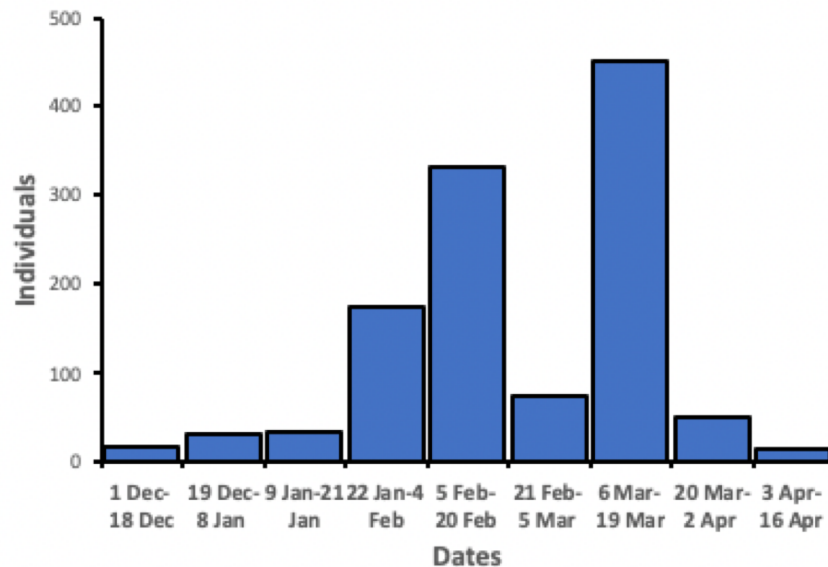


Modelling the drift of bycaught dolphin stranded carcasses helps identifying involved fisheries

- 1-Recent stranding data put in perspective
- 2-Mortality areas vs fishing effort distribution: February 2017
- 3-Mortality areas vs fishing effort distribution: 2006-2018
- 4-Zooming in nets: 2013-2018
- 5-Concluding remarks

Update on recent stranding data



1170 small cetaceans reported stranded
along the atlantic coast of France from
Dec 1, 2018, to April 16, 2019

Two multiple stranding events
(late Jan.- mid Feb. & mid March)

90% examined by Stranding Scheme
93% common dolphins
85% with bycatch marks



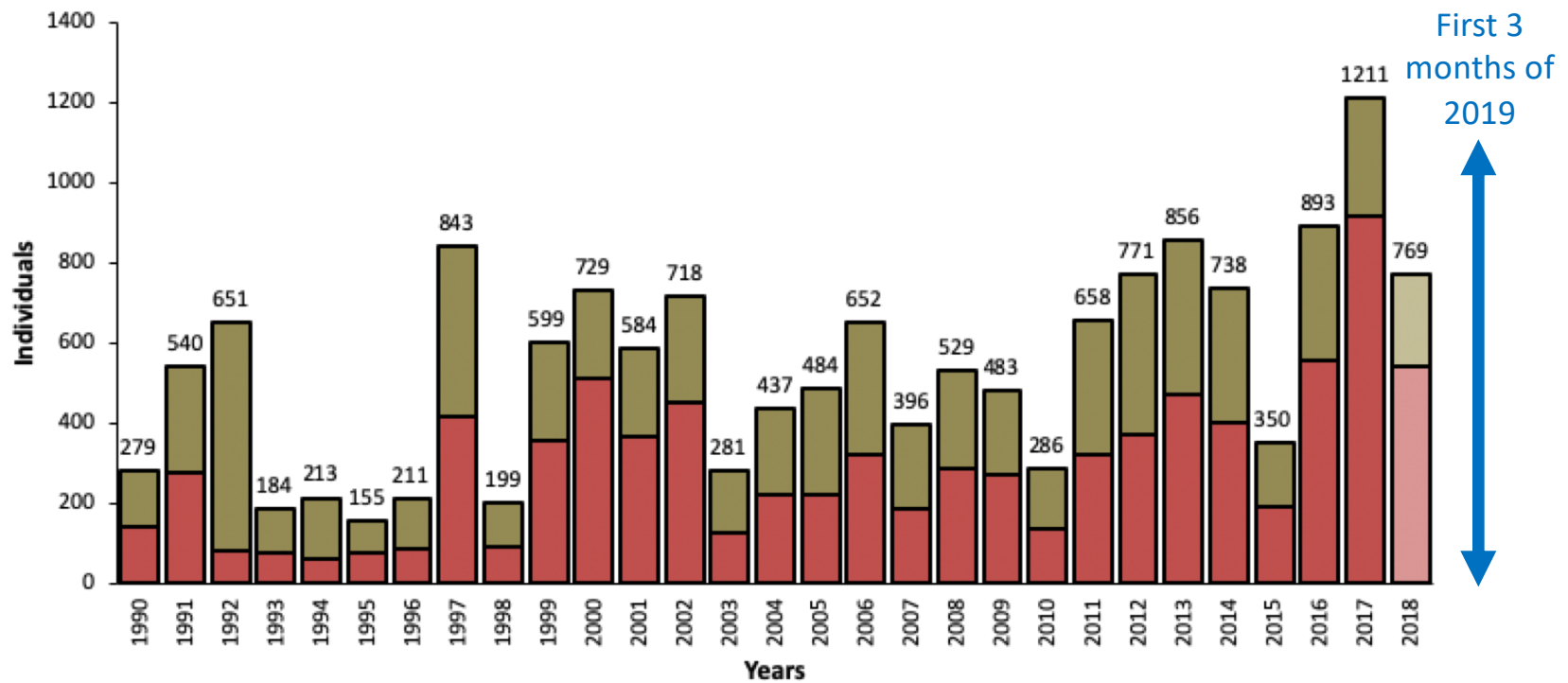
Net marks
Fracture of rostrum
Amputations
Hole under jaw
Flensing
Piece of fishing gear



