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## Long-term monitoring of marine ecosystem sentinel species: The French Southern Breeding Seabird Survey

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► **To cite this version:**

Karine Delord, Yves Cherel, Henry Weimerskirch, Julien Collet, Timothée Bonnet, et al.. Long-term monitoring of marine ecosystem sentinel species: The French Southern Breeding Seabird Survey. EURING 2023, Apr 2023, Montpellier, France. 2023, 10.13140/RG.2.2.28820.88965 . hal-04256281

**HAL Id: hal-04256281**

**<https://hal.science/hal-04256281>**

Submitted on 24 Oct 2023

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# Long-term monitoring of marine ecosystem sentinel species :

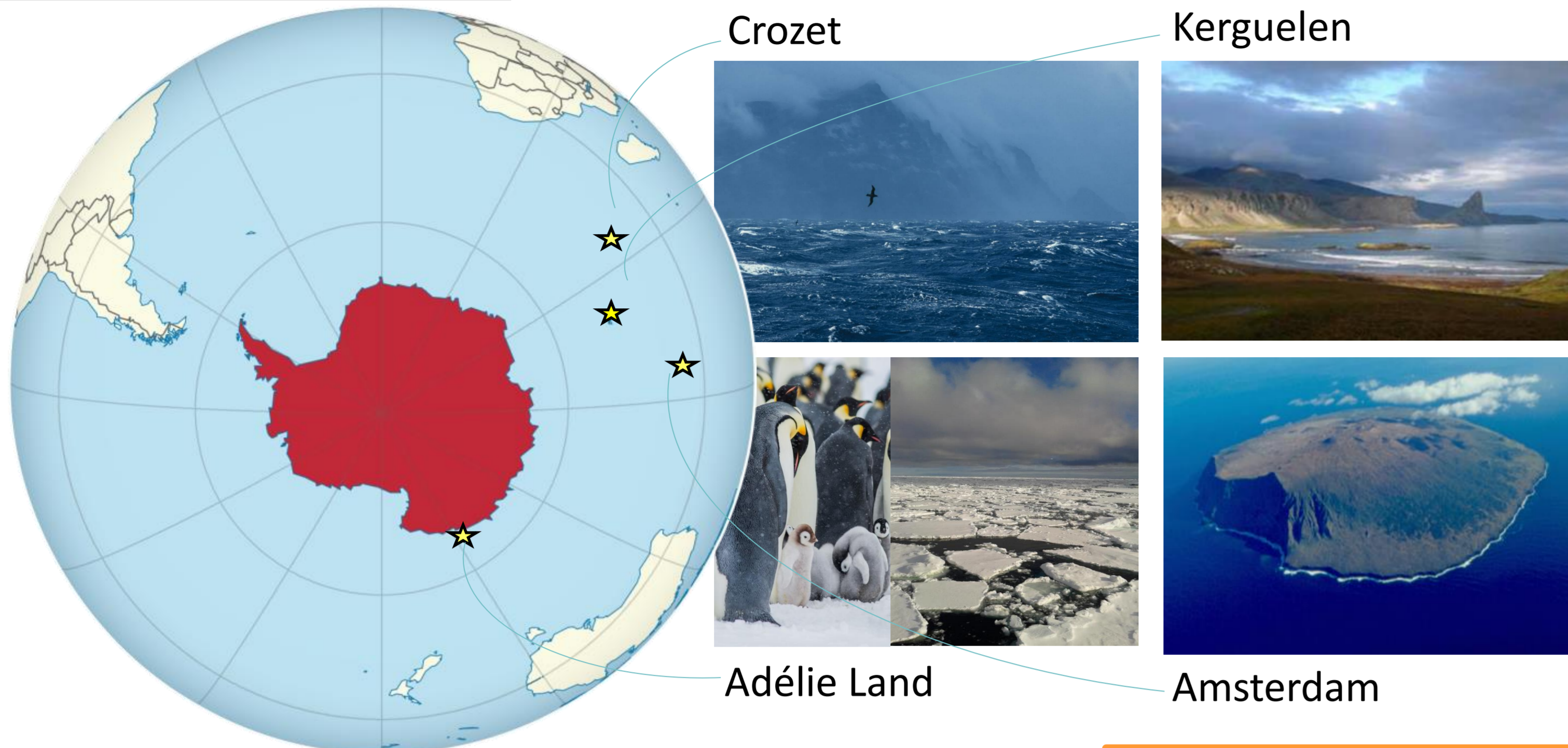
## The French Southern Breeding Seabird Survey

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### Sites and colonies



### Individual and population monitoring

Since early 1950's  
4 study sites on a latitudinal gradient polar -> subtropical  
> 30 species  
~ 133,000 marked individuals; ~ 450,000 observations

