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MERCURY CONTAMINATION & FEEDING ECOLOGY OF THE BLACK-LEGGED KITTIWAKE COLONY OF BOULOGNE-SUR-MER

**P. LEMESLE, W. JOUANNEAU, N. LEGROUX,
A. WARD, Y. CHEREL, P. BUSTAMANTE,
O. CHASTEL**

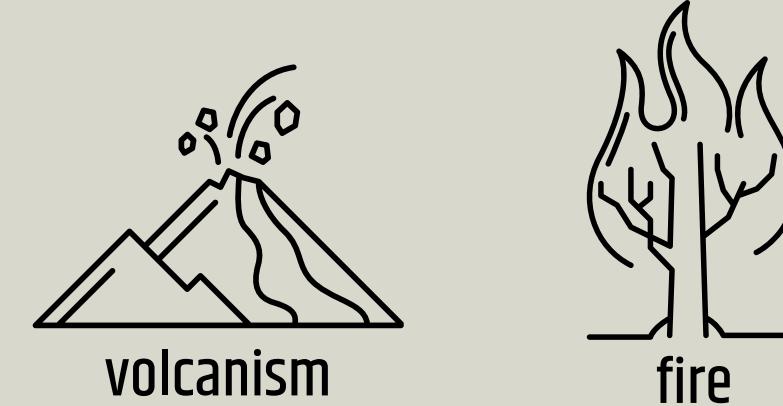
Rencontre nationale du réseau " oiseaux marins "





INTRODUCTION

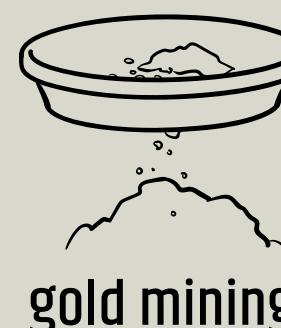
- Natural emissions



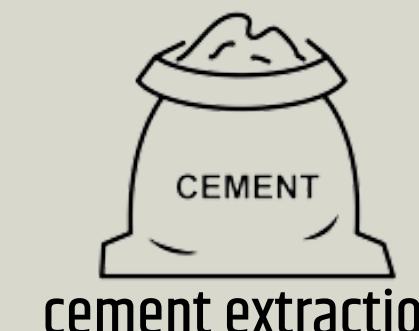
MERCURY (Hg)