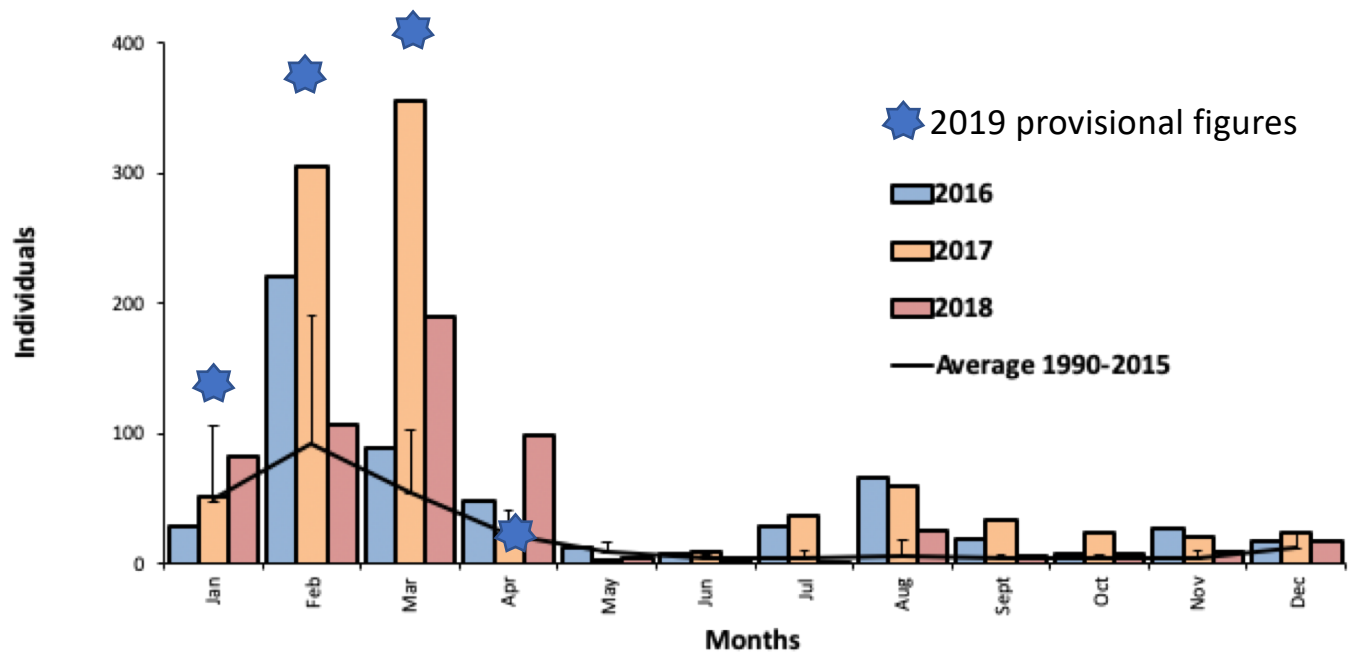
If no such external lesion
Good body condition
No pathological condition
Fresh food items
Asphyxia lung lesions



