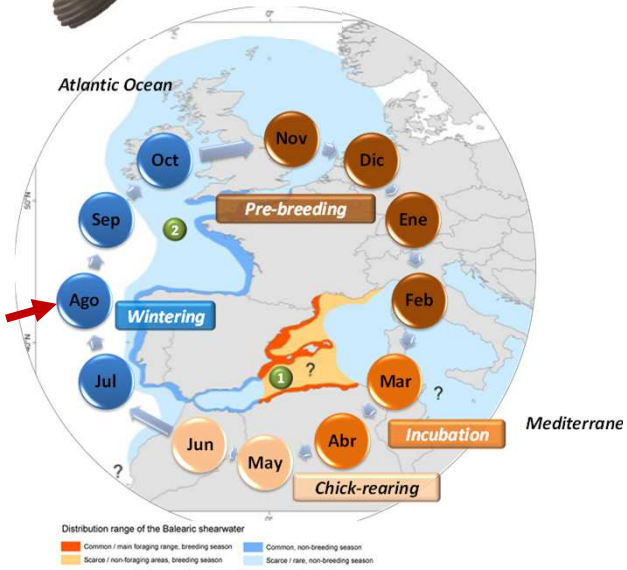


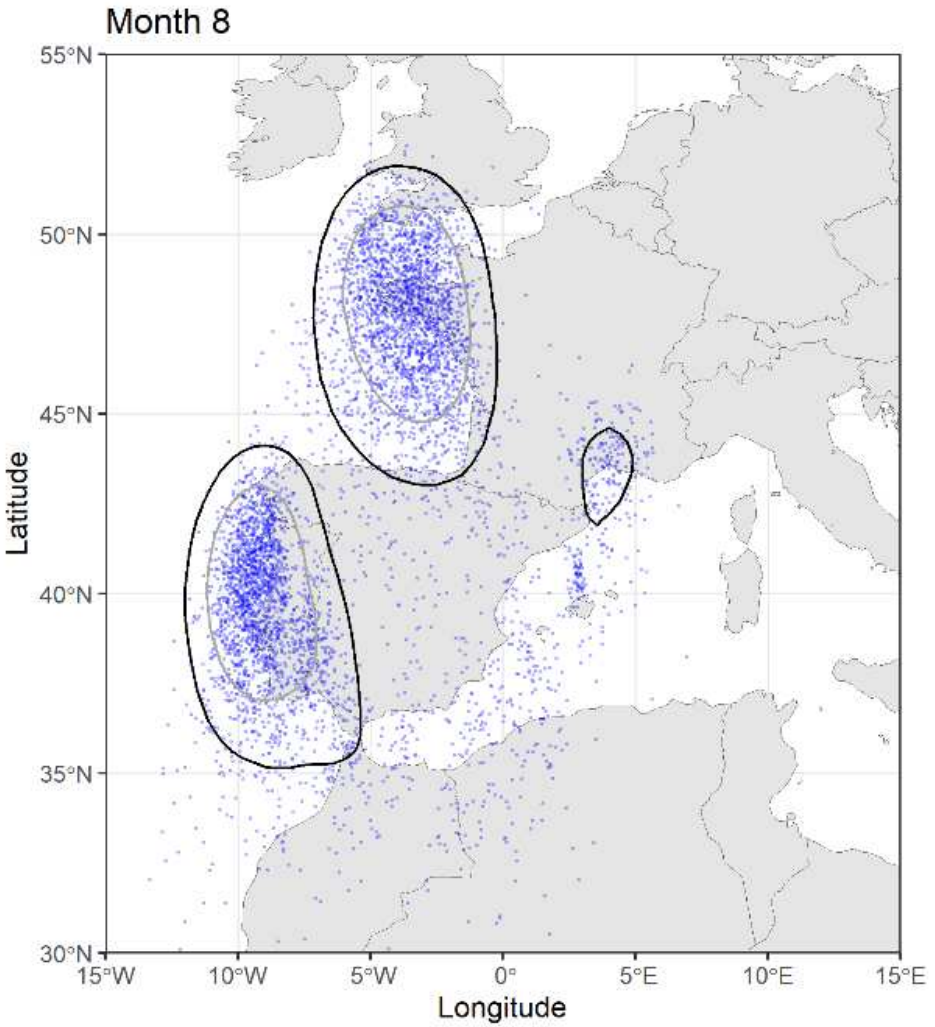


AZTI
MEMBER OF
BASQUE RESEARCH
& TECHNOLOGY ALLIANCE

MONTHLY CHANGES IN DISTRIBUTION AREAS

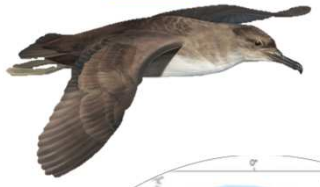


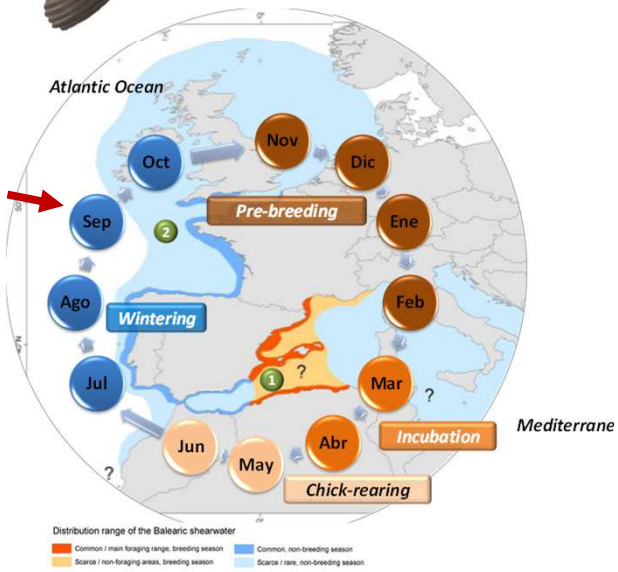


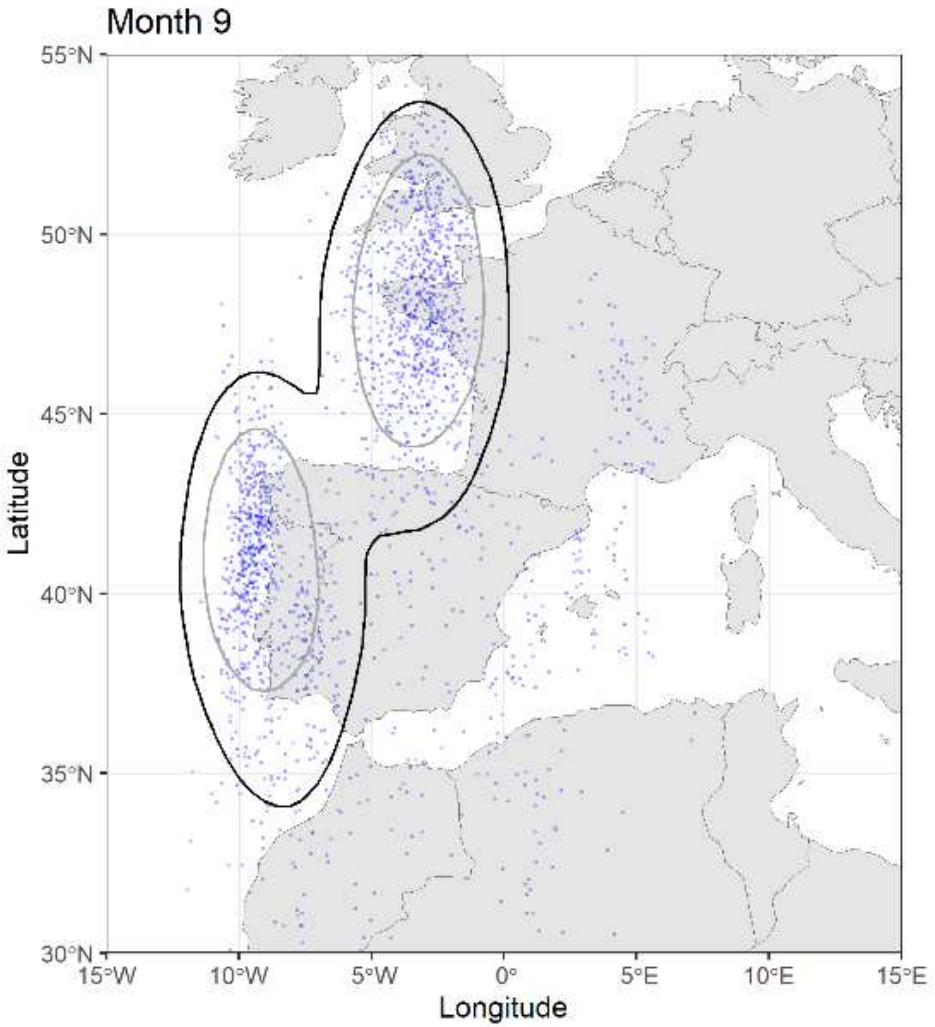


AZTI
MEMBER OF
BASQUE RESEARCH
& TECHNOLOGY ALLIANCE

MONTHLY CHANGES IN DISTRIBUTION AREAS