- Increasing anthropogenic emissions since the Industrial Revolution

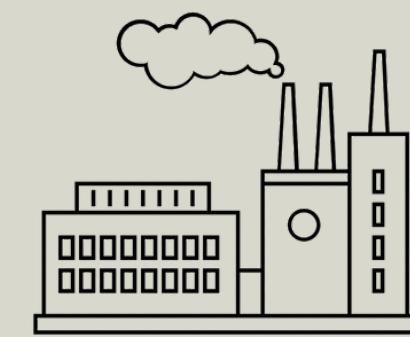
combustion
of coal &
hydrocarbons



gold mining

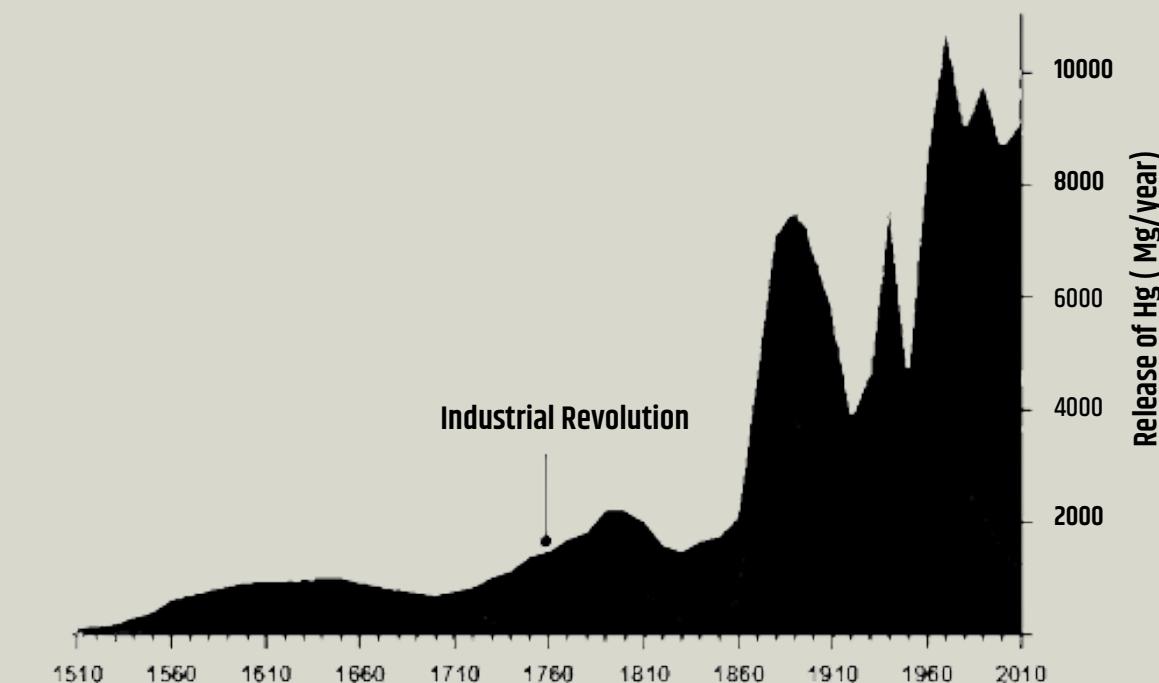


cement extraction



industrial
processes

...



[1] Streets et al. 2019, Environmental Research Letters

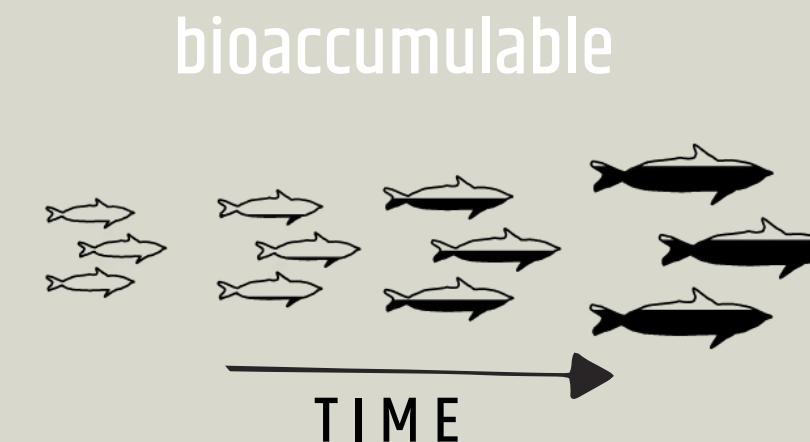


INTRODUCTION

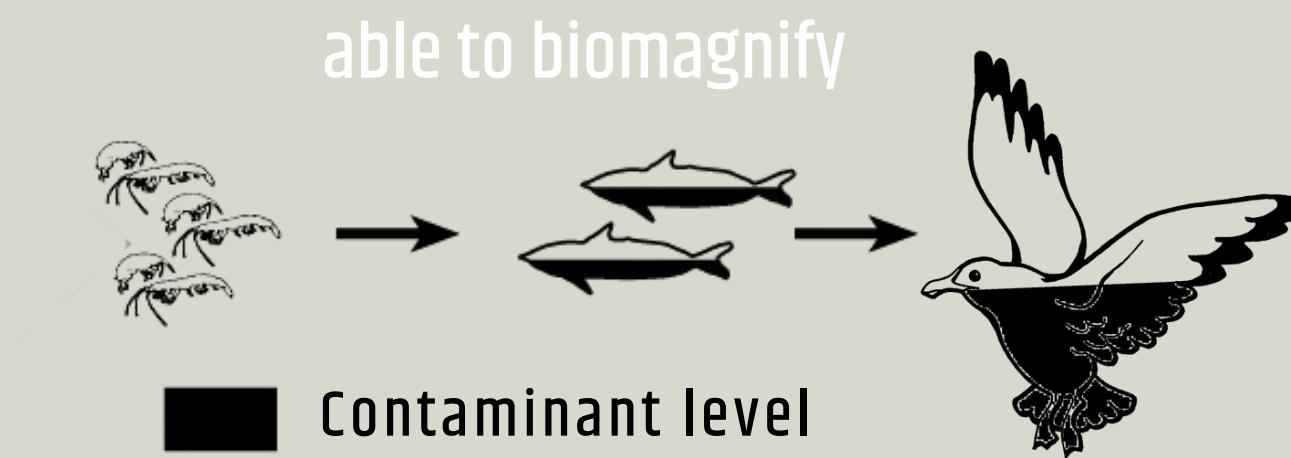


"Mercury is considered by WHO as one of the top ten chemicals or groups of chemicals of major public health concern." (2017)

transported by ocean
currents
&
atmospheric currents



Hg is :



a neurotoxicant
with sublethal and
lethal effects



INTRODUCTION

Evaluate the contamination → Bioindicators = An organism that by its presence or condition provides information on the state of the ecosystem



Seabirds are relevant bioindicators:



high trophic level

population abundance

colonial reproduction



INTRODUCTION



Black-legged kittiwake
(*Rissa tridactyla*)