Update on recent stranding data

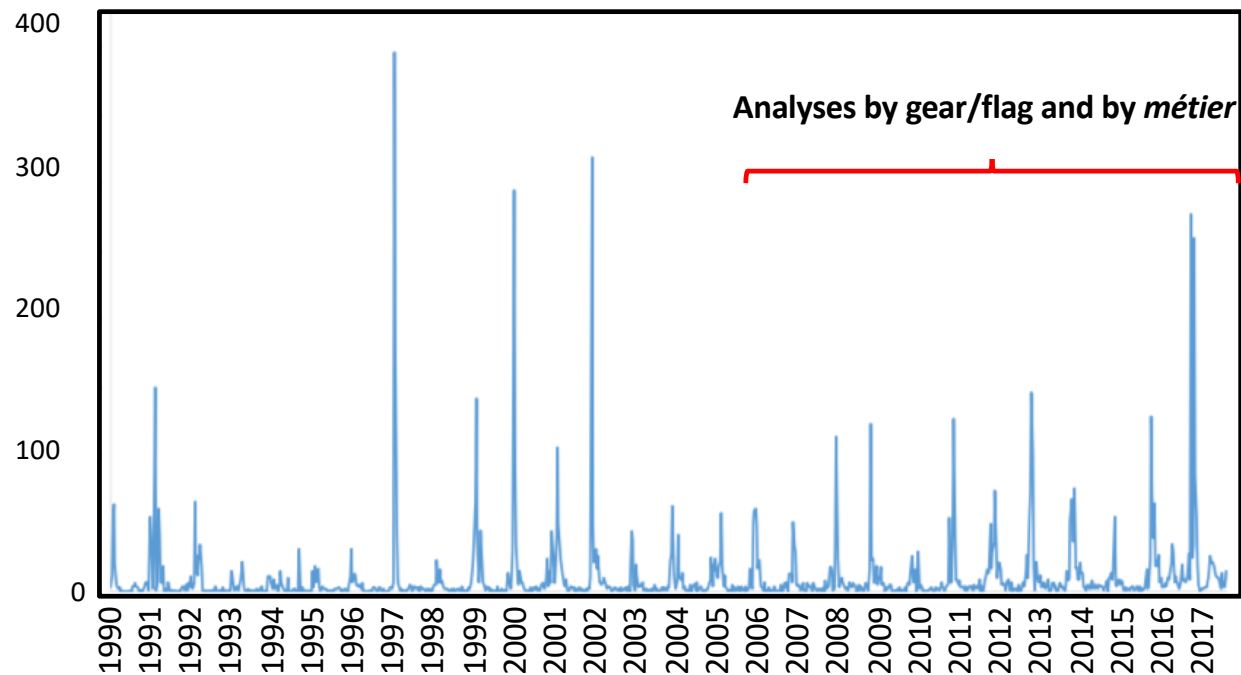


Update on recent stranding data



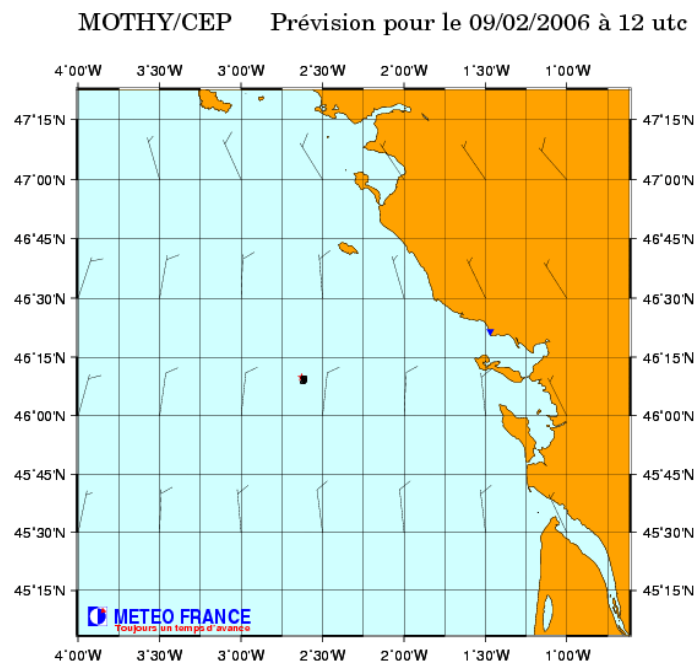
Update on recent stranding data

Multiple stranding events (MSE: 1-3 weeks, 100s stranded dolphins; observed 23 of last 30 years). Analyses of spatial matching between areas of mortality and fishing effort distributions during MSEs.



Mortality vs fishing effort
distributions: February 2017,
to illustrate the approach