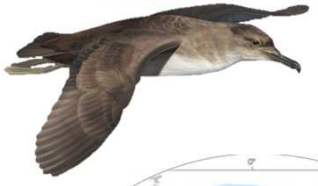


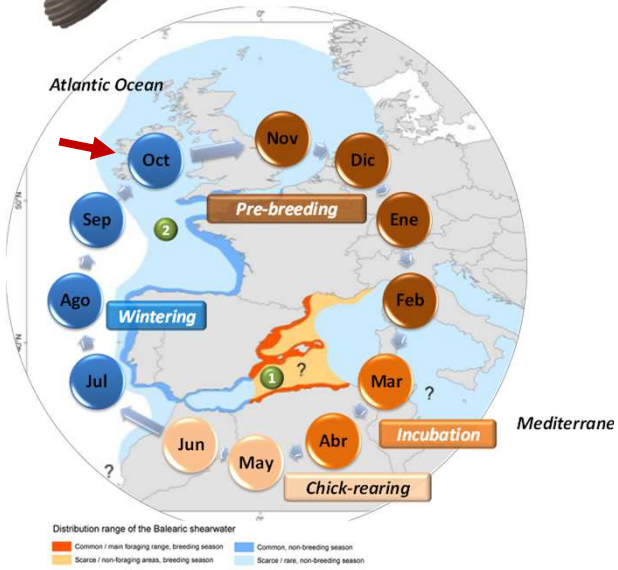


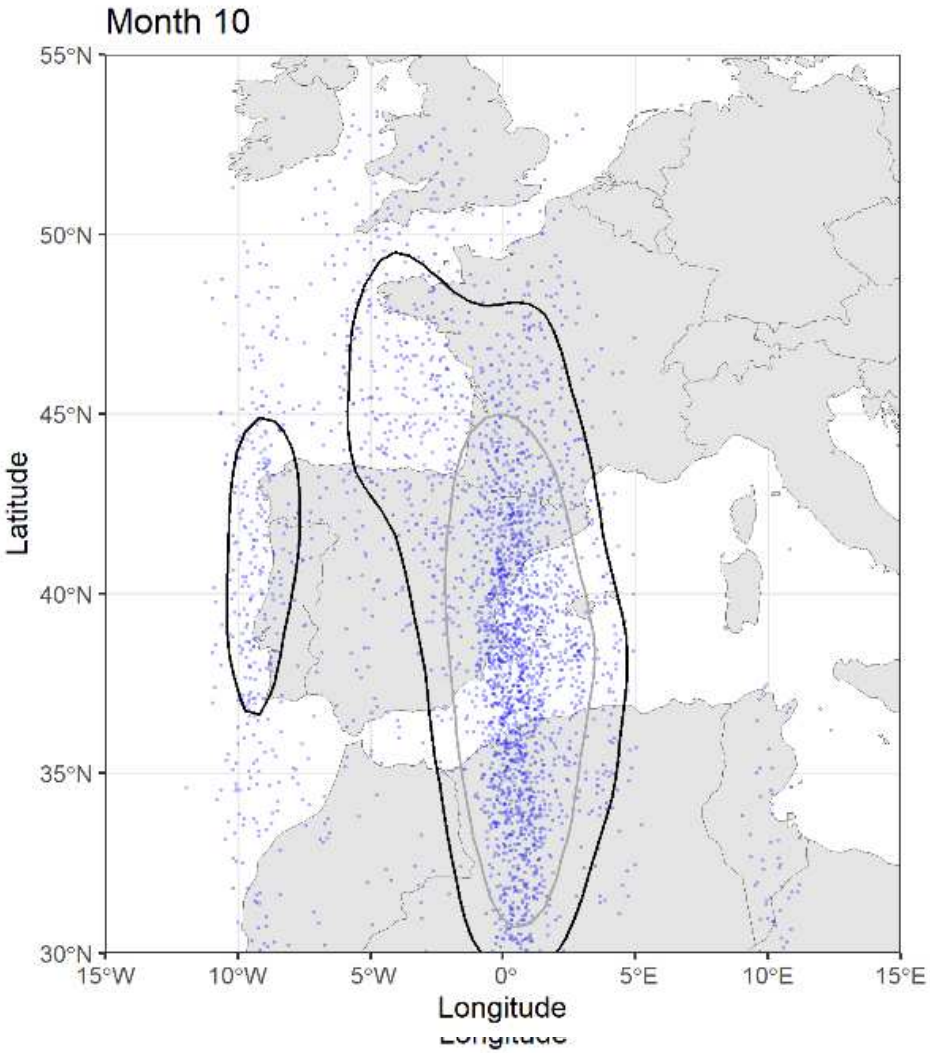


AZTI
MEMBER OF
BASQUE RESEARCH
& TECHNOLOGY ALLIANCE

MONTHLY CHANGES IN DISTRIBUTION AREAS



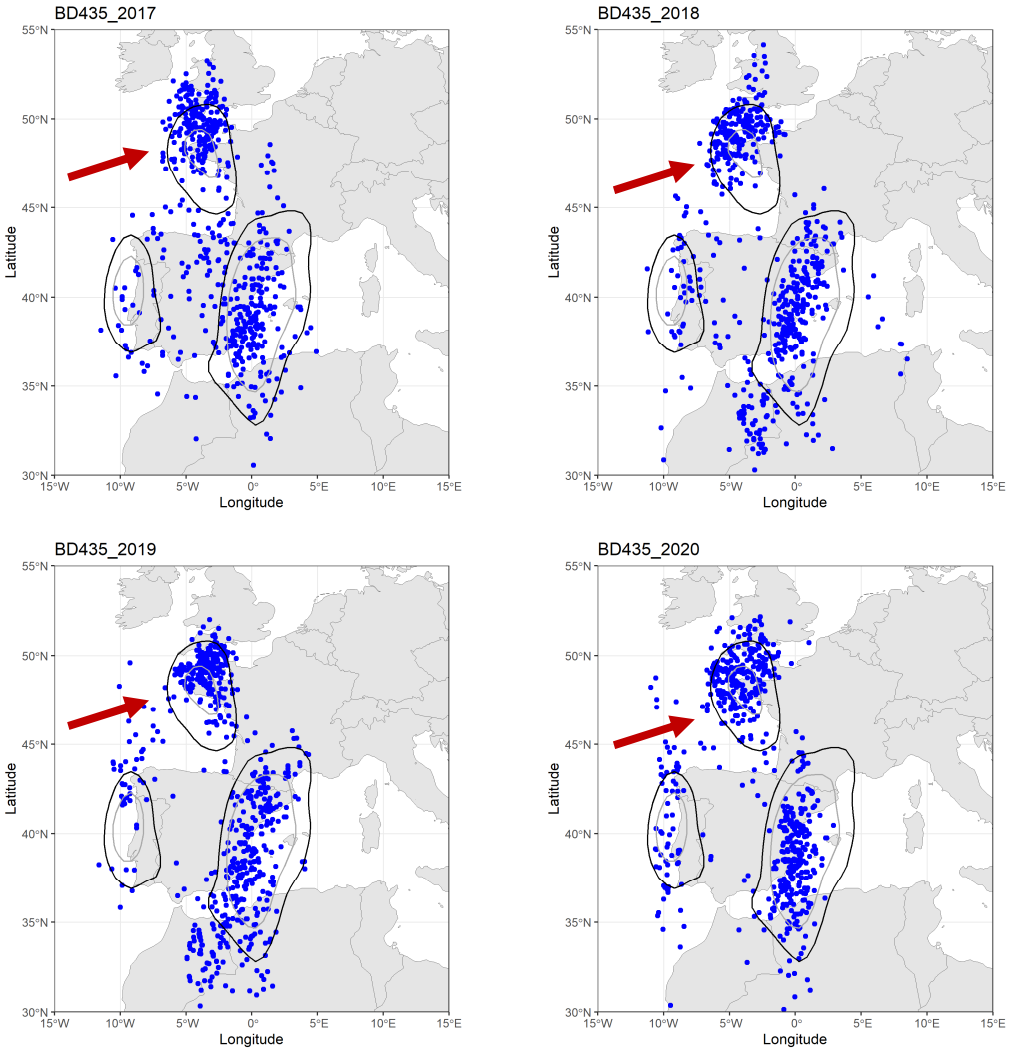




AZTI
MEMBER OF BASQUE RESEARCH & TECHNOLOGY ALLIANCE

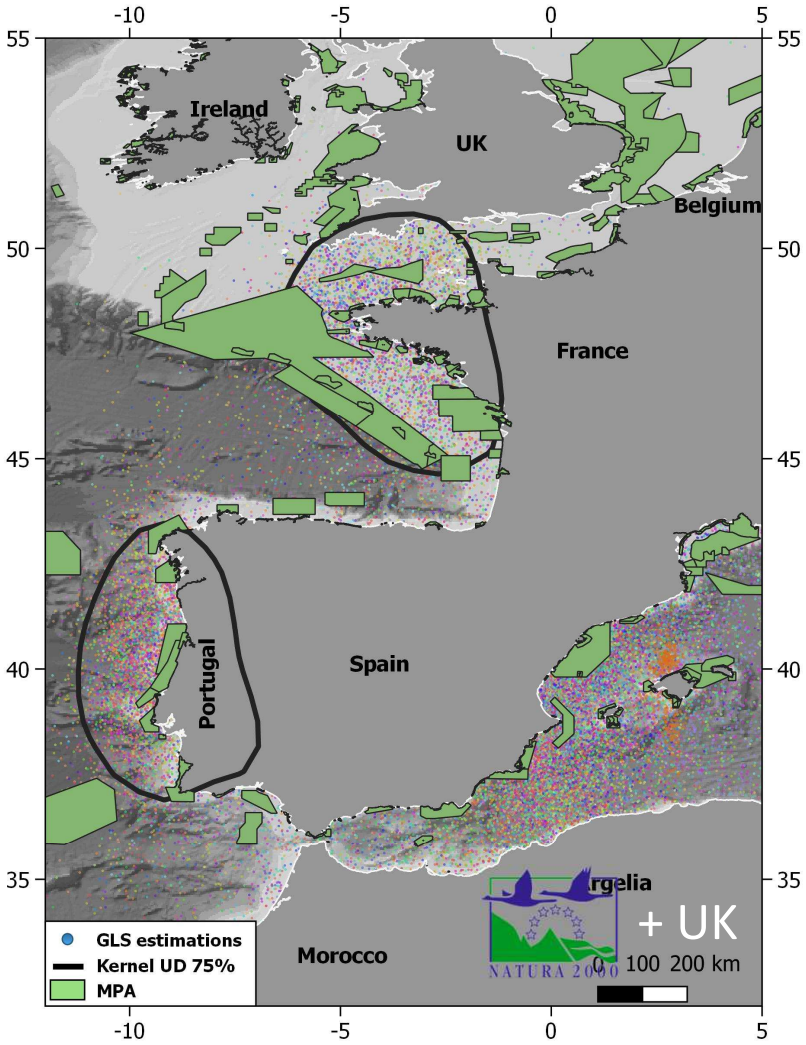
HIGH NON-BREEDING FIDELITY

- Most individuals visit the same area year after year → high non-breeding fidelity.