### Breeding survey

Since early 1950's  
Partner identity  
Reproductive frequency and output  
Pedigree  
Phenology

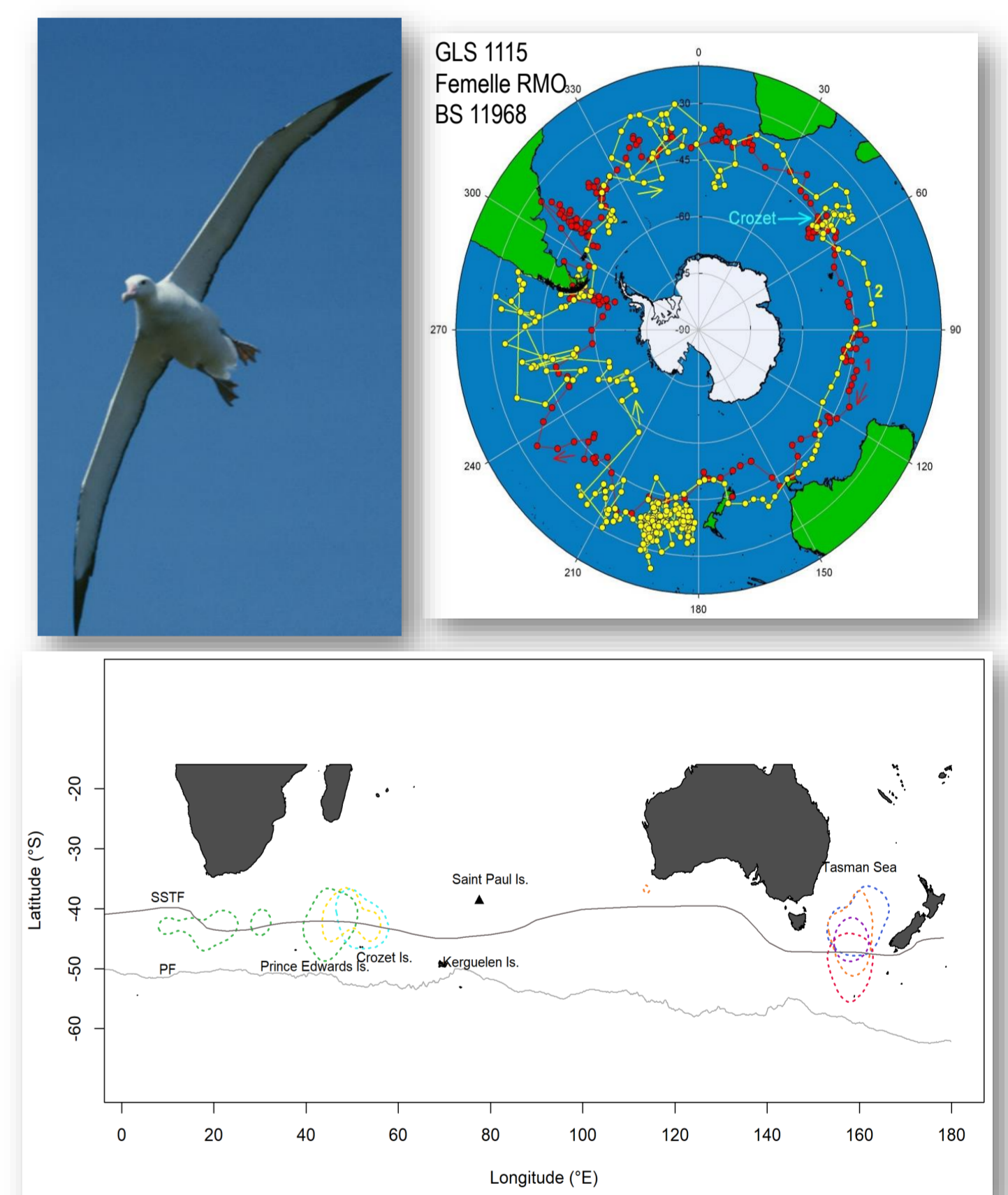
~ 20,000 registration-year  
~ 3,000 new identified individuals yearly