Mortality vs fishing effort distributions: by gear-flag, February 2017

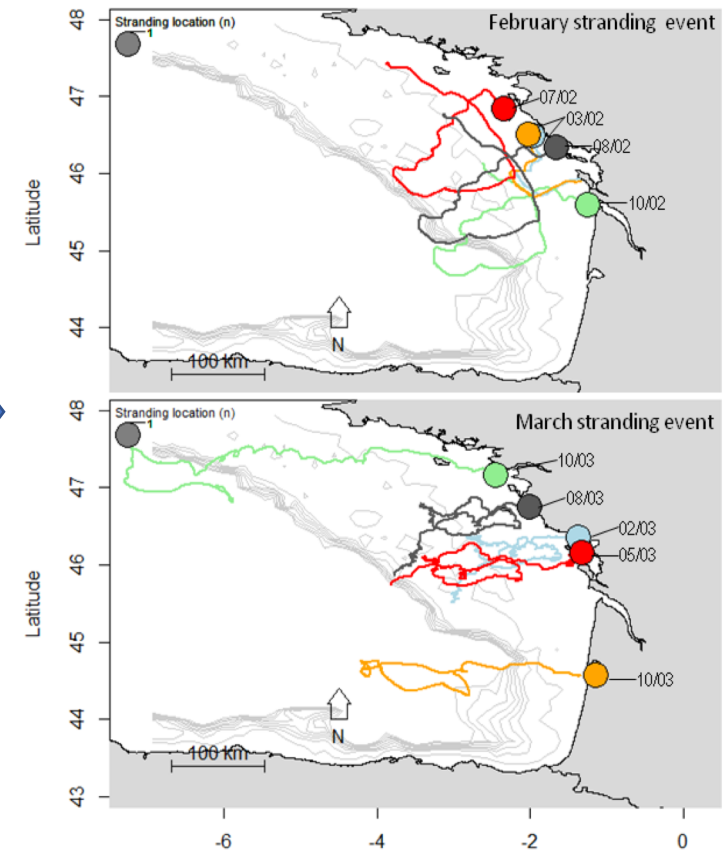


D.delphis NECECETPRO1

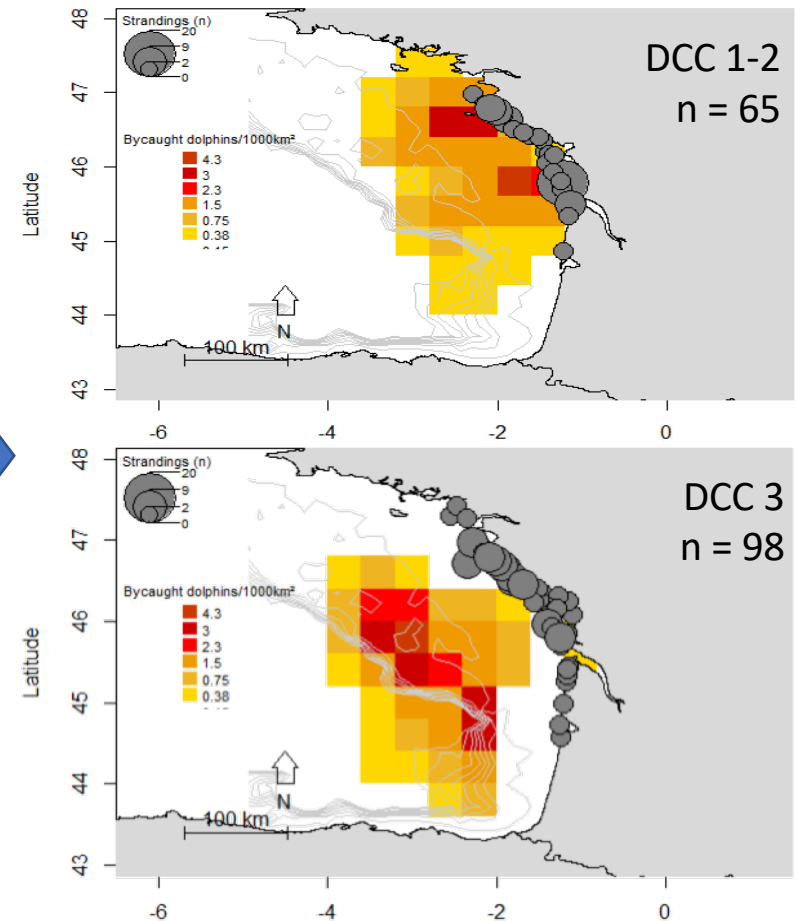
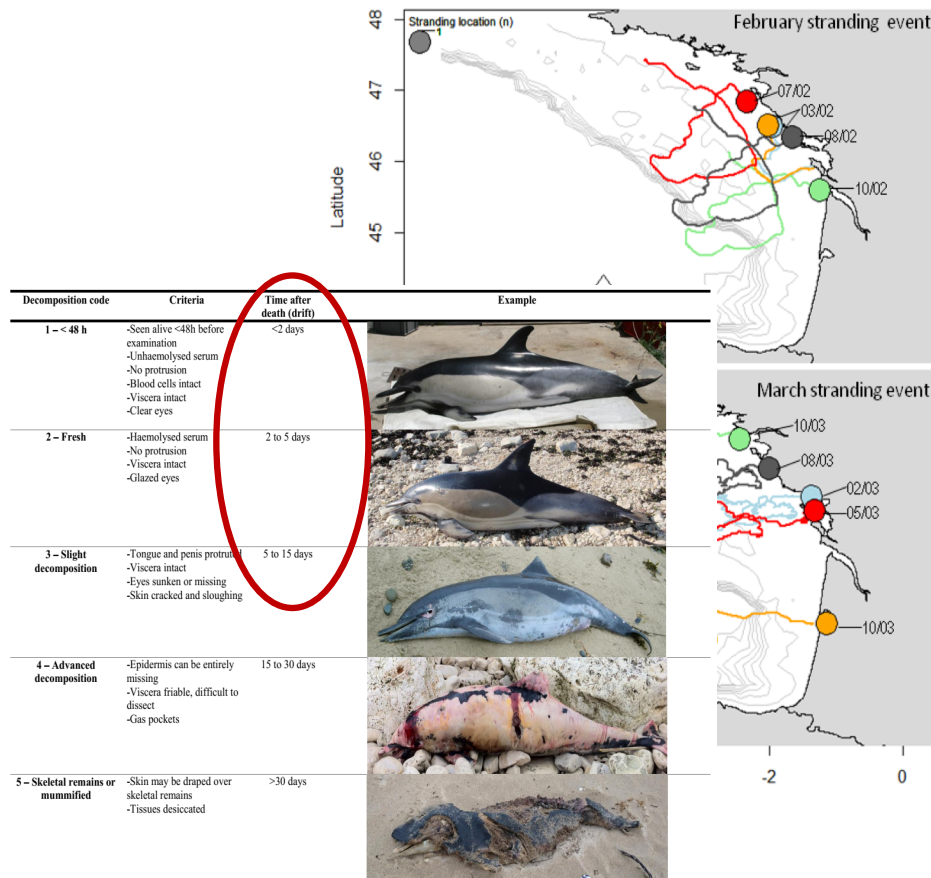
Position initiale :
le 09/02/2006 à 10h00 utc
Latitude : 46° 09,90'
Longitude : -2° 37,68'

2 : immersion 20%
3 : immersion 30%
4 : immersion 40%
5 : immersion 50%
6 : immersion 60%
7 : immersion 70%
8 : immersion 80%
9 : immersion 90%
0 : immersion 100%