- Example of an individual from Ibiza visiting the Bay of Biscay during 4 consecutive summers.



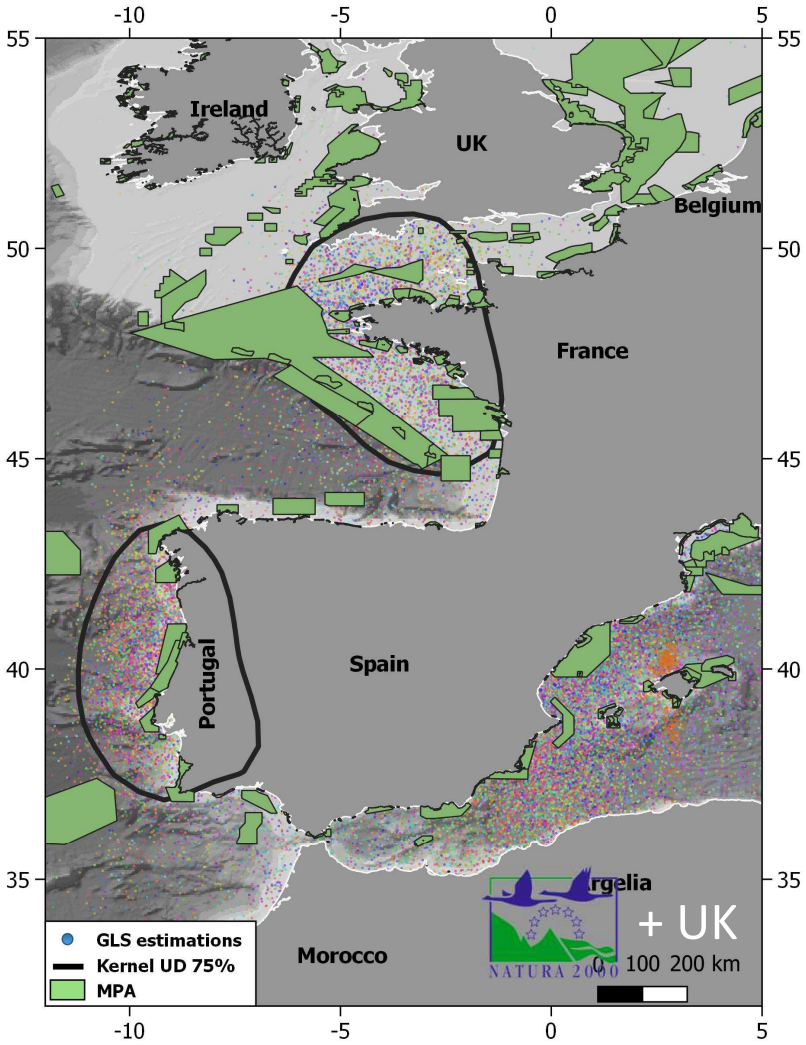
AZTI
MEMBER OF BASQUE RESEARCH & TECHNOLOGY ALLIANCE

SPATIAL OVERLAP WITH MPAs



AZTI
MEMBER OF BASQUE RESEARCH & TECHNOLOGY ALLIANCE

SPATIAL OVERLAP WITH MPAs

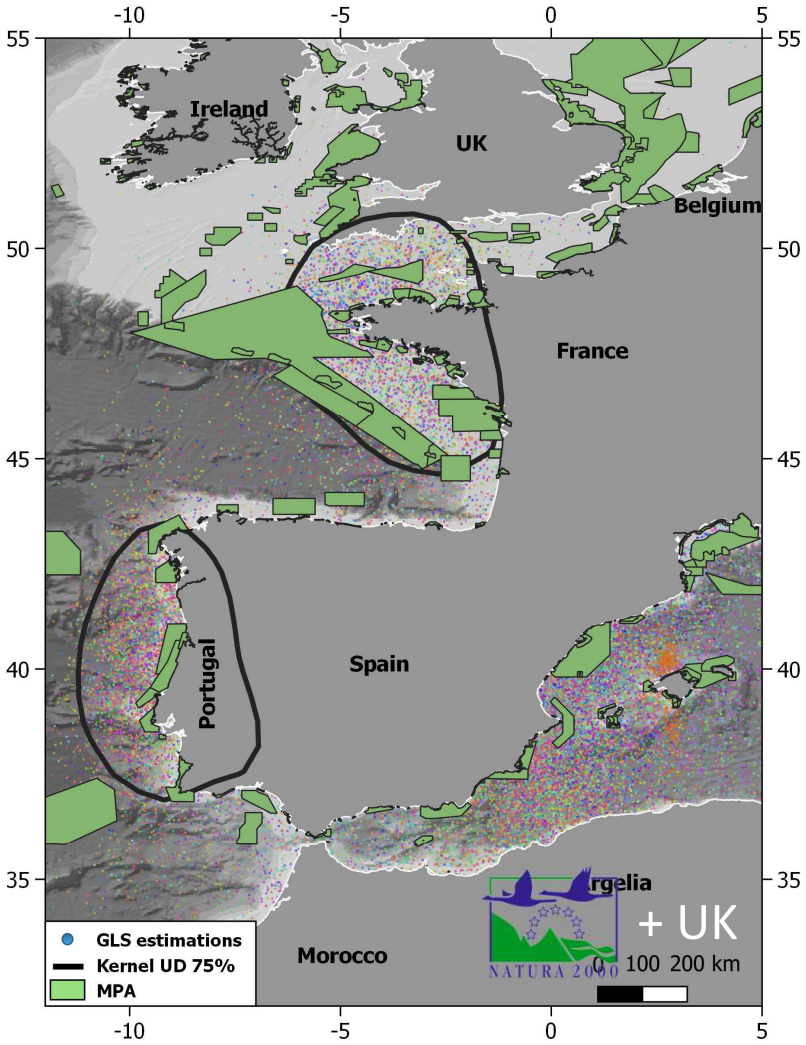


Four different Economic Exclusive Zone:

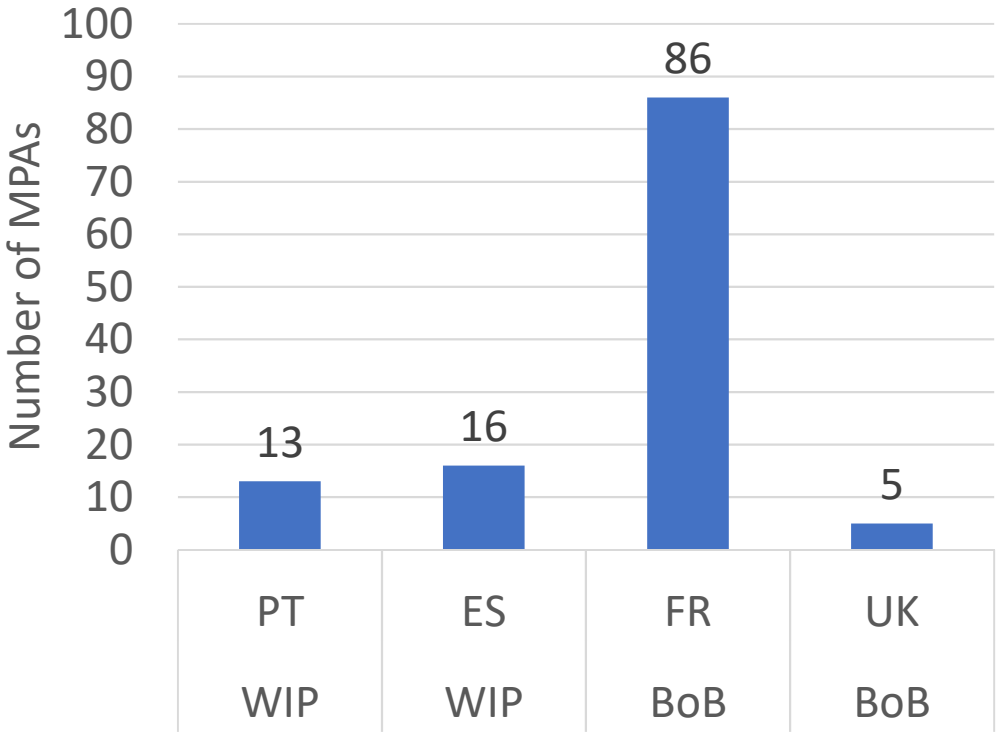
PT ES FR UK

AZTI
MEMBER OF BASQUE RESEARCH & TECHNOLOGY ALLIANCE

SPATIAL OVERLAP WITH MPAs

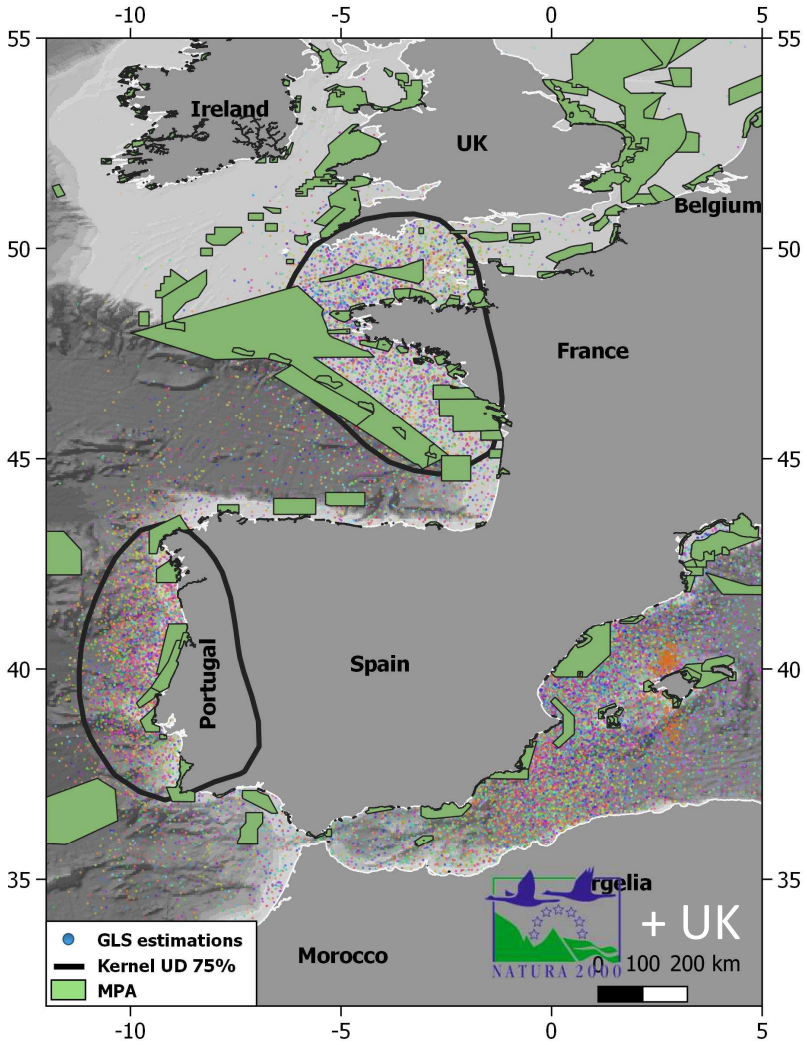


Balearic shearwater distribution overlap (UD75%) with MPAs



AZTI
MEMBER OF BASQUE RESEARCH & TECHNOLOGY ALLIANCE

SPATIAL OVERLAP WITH MPAs



32% of MPAs identified Balearic shearwater as a priority species

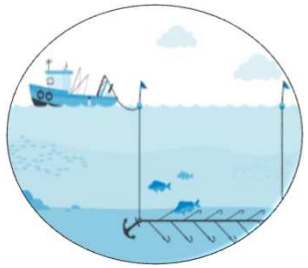
PT	ES	FR	UK
46%	38%	30%	0%

AZTI
MEMBER OF
BASQUE RESEARCH
& TECHNOLOGY ALLIANCE

SPATIAL OVERLAP WITH MPAs

Identification of Balearic shearwater threats with medium-high impact in MPAs:

- **Introduced species** in 17% of MPAs

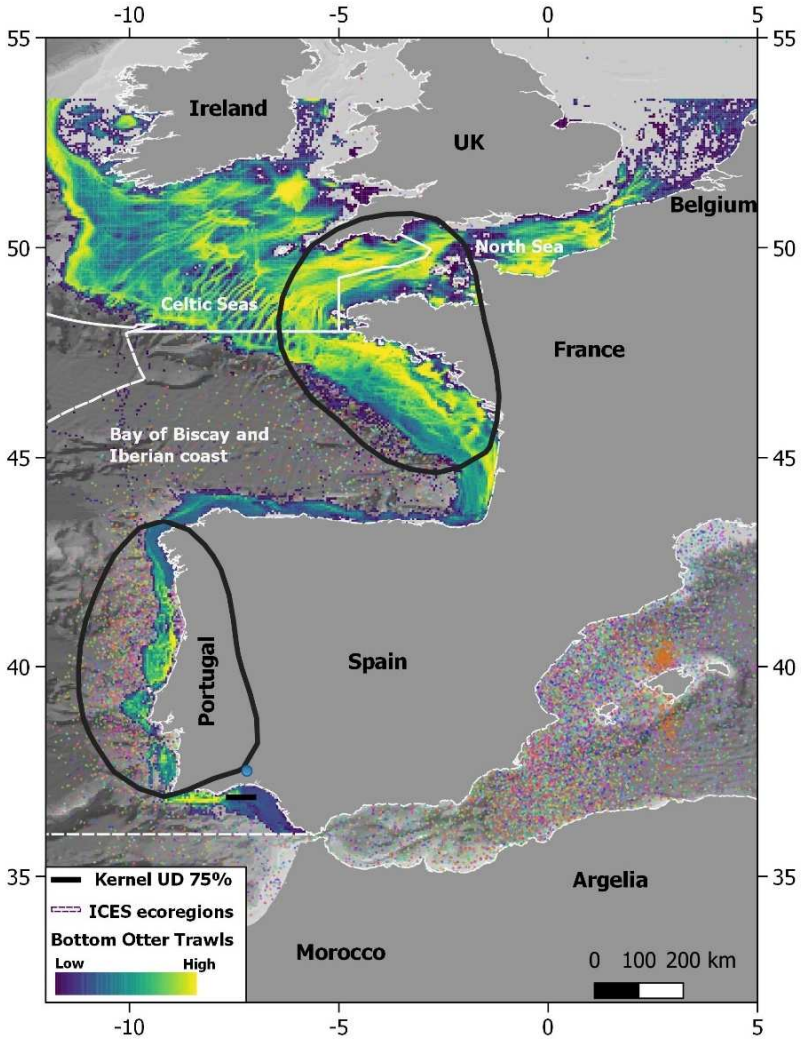


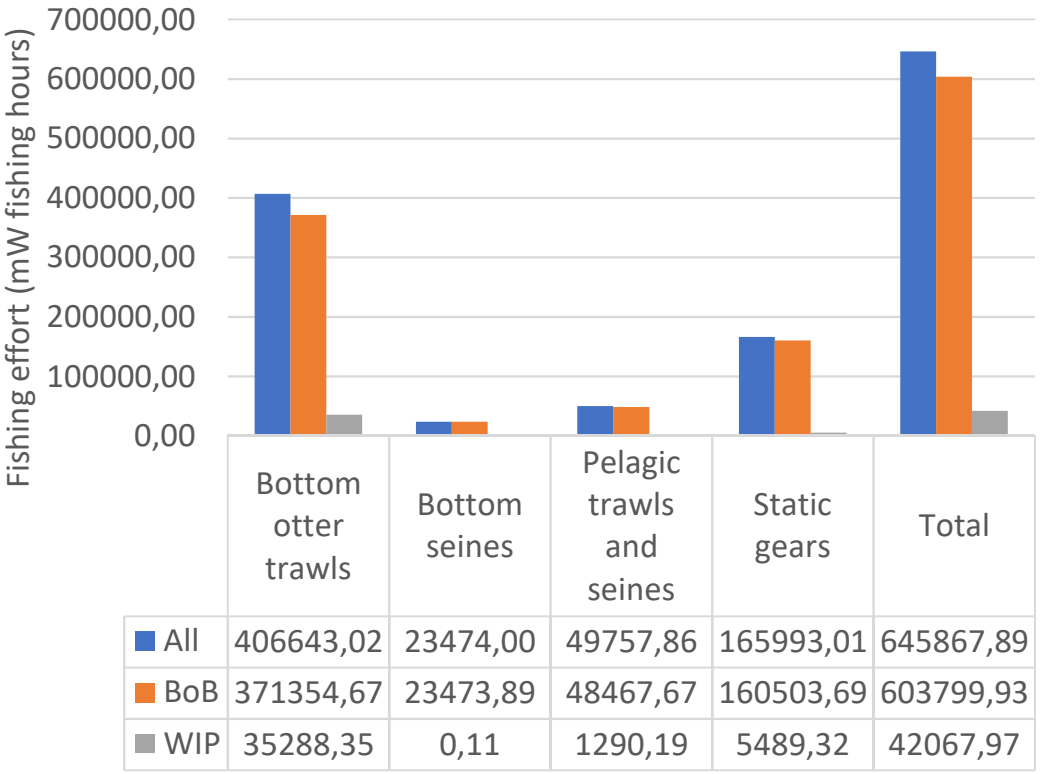
- **Professional fishing** in 24% of MPAs