Most numerous seabird in the northern hemisphere



Data from northern colonies

Svalbard + Norway
(+ Russia + Iceland)



France = Southern limit of the breeding distribution
 No data on mainland France

European distribution



Need to know the contamination of breeding black-legged kittiwakes in France



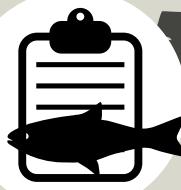
OBJECTIVES



Describe the Hg blood levels of black-legged kittiwakes from Boulogne-sur-Mer at different life stages (adult and chick)



Evaluate the influences of environmental and biological factors



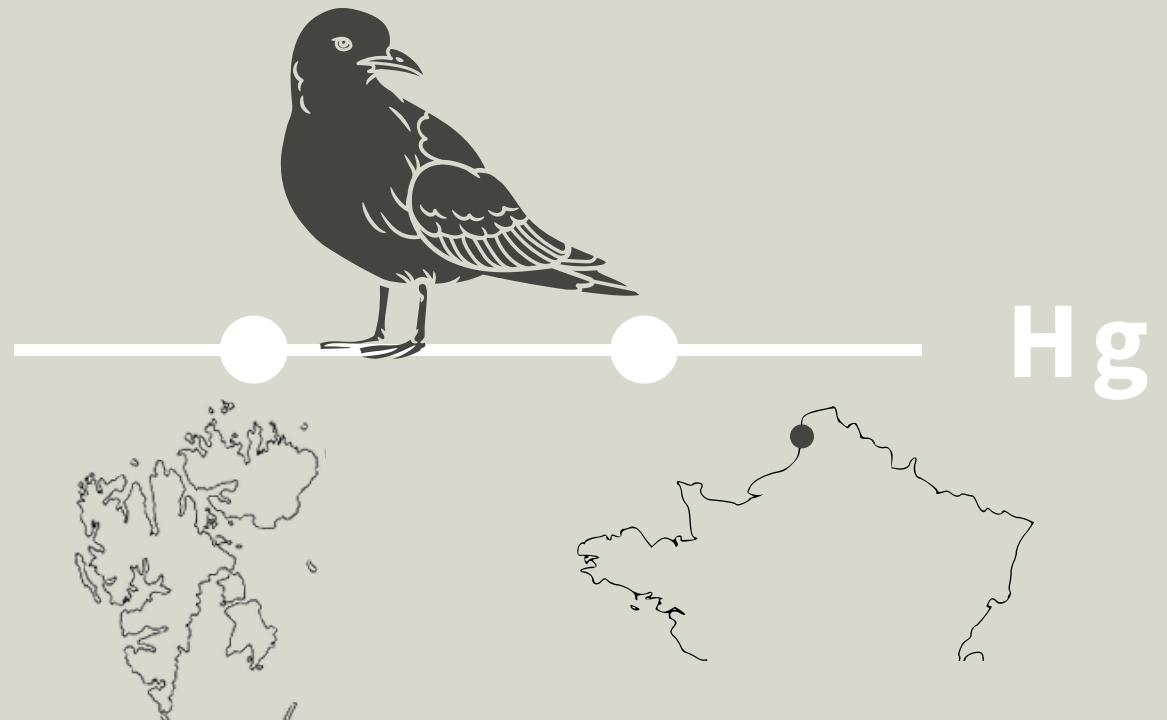
Complete the knowledge on the feeding ecology of black-legged kittiwakes (regurgitates)