Système géodésique: WGS 84



Mortality vs fishing effort distributions: by gear and flag, February 2017

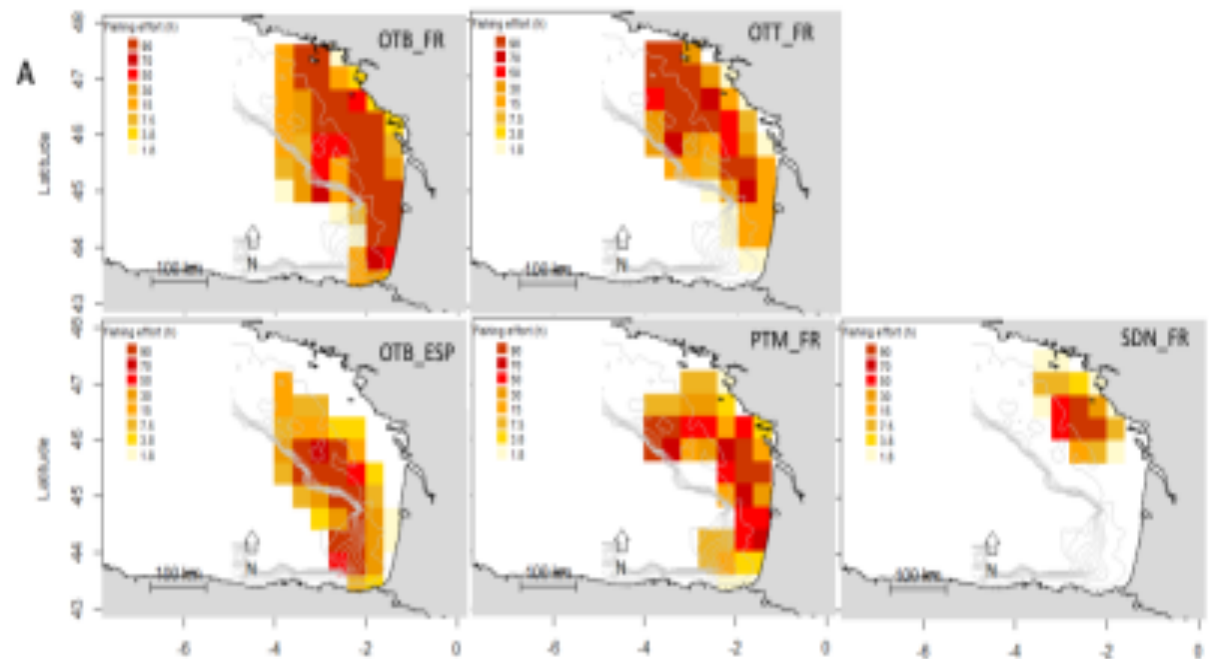


Mortality vs fishing effort distributions: by gear and flag, February 2017

Fishing effort aggregated by
fishing gear and vessel flag

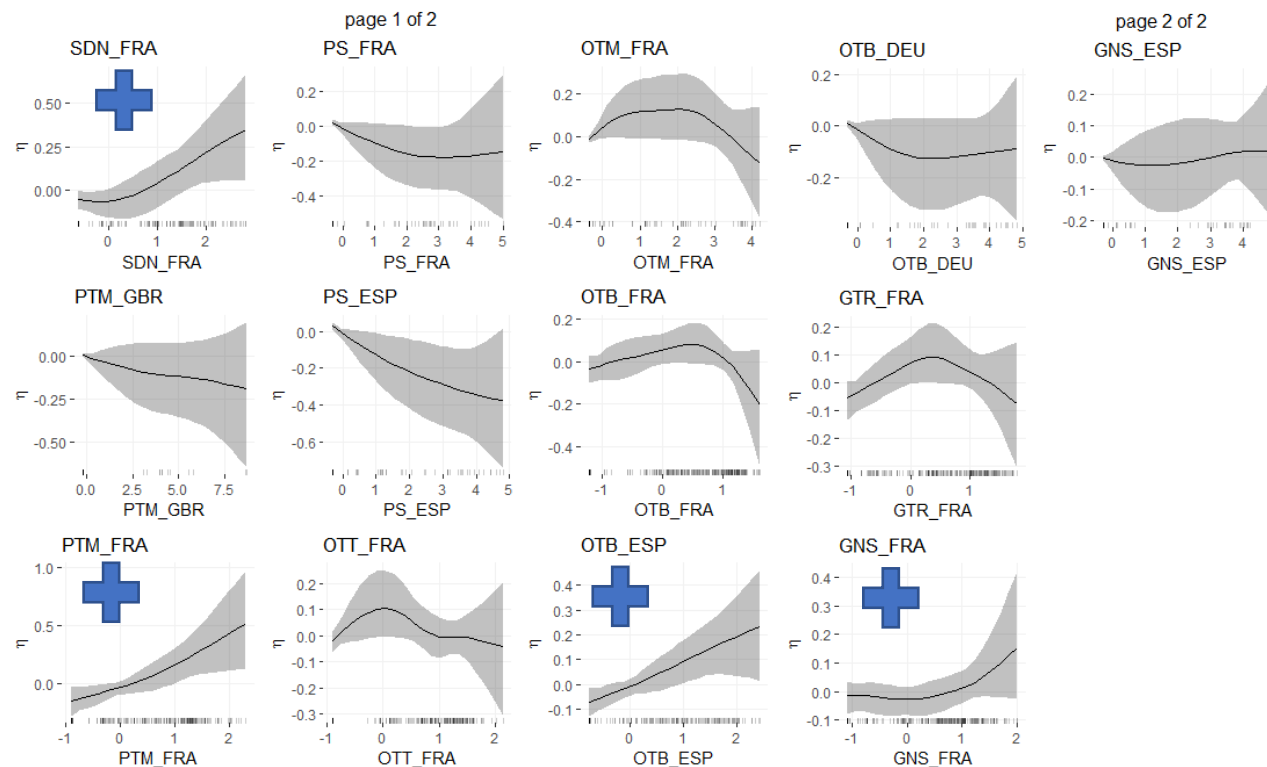
VMS data for vessels > 12 m;
analysed by *Ifremer*

Main criteria: vessel speed
threshold 4.5 knots



Mortality vs fishing effort distributions: by gear and flag, February 2017

Prediction and variable selection using « Spike and Slab »



| Gear type codes | |
|-----------------|-----------------------|
| GNS | set gill net |
| GTR | trammel net |
| OTB | bottom otter trawl |
| OTM | mid-water otter trawl |
| OTT | otter trawl |
| PS | purse seine |
| PTM | mid-water pair trawl |
| SDN | Danish seine |

Mortality vs fishing effort distributions: by gear and flag, February 2017

PTM_FR: Midwater Pair Trawl_France

Identified since the 1990; studied during the 2000; now reduced to 15-20 pairs; targets seabass, hake, anchovy, albacore