- **Recreational fishing** in 23% of MPAs

AZTI
MEMBER OF BASQUE RESEARCH & TECHNOLOGY ALLIANCE

SPATIAL OVERLAP WITH FISHERIES
Bottom otter trawls

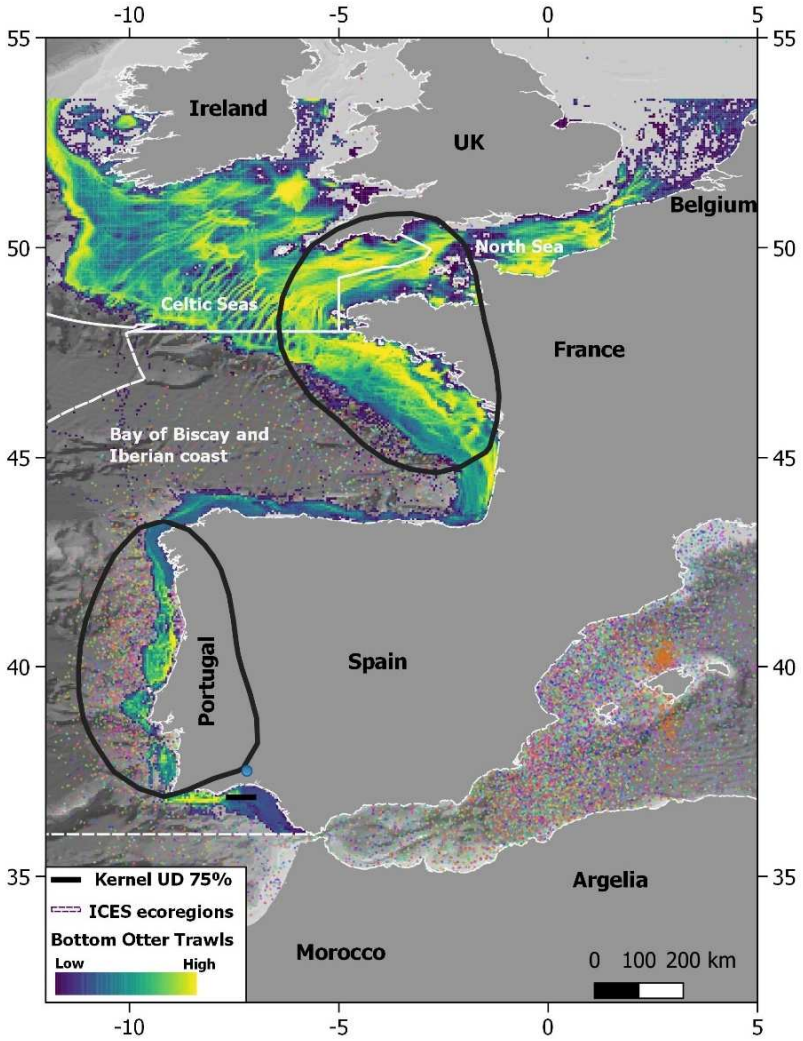


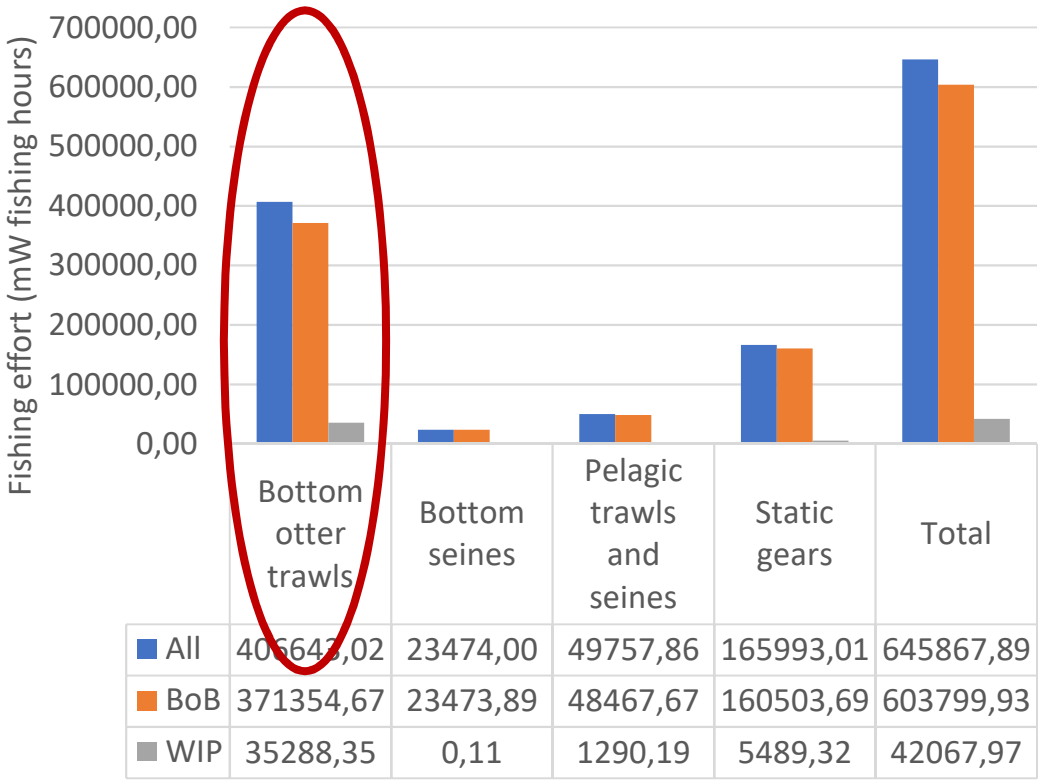


	Bottom otter trawls	Bottom seines	Pelagic trawls and seines	Static gears	Total
All	406643,02	23474,00	49757,86	165993,01	645867,89
BoB	371354,67	23473,89	48467,67	160503,69	603799,93
WIP	35288,35	0,11	1290,19	5489,32	42067,97

AZTI
MEMBER OF BASQUE RESEARCH & TECHNOLOGY ALLIANCE

SPATIAL OVERLAP WITH FISHERIES
Bottom otter trawls

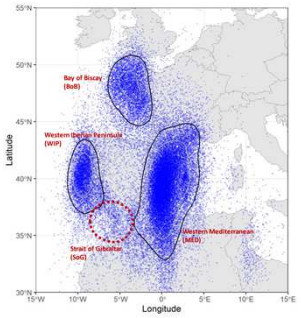




	Bottom otter trawls	Bottom seines	Pelagic trawls and seines	Static gears	Total
All	406643,02	23474,00	49757,86	165993,01	645867,89
BoB	371354,67	23473,89	48467,67	160503,69	603799,93
WIP	35288,35	0,11	1290,19	5489,32	42067,97

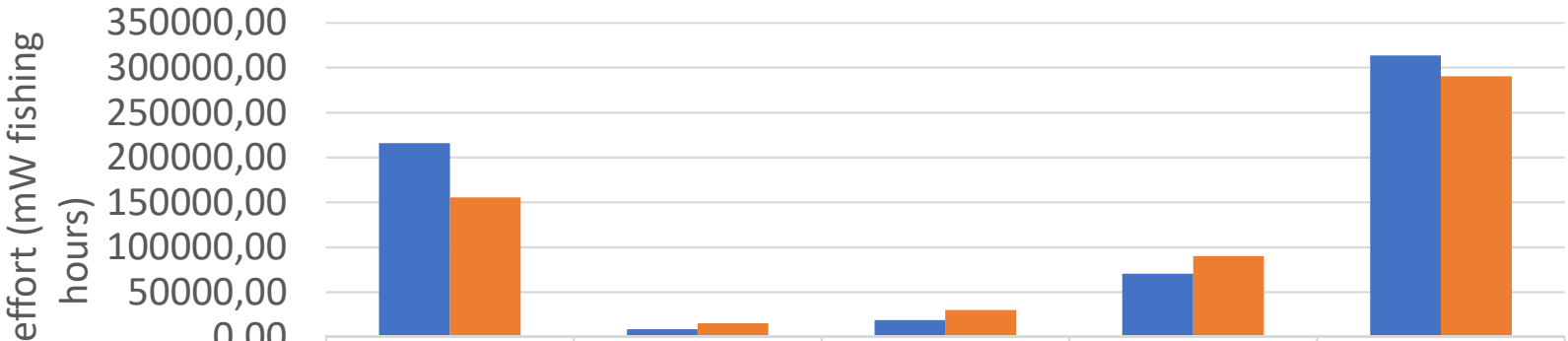
- Higher fishing effort in BoB than in WIP
- Higher fishing effort in bottom trawlers (63%)

AZTI
MEMBER OF
BASQUE RESEARCH
& TECHNOLOGY ALLIANCE



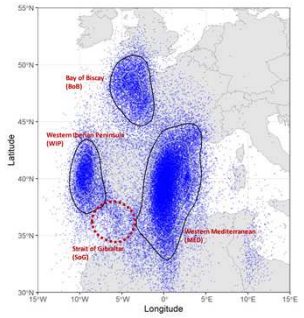
FISHING EFFORT IN/OUT MPAs

Bay of Biscay (average 2018-2021)