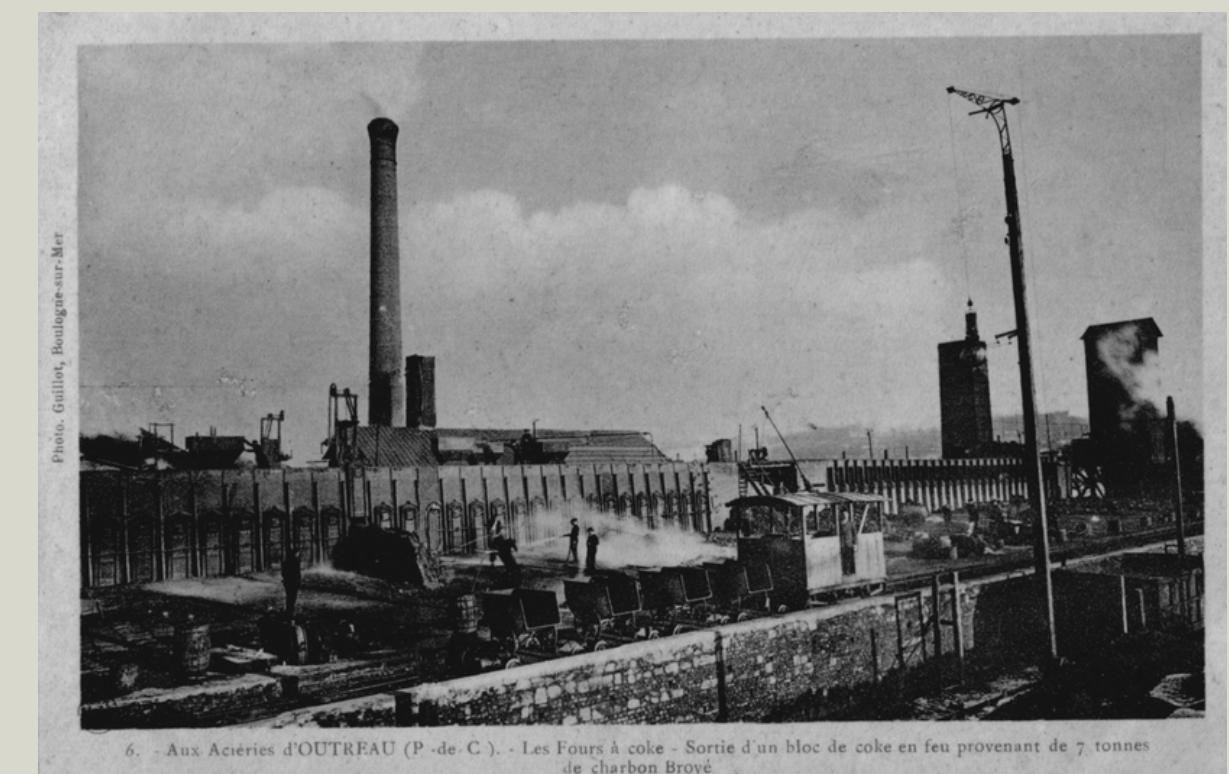
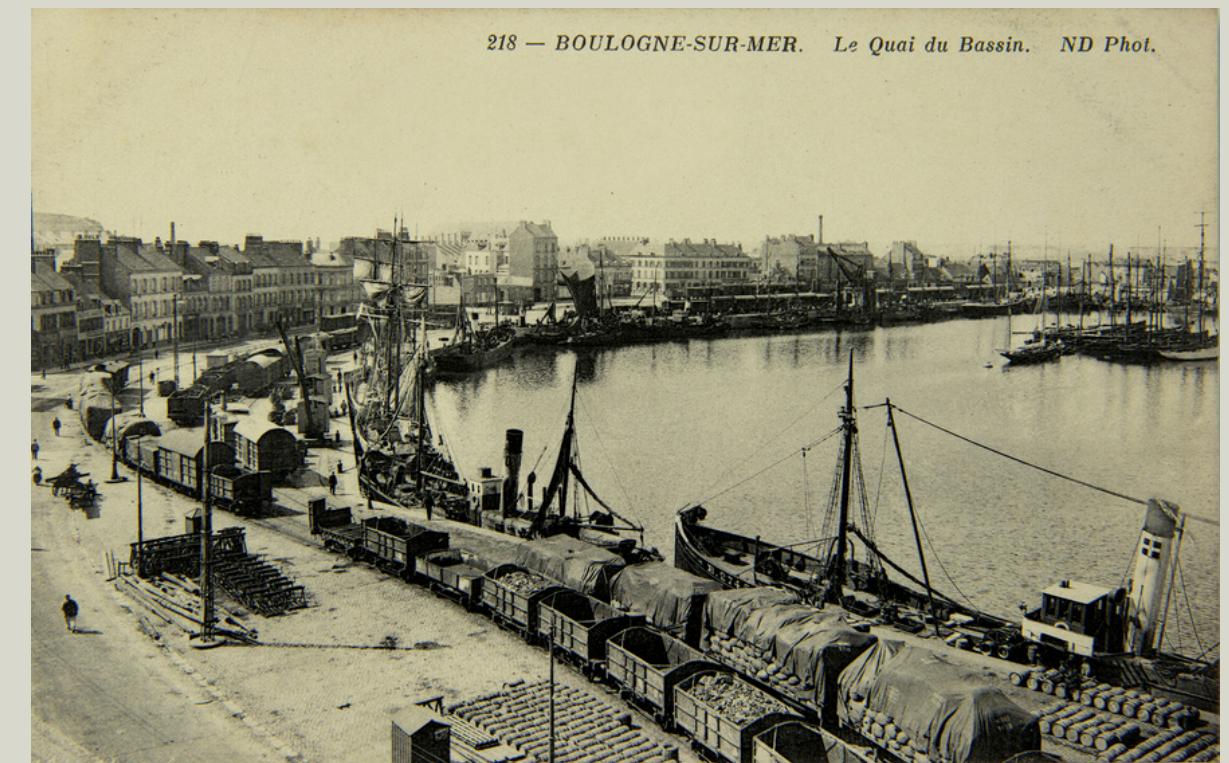
HYPOTHESES



Describe the Hg blood levels



Higher concentration in areas close to
human activities



6. - Aux Acieries d'OUTREAU (P.-de.-C.). - Les Fours à coke - Sortie d'un bloc de coke en feu provenant de 7 tonnes de charbon Broye



OBJECTIVES

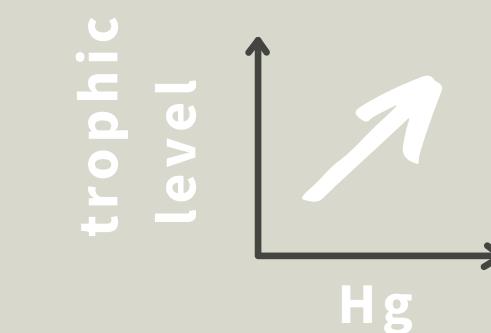


Describe the Hg blood levels

Higher concentration in areas close to
human activities



Evaluate the influences of environmental and biological factors



Sex and trophic level are influential
parameters



OBJECTIVES



Describe the Hg blood levels

Higher concentration in areas close to
human activities



Evaluate the influences of environmental and biological factors

Sex and trophic level are influential parameters



Complete the knowledge on the feeding ecology

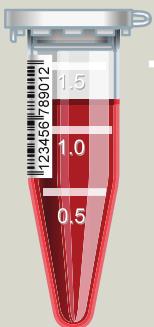
A main species, mainly
small fish
(clupeid & gadidae)



MATERIALS



July 2, 2020
port of Boulogne-sur-Mer



Total mercury (THg)
Isotope $\delta^{15}\text{N}$
Isotope $\delta^{13}\text{C}$

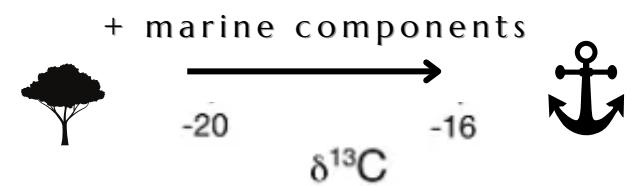


CATCHING
with telescopic pole

BLOOD SAMPLES

20 adults (10 ♀ - 10 ♂) - 12 chicks

Hg concentration
Proxi of trophic position
Proxi of feeding area



9 spontaneous regurgitates



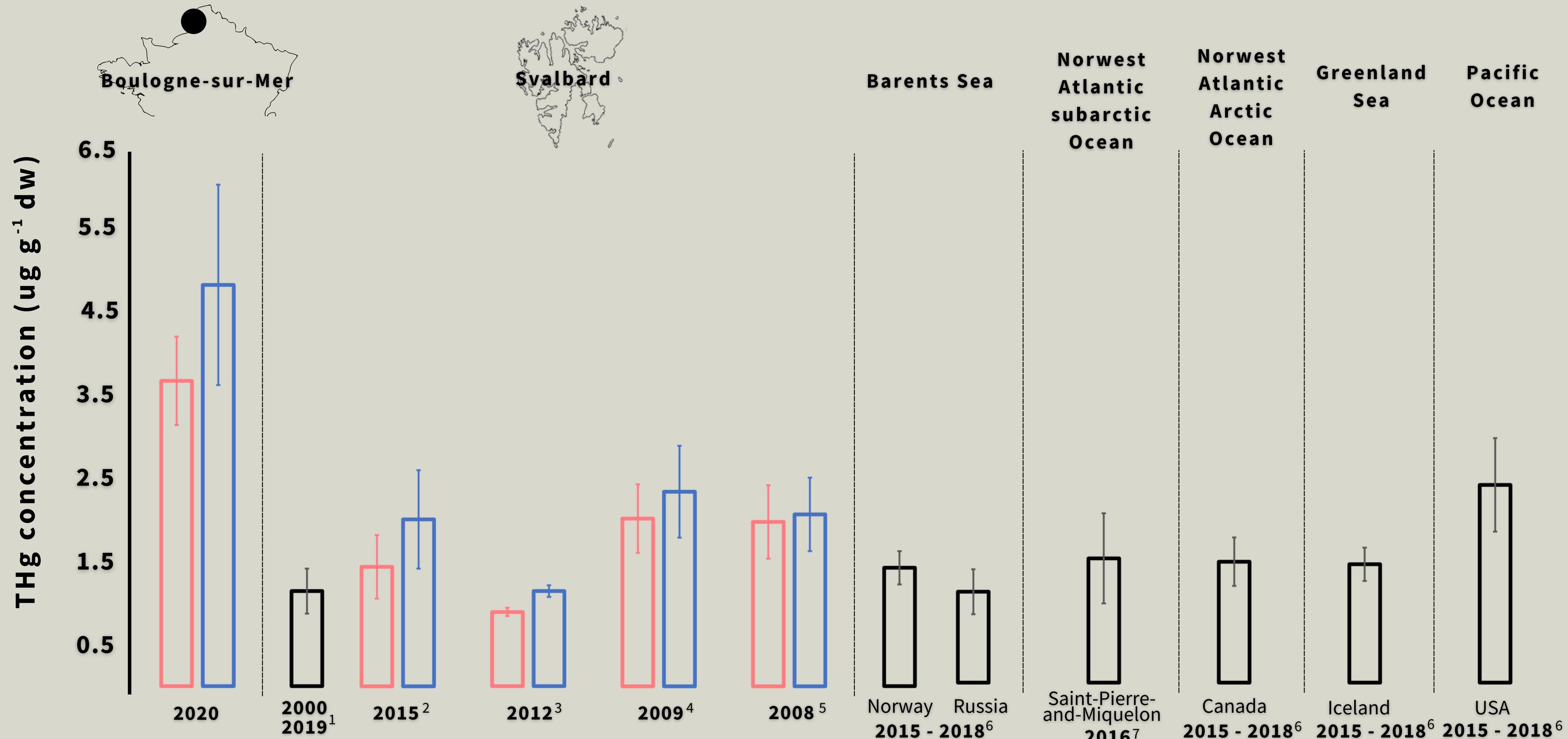
Numerical abundance
Frequency of
occurrence
of each prey
consumed





RESULTS

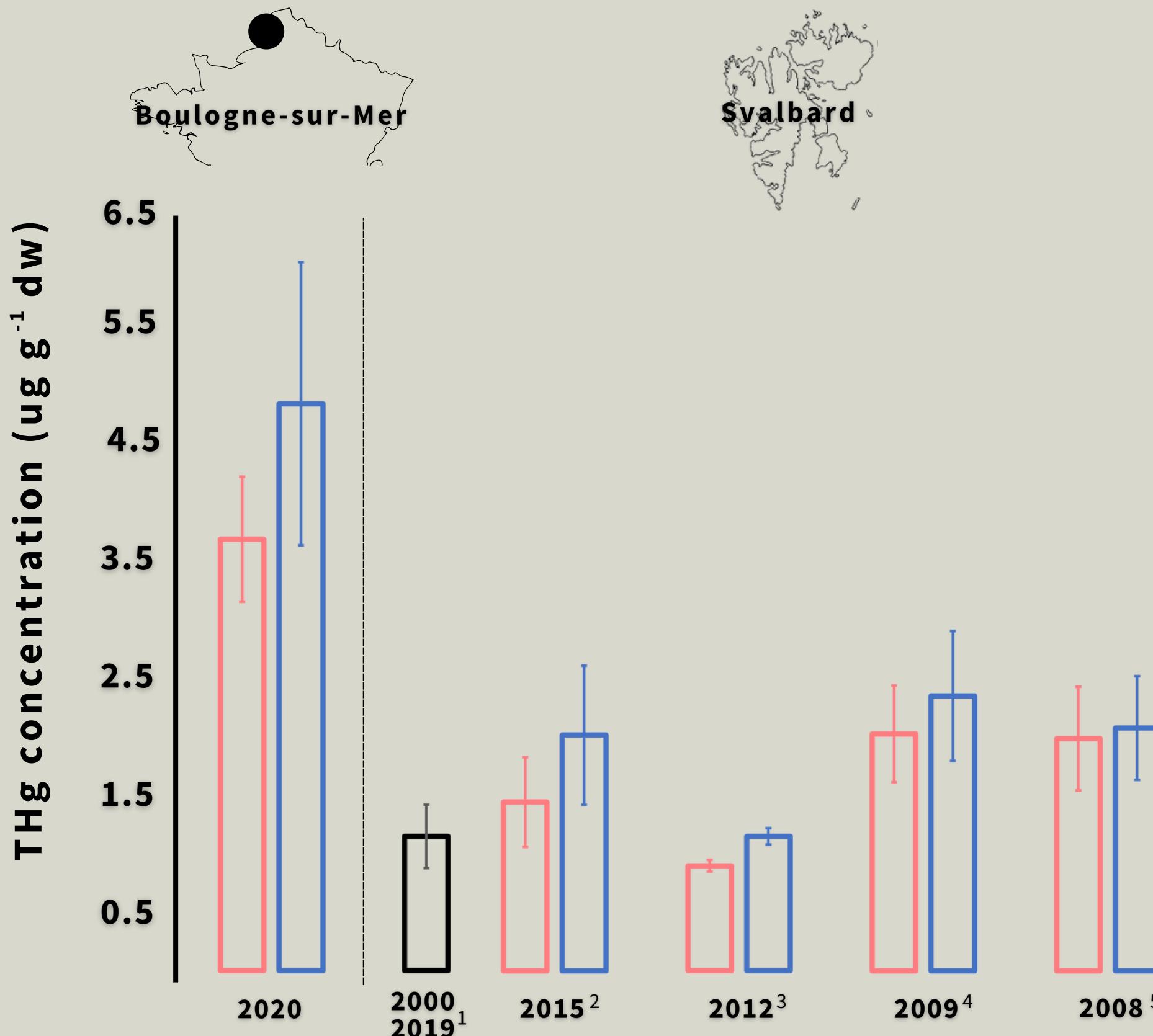
Describe the Hg blood levels





RESULTS

Describe the Hg blood levels



Sublethal impacts observed in Svalbard colony

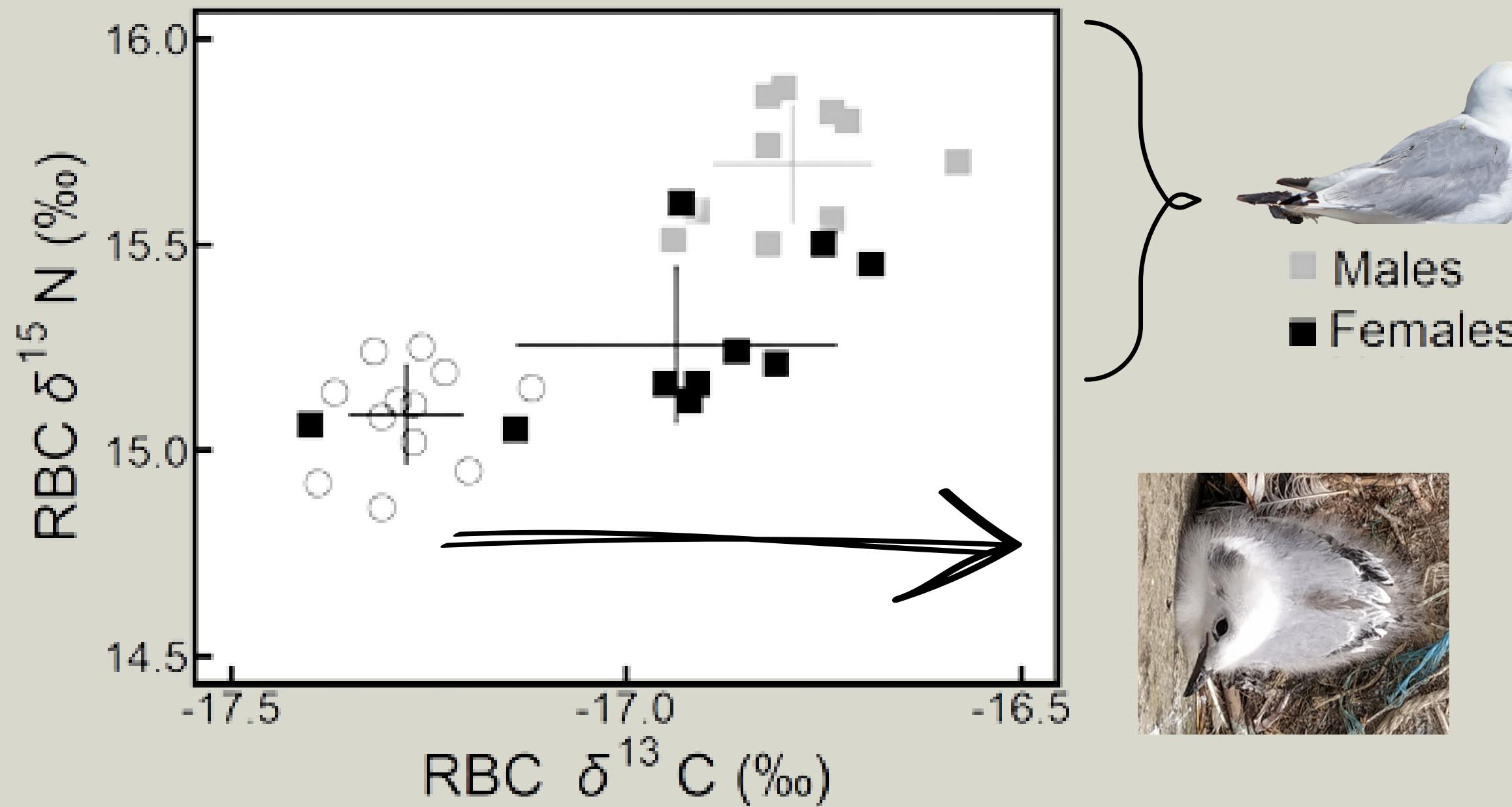
- Alteration of reproductive hormones ^[5,6]
(luteinizing and glucocorticoid hormones & prolactin)
- Relationship to skipping breeding ^[5]
- Ability to raise more than one chick ^[6]
- At Boulogne-sur-Mer:
High [Hg] > sublethal concentrations
- Vulnerability of the colony?





RESULTS

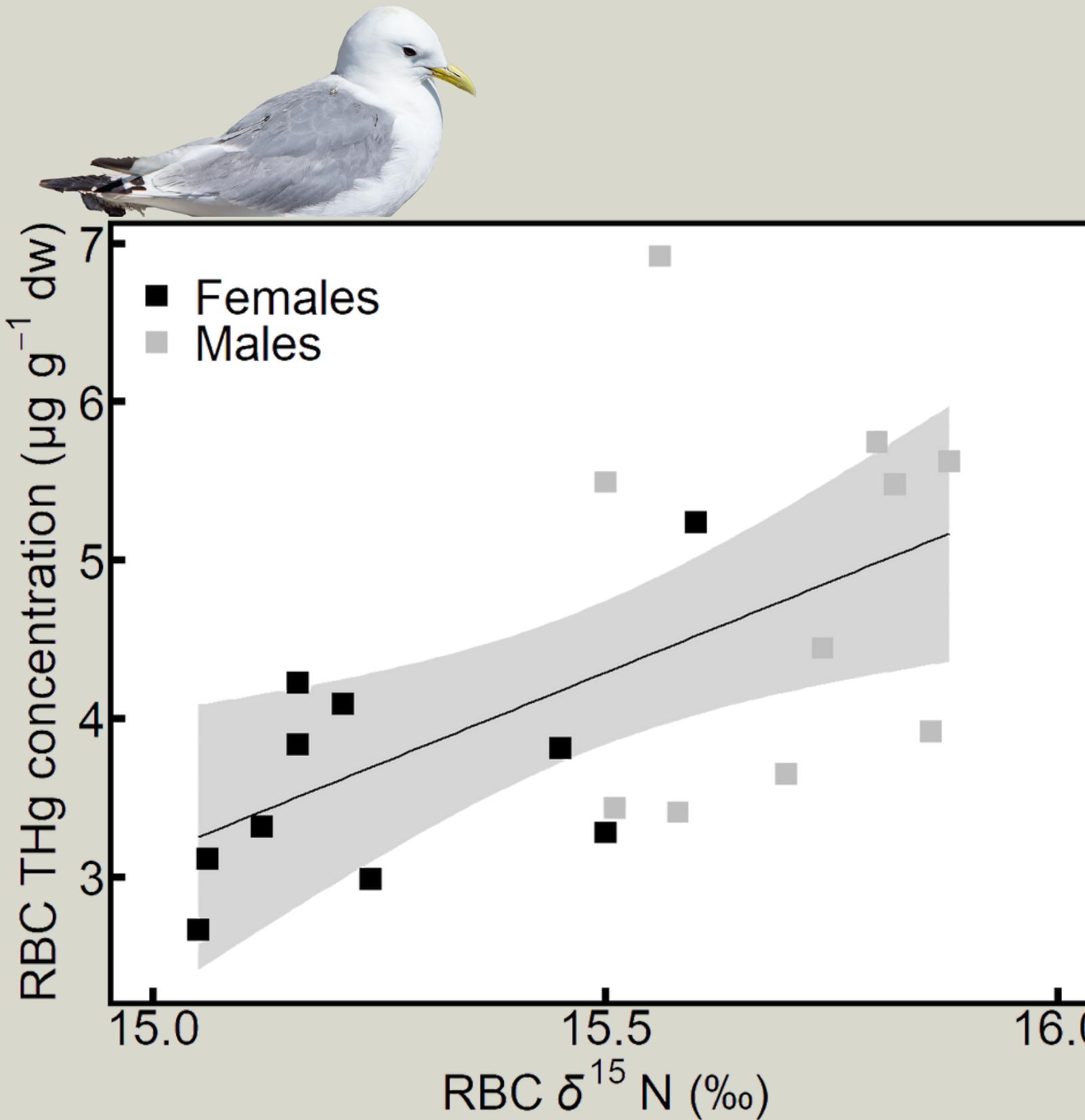
Influences of environmental and biological factors





RESULTS

Influences of environmental and biological factors



↑ [Hg]

with the trophic level

p<0.01

♂ higher trophic level than ♀



Differential consumption of prey ?
of age class of prey?

=

Hg difference ?



DIET COMPOSITION