OTB_SP: Bottom Otter Trawl_Spain

Includes HVO and VHVO trawls targetting hake, horse mackerel, blue whitting

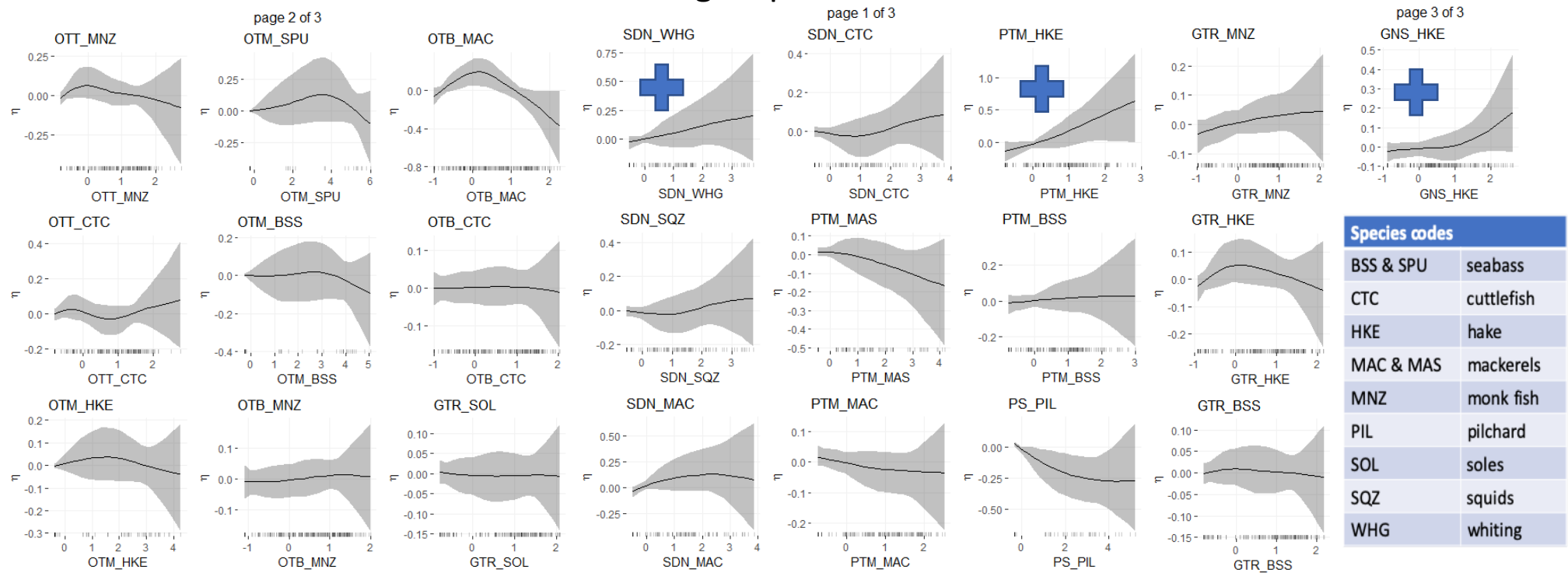
SDN_FR: Danish Seine_France

New gear in the area, not well known, targets seabass among other species

GNS_FR: numerous vessels of various sizes and multiple target species

Mortality vs fishing effort distributions: French fisheries only, by *métier* (species >10% of total landings), February 2017

Prediction and variable selection using « Spike and Slab »

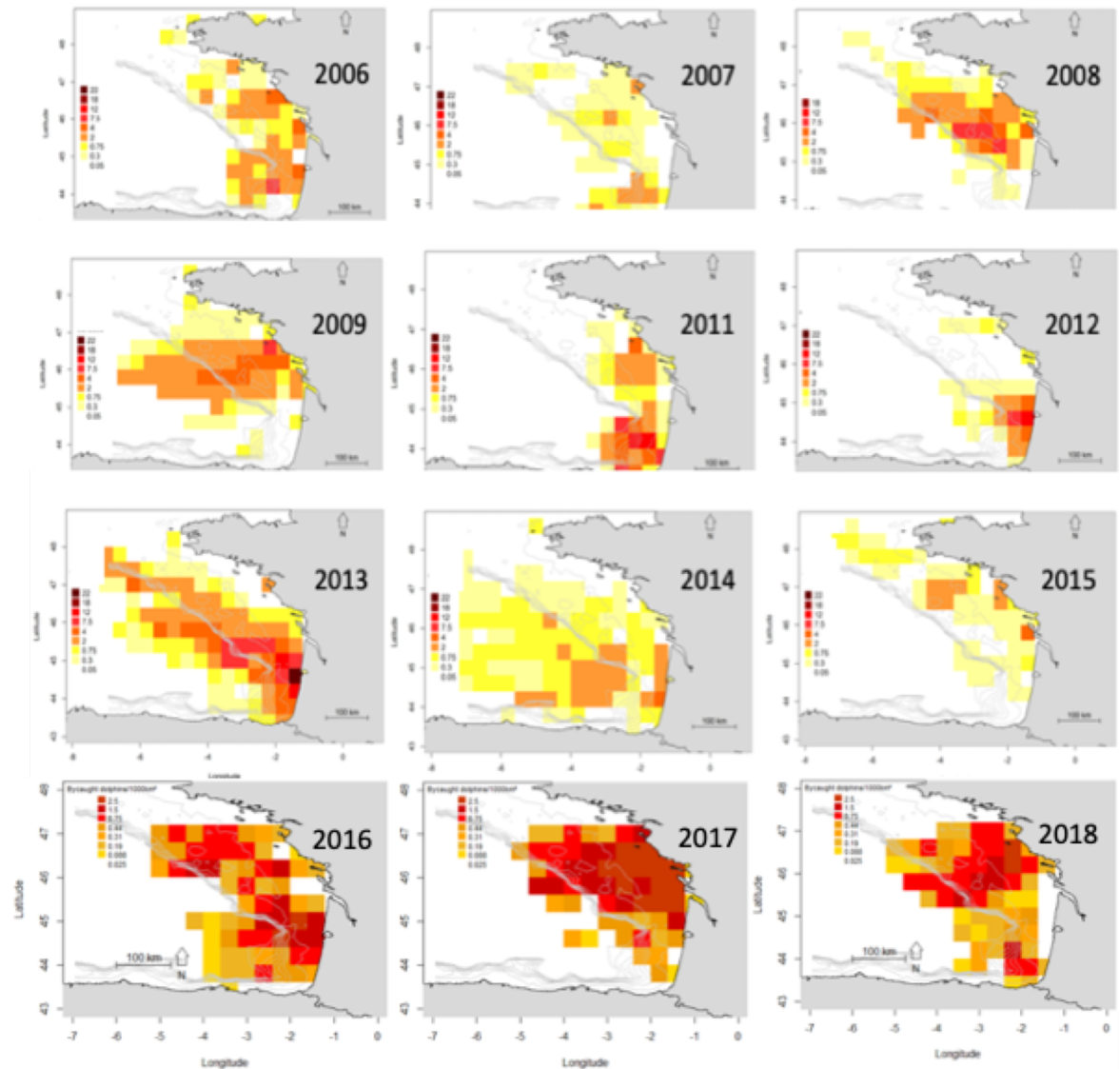


Mortality vs fishing effort
distributions: generalisation to all
MSEs from 2006-2018