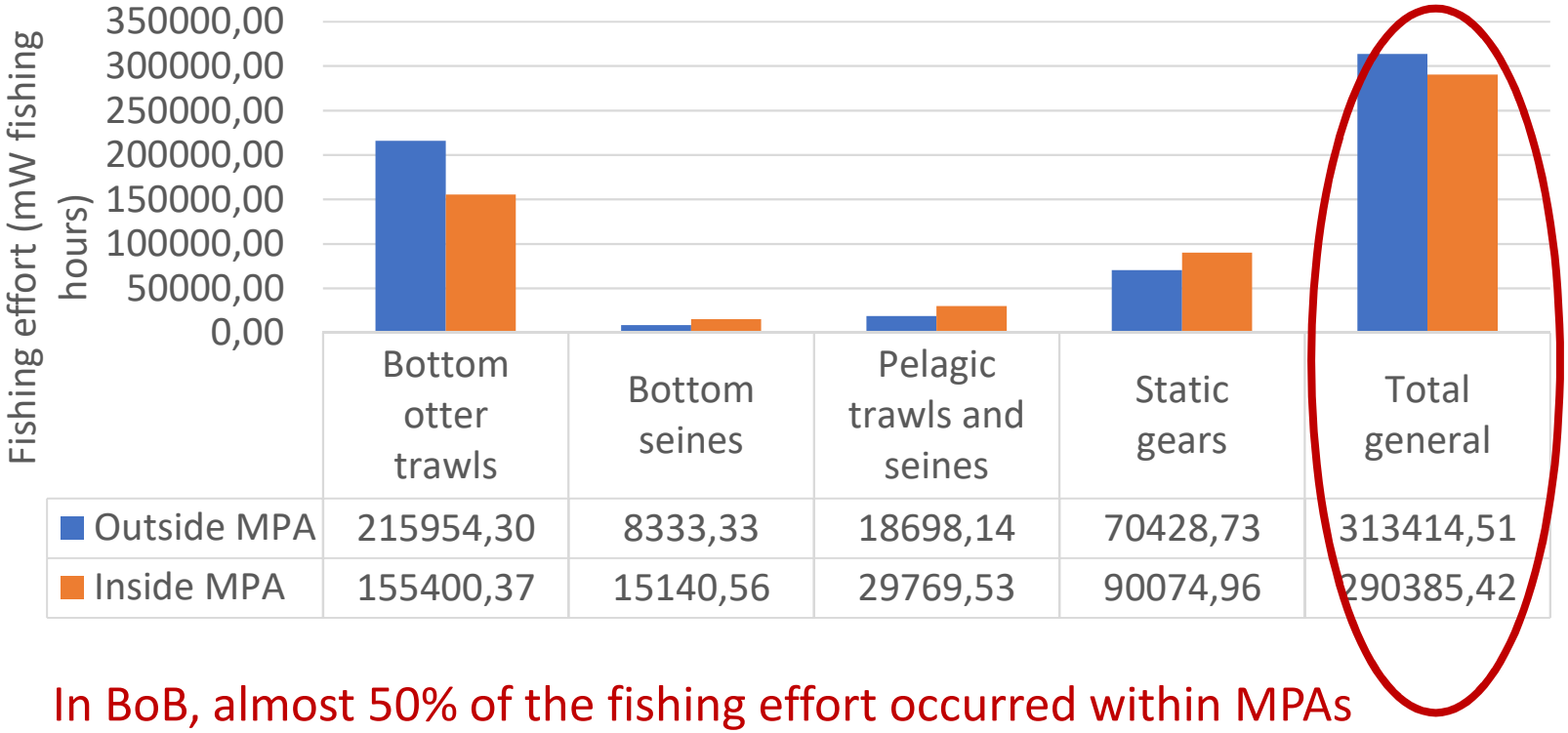
	Bottom otter trawls	Bottom seines	Pelagic trawls and seines	Static gears	Total general
Outside MPA	215954,30	8333,33	18698,14	70428,73	313414,51
Inside MPA	155400,37	15140,56	29769,53	90074,96	290385,42

AZTI
MEMBER OF BASQUE RESEARCH & TECHNOLOGY ALLIANCE



FISHING EFFORT IN/OUT MPAs

Bay of Biscay (average 2018-2021)

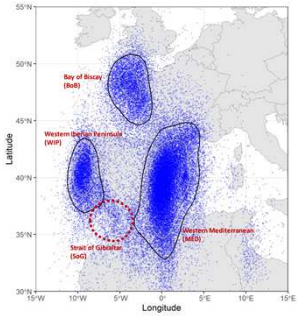


	Bottom otter trawls	Bottom seines	Pelagic trawls and seines	Static gears	Total general
Outside MPA	215954,30	8333,33	18698,14	70428,73	313414,51
Inside MPA	155400,37	15140,56	29769,53	90074,96	290385,42

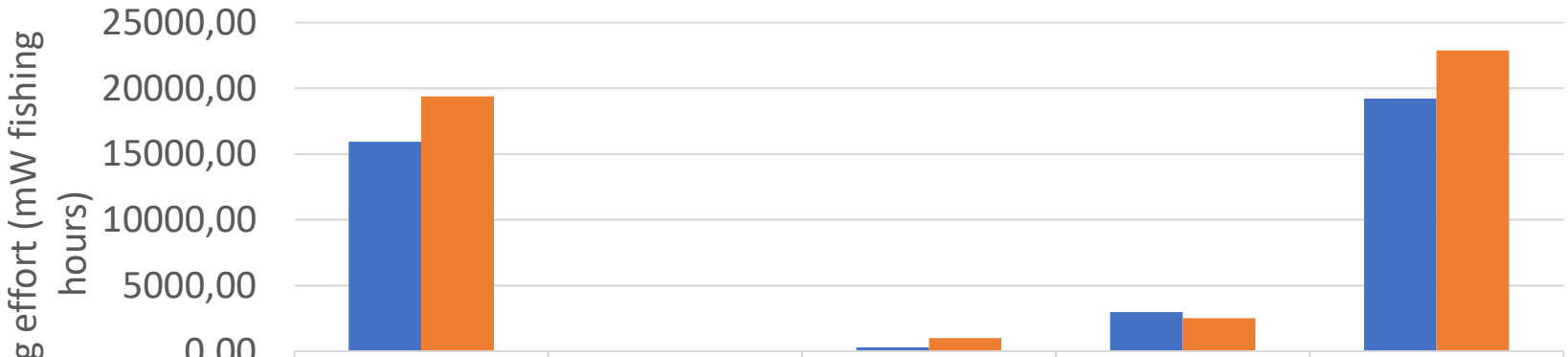
- In BoB, almost 50% of the fishing effort occurred within MPAs
- Within MPAs: 42% of bottom trawls, 64% of bottom seines, 61% of pelagic trawls and seines and 56% of static gears.

MEMBER OF BASQUE RESEARCH & TECHNOLOGY ALLIANCE

FISHING EFFORT IN/OUT MPAs

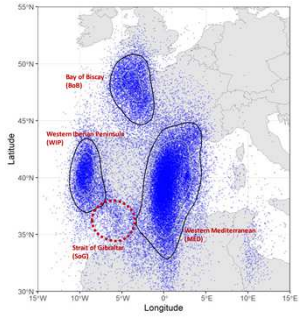


Western Iberian Peninsula (average 2018-2021)



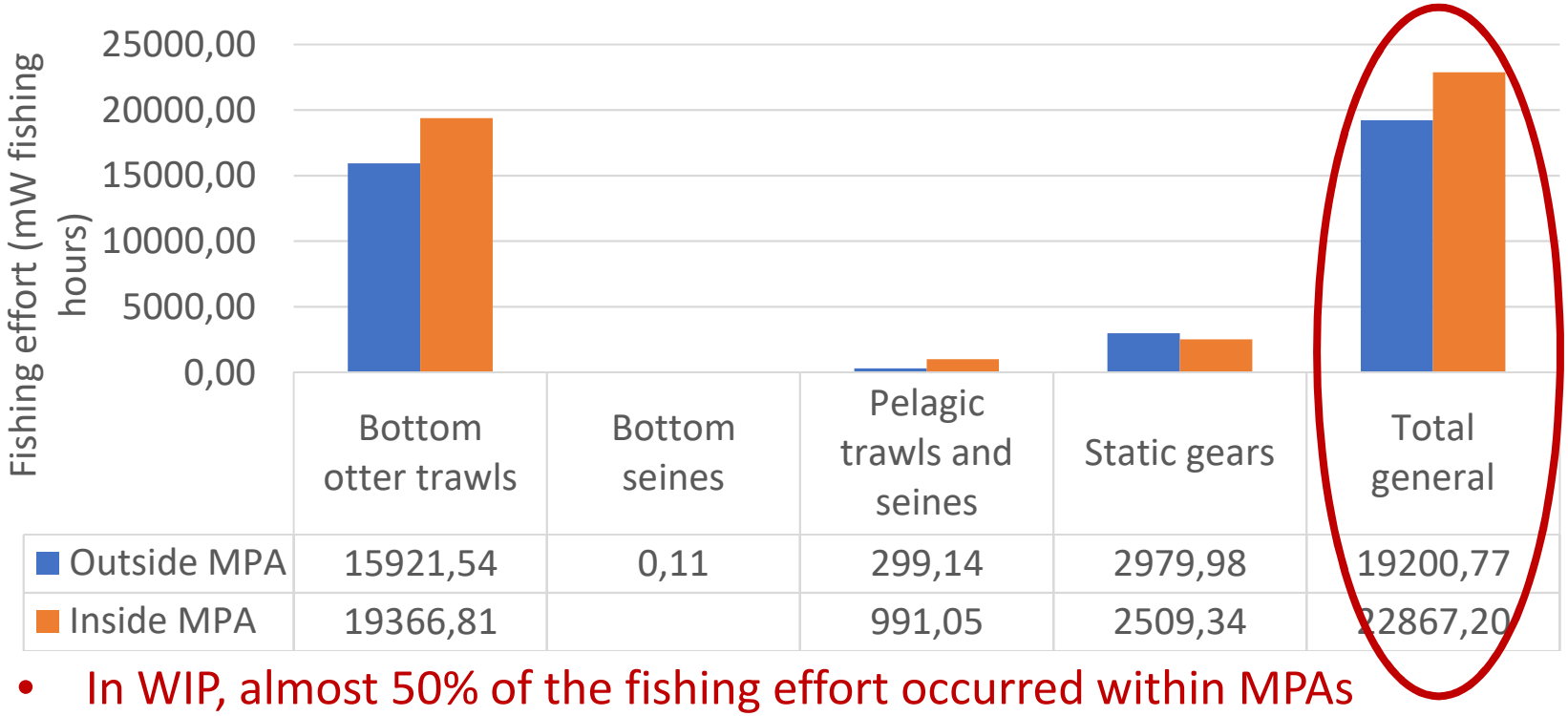
	Bottom otter trawls	Bottom seines	Pelagic trawls and seines	Static gears	Total general
Outside MPA	15921,54	0,11	299,14	2979,98	19200,77
Inside MPA	19366,81		991,05	2509,34	22867,20