### Movement at-sea

#### Foraging behaviour

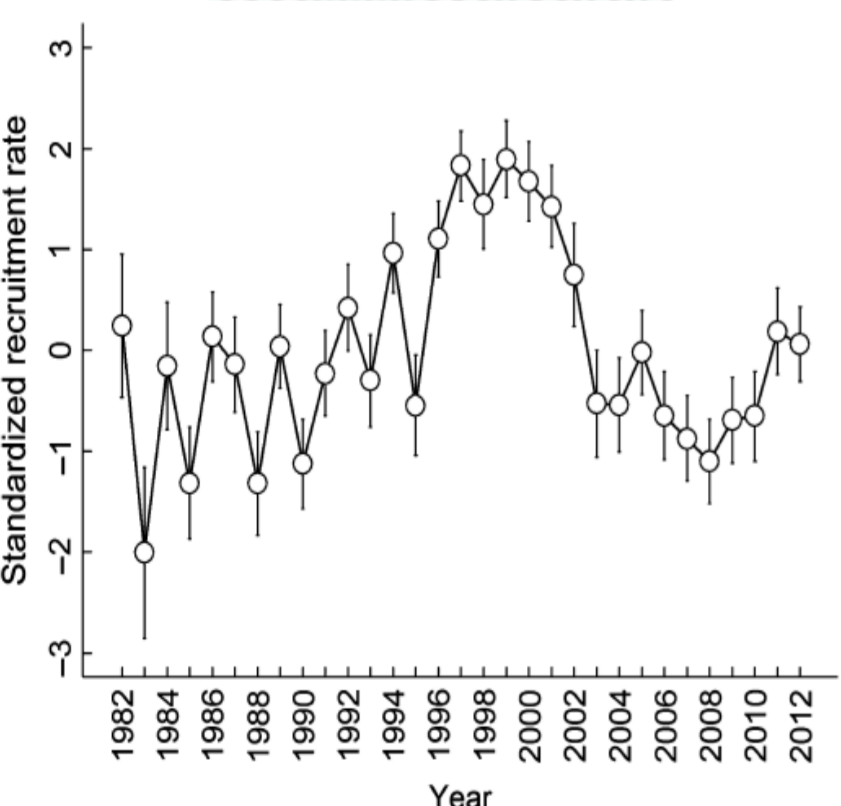
Since late 1980's  
ARGOS, GPS, TDR  
Foraging effort  
Foraging areas