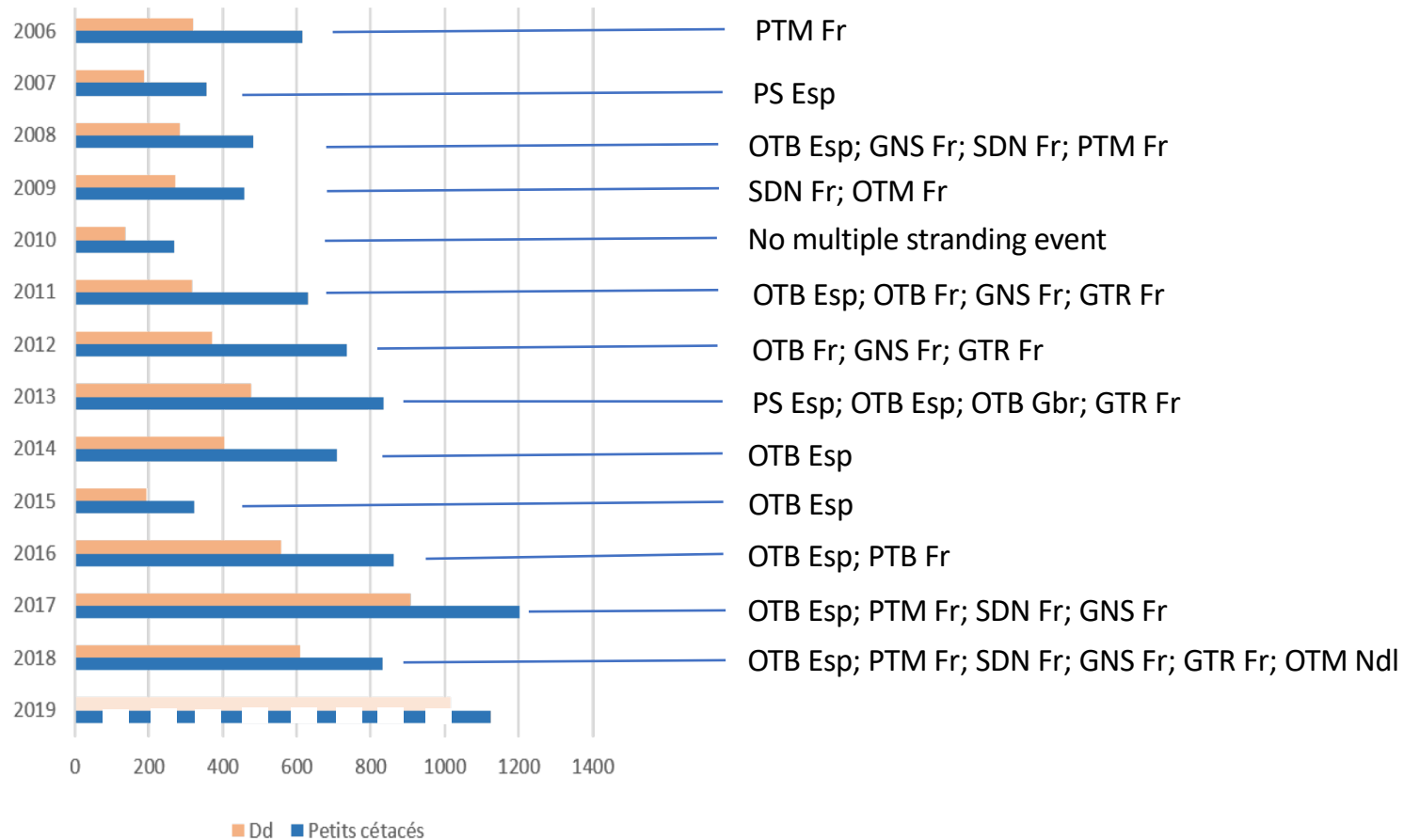
Mortality areas: from drift
reverse modelling for all MSEs
from 2006-2018

vs

Similar maps made available
by Ifremer for fishing efforts of
all fleets (gear/flag) and all
métiers (gear/target species)
among French fleets