AZTI
MEMBER OF BASQUE RESEARCH & TECHNOLOGY ALLIANCE



FISHING EFFORT IN/OUT MPAs

Western Iberian Peninsula (average 2018-2021)



	Bottom otter trawls	Bottom seines	Pelagic trawls and seines	Static gears	Total general
Outside MPA	15921,54	0,11	299,14	2979,98	19200,77
Inside MPA	19366,81		991,05	2509,34	22867,20

- In WIP, almost 50% of the fishing effort occurred within MPAs
- Within MPAs: 55% of bottom trawls, 0% of bottom seines, 77% of pelagic trawls and seines and 46% of static gears.

AZTI
MEMBER OF BASQUE RESEARCH & TECHNOLOGY ALLIANCE

TAKE HOME MESSAGES

- Different colonies of Balearic shearwaters showed similar important Atlantic areas, which are visited repeatedly year after year.
- Important Atlantic areas located within four different EEZ, encompassing a total of 120 MPAs (32% identified Balearic shearwater as a priority species).
- Identification of the main threats (introduced predators, commercial and recreational fishing) of Balearic shearwater with medium-high impact in average 21% of MPAs.
- Higher fishing effort in BoB than in WIP, mainly trawls, and almost 50% of the fishing effort occurred within MPAs in both Atlantic important areas → review management measures of these MPAs.

AZTI
MEMBER OF BASQUE RESEARCH & TECHNOLOGY ALLIANCE

FUTURE RESEARCH

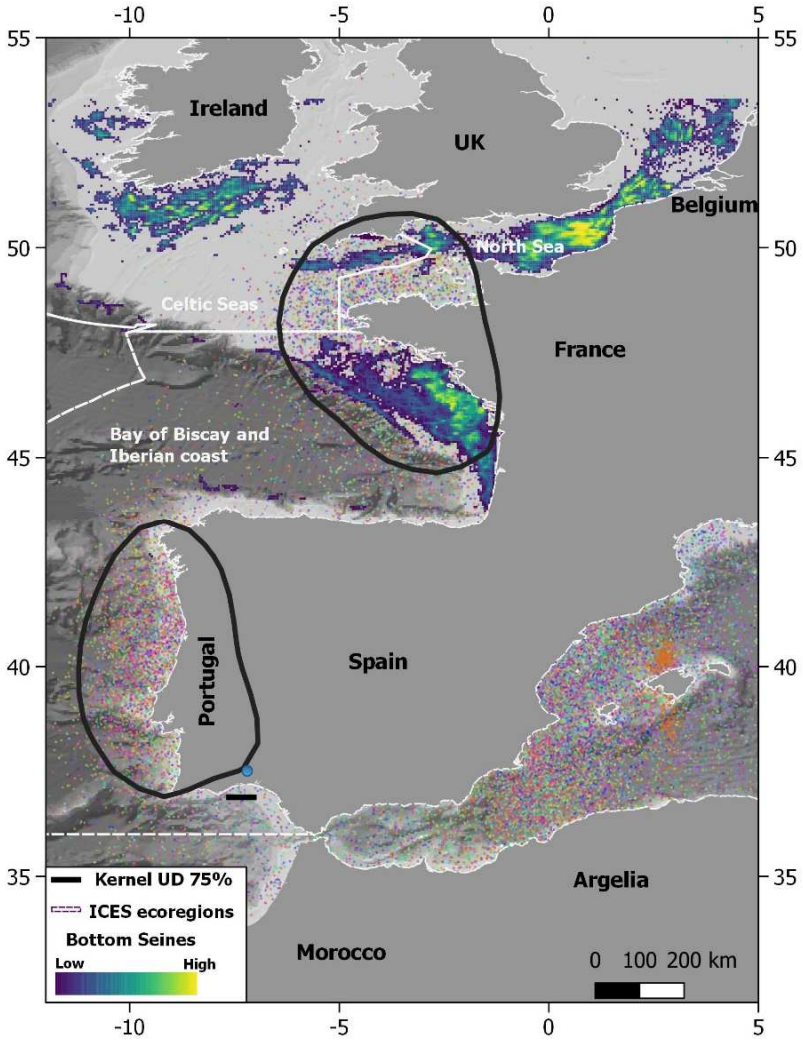
- Future refinament of these areas using activity data to identify high use areas.
- Transboundary management and conservation measures are needed to protect the critically endangered Balearic shearwater (international agreements and Regional Fisheries Management Organisations).
- Study MPA connectivity to develop movement corridors.
- Spatial overlap of fishing effort was only analysed considering vessels larger than 12 m length → artisanal fishing monitoring should be improved to jointly assess artisanal and industrial fishing activity.

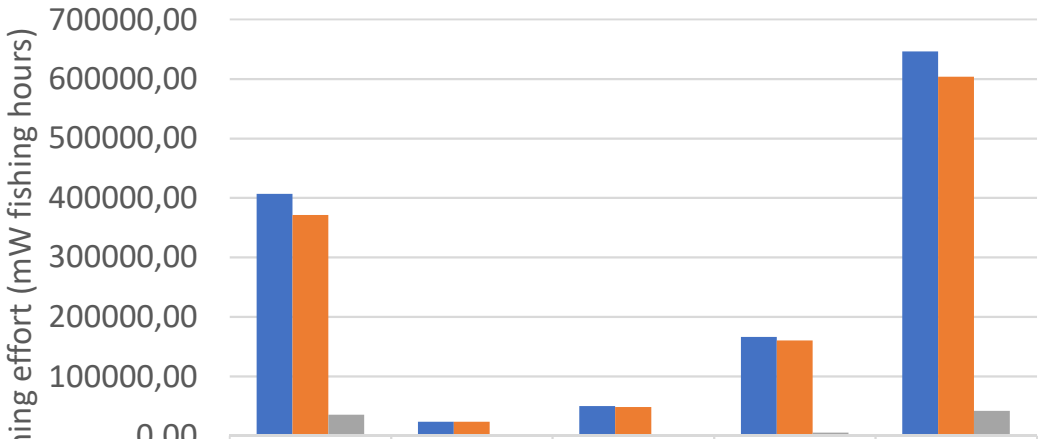
Eskerrik asko, merci, gracias, thank you

Thanks to
Servei de Protecció d'Espècies i d'Espais de Natura Balear (Balearic Government).