### Migratory behaviour



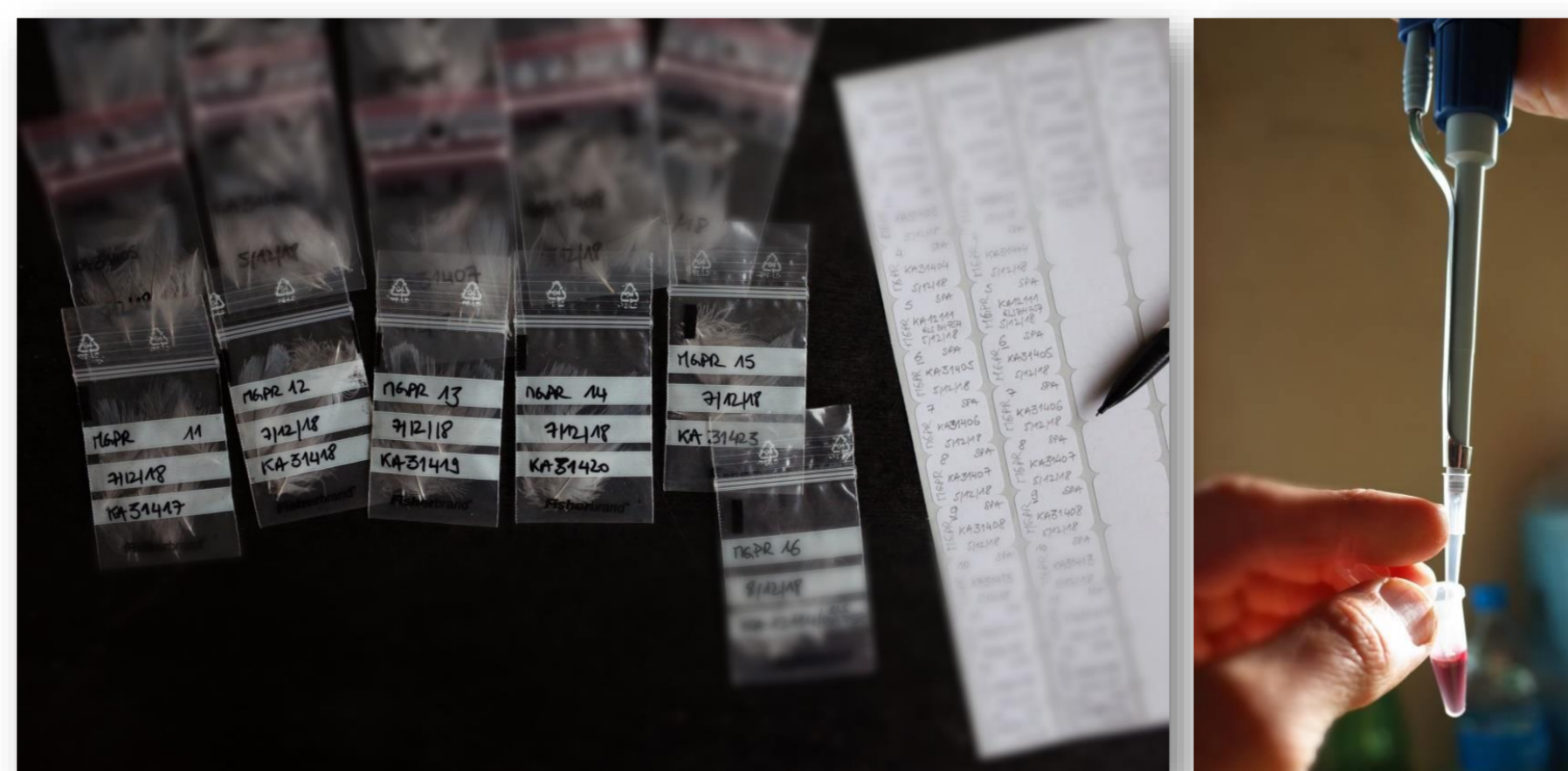
### Individual resightings

Since early 1950's  
Capture-mark-recapture  
Demographic traits  
Annual and life-time reproductive success  
Body condition  
Phenotypic traits



### Tissues sampling

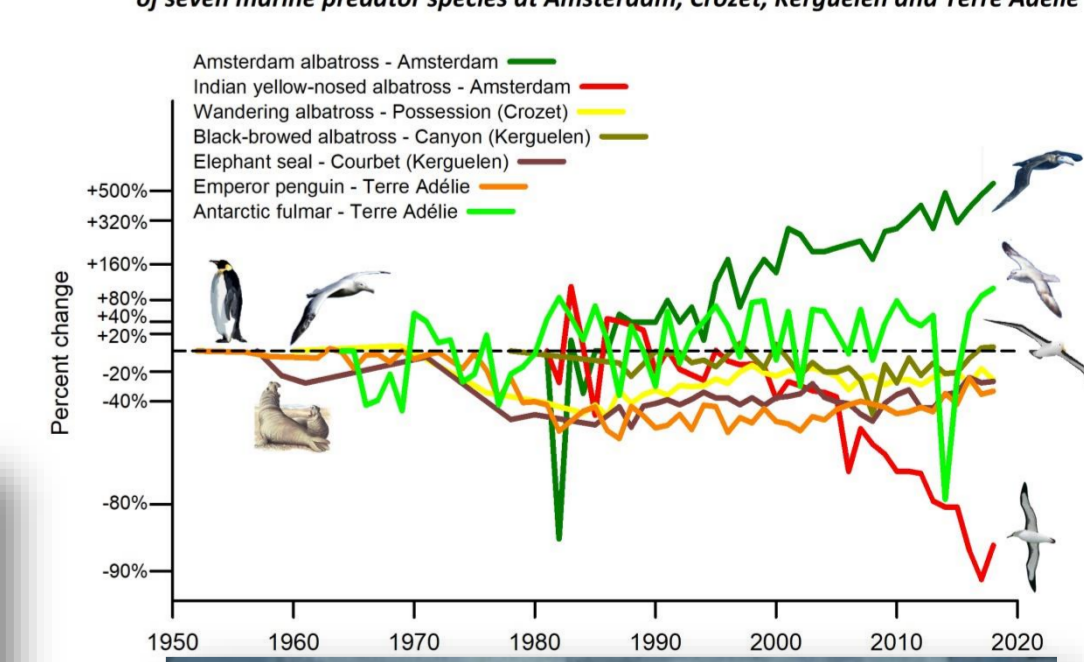
Since late 1990's  
Carbon and nitrogen stable isotopes ratios  
Pollutants levels  
Telomere length  
Hormones levels  
Pathogens



### Population census

Breeding pairs  
Trends

Changes in the number of breeding pairs (birds) and breeding females (seals) of seven marine predator species at Amsterdam, Crozet, Kerguelen and Terre Adélie



### OUTPUTS

Lifelong studies can unravel how behavioral and life-history patterns emerge in the wild that shape the evolution of species and their adaptation to their environment. Long-term data are essential for understanding the effects of environmental variability and change on populations and in designing conservation efforts.

### CONCLUSION

Long-term studies remain challenging to sustain due to the difficulty of obtaining uninterrupted funding and to technical and logistical challenges. "It is never too late to start a long-term monitoring survey, but it is always too early to stop it".

#### Acknowledgements

~200 Field workers. The study was supported by French Polar Institute IPF, Zone Atelier de Recherches sur l'Environnement Antarctique et Subantarctique (CNRS-INEE), Terres Australes et Antarctiques Françaises

#### References

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