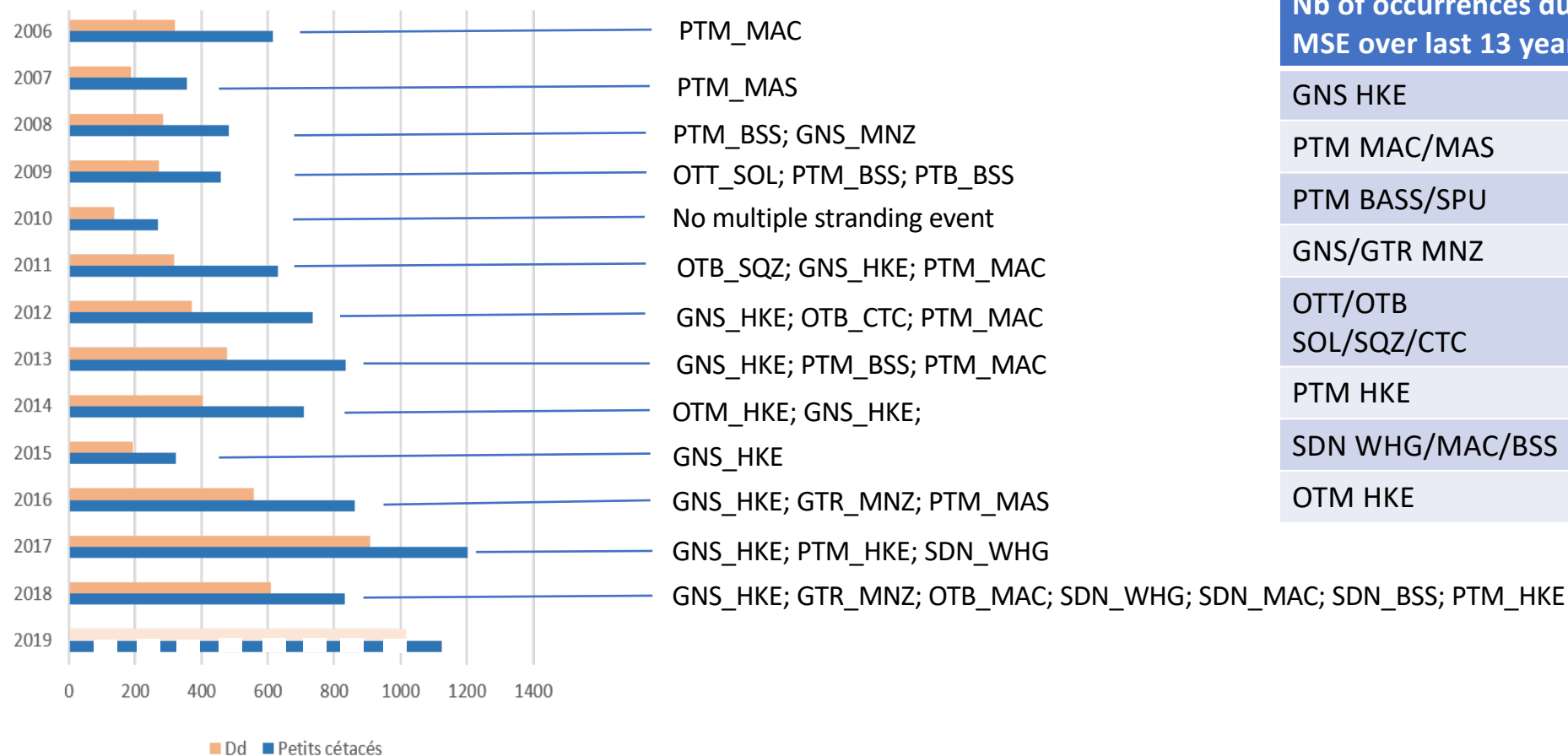


Mortality vs fishing effort distributions: by gear and flag , MSE from 2006-2018



| Nb of occurrences during MSE over last 13 years | |
|---|---|
| OTB Esp Fr Gbr | 9 |
| GNS Fr | 5 |
| GTR Fr | 4 |
| PTM Fr | 4 |
| SDN Fr | 4 |
| OTM Fr Ndl | 2 |
| PS Esp | 2 |
| PTB Fr | 1 |

Mortality vs fishing effort distributions: French fisheries only, by *métier* (species >10% of total landings), MSE from 2006-2018



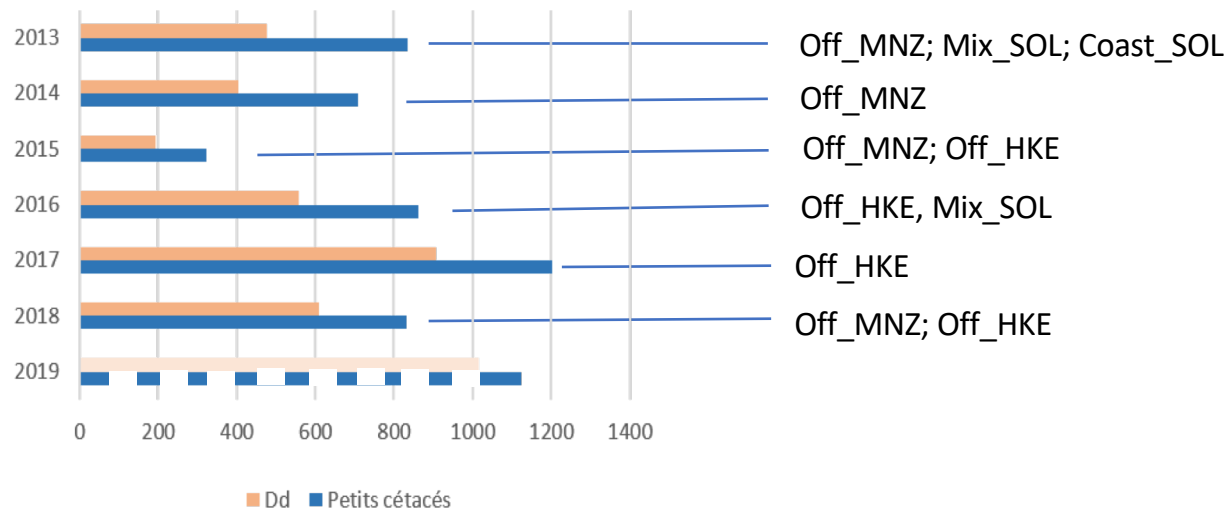
| Nb of occurrences during MSE over last 13 years | |
|---|---|
| GNS HKE | 8 |
| PTM MAC/MAS | 6 |
| PTM BASS/SPU | 3 |
| GNS/GTR MNZ | 3 |
| OTT/OTB SOL/SQZ/CTC | 3 |
| PTM HKE | 2 |
| SDN WHG/MAC/BSS | 2 |
| OTM HKE | 1 |

Zooming in net types: 2013-2018

4 different netter categories: 3 miles netters; coastal netters; mixt netters; offshore netters.



| Netter category | Fleet size (2018) | % vessel >10m (2018) |
|-----------------|-------------------|----------------------|
| 3 M | 58 | 12% |
| Coastal | 328 | 25% |
| Mixt | 47 | 96% |
| Offshore | 63 | 100% |



| Nb of occurrences during MSE over last 6 years | |
|--|---|
| Off HKE | 4 |
| Off MNZ | 4 |
| Mixt SOL | 2 |
| Coast SOL | 1 |

Conclusive remarks

- **Work in progress !**
- Drift modeling allows candidate fisheries to be identified;
- aggregating fishing effort at *métier* level would be more discriminating than at gear level;
- Uncertainty partly related to difficulty in estimating death-to-stranding time and FAO fishing gear typology and codes;
- Diversity of candidate gears (PTM, OT, GNS, GTR) and target species (CTC, CTL, MNZ, HKE, BSS, MAC) makes monitoring and mitigation more complex to design and expensive to implement;
- Candidate fisheries should be submitted to reinforced observer and/or REM monitoring;
- Expand same analyses including periods out of multiple stranding events; perform same analyses for harbour porpoise.