AZTI
MEMBER OF BASQUE RESEARCH & TECHNOLOGY ALLIANCE

SPATIAL OVERLAP WITH FISHERIES
Bottom seines

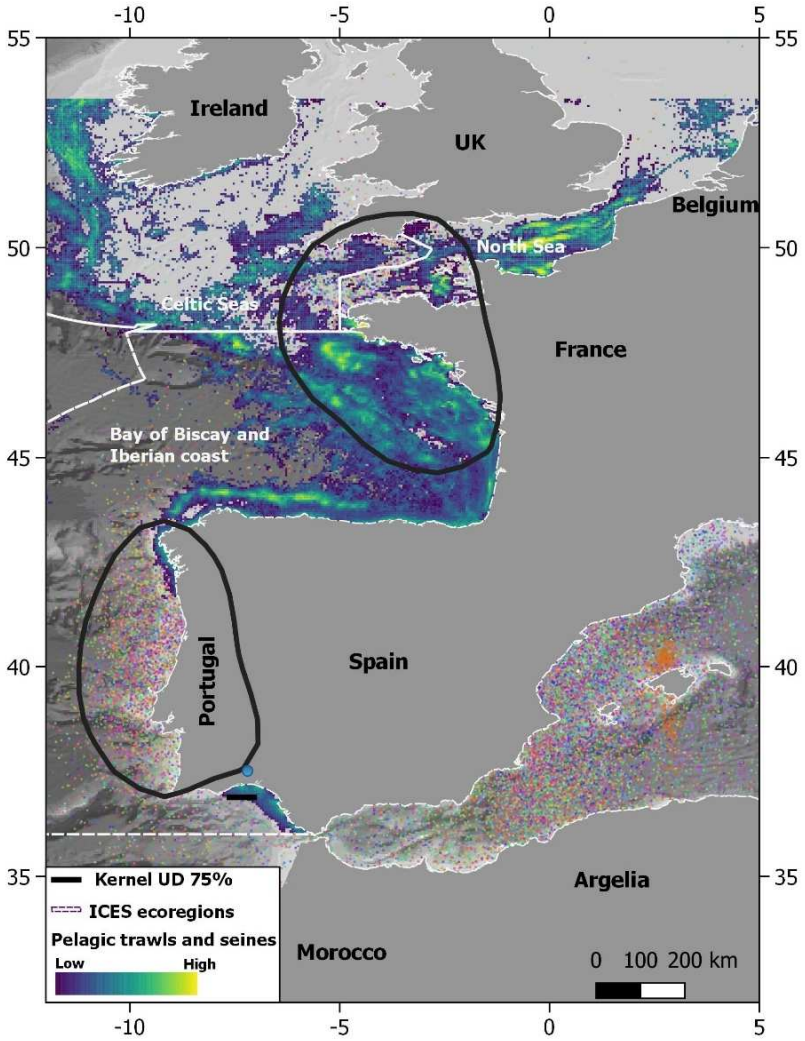


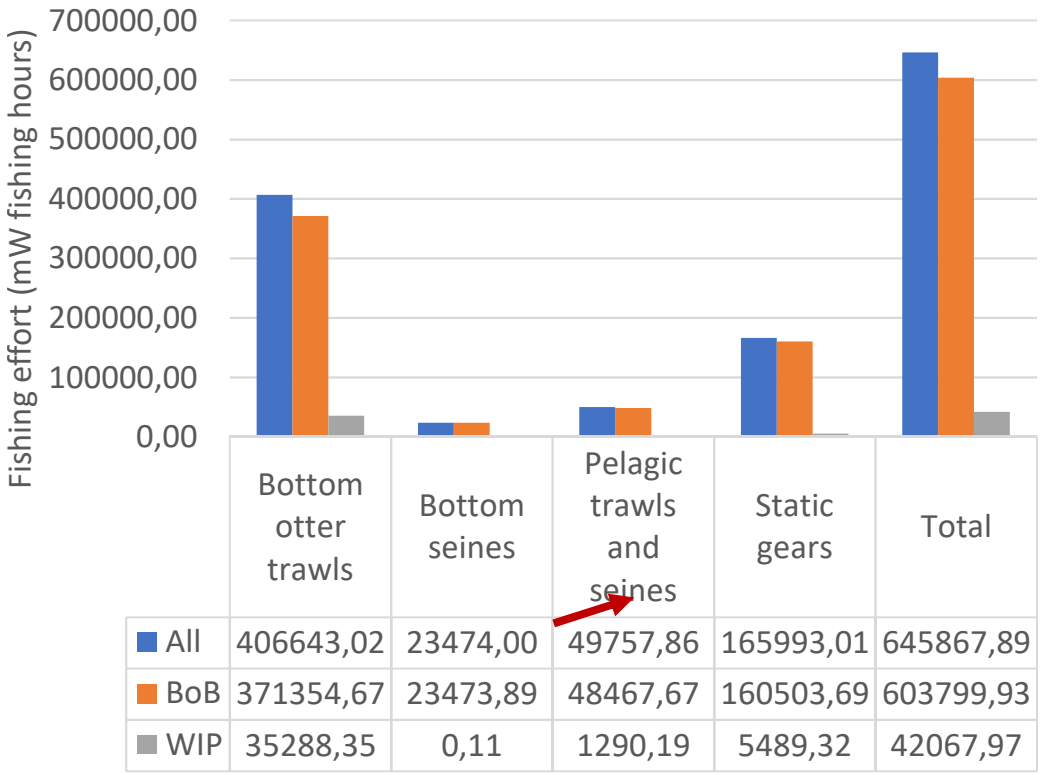


	Bottom otter trawls	Bottom seines	Pelagic trawls and seines	Static gears	Total
All	406643,02	23474,00	49757,86	165993,01	645867,89
BoB	371354,67	23473,89	48467,67	160503,69	603799,93
WIP	35288,35	0,11	1290,19	5489,32	42067,97

AZTI
MEMBER OF BASQUE RESEARCH & TECHNOLOGY ALLIANCE

SPATIAL OVERLAP WITH FISHERIES
Pelagic trawls and seines

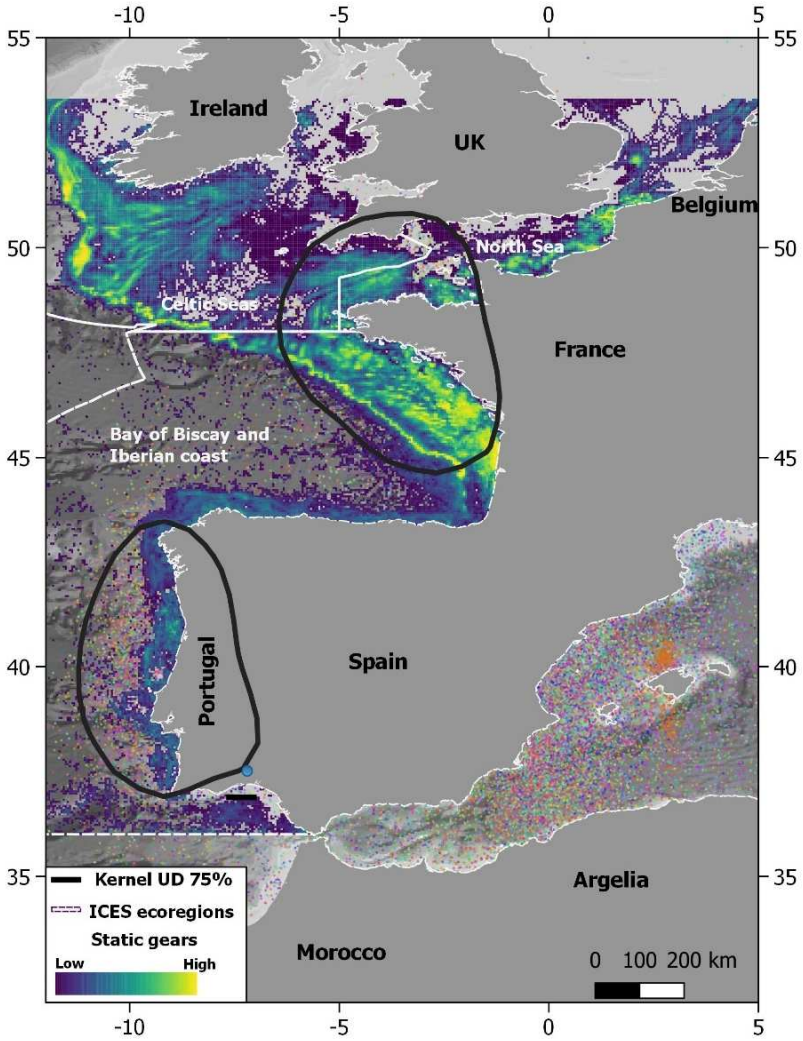


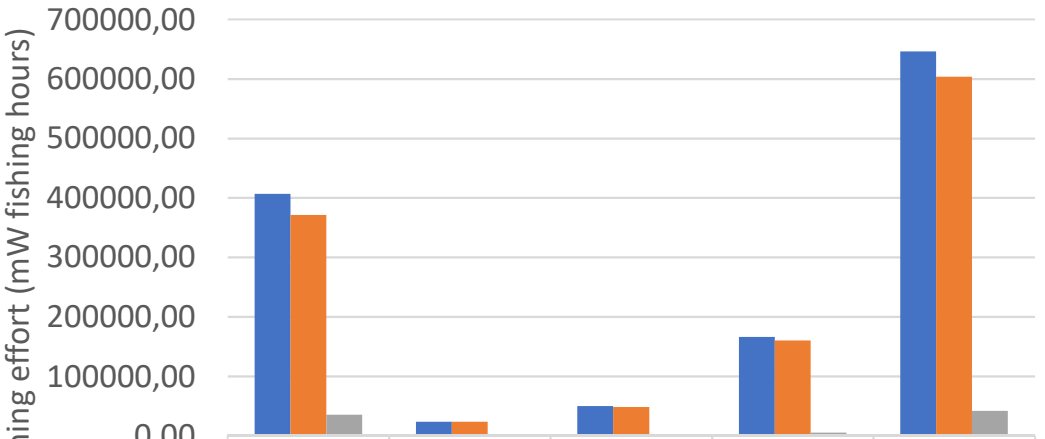


	Bottom otter trawls	Bottom seines	Pelagic trawls and seines	Static gears	Total
All	406643,02	23474,00	49757,86	165993,01	645867,89
BoB	371354,67	23473,89	48467,67	160503,69	603799,93
WIP	35288,35	0,11	1290,19	5489,32	42067,97

AZTI
MEMBER OF BASQUE RESEARCH & TECHNOLOGY ALLIANCE

SPATIAL OVERLAP WITH FISHERIES
Static gears





	Bottom otter trawls	Bottom seines	Pelagic trawls and seines	Static gears	Total
All	406643,02	23474,00	49757,86	165993,01	645867,89
BoB	371354,67	23473,89	48467,67	160503,69	603799,93
WIP	35288,35	0,11	1290,19	5489,32	42067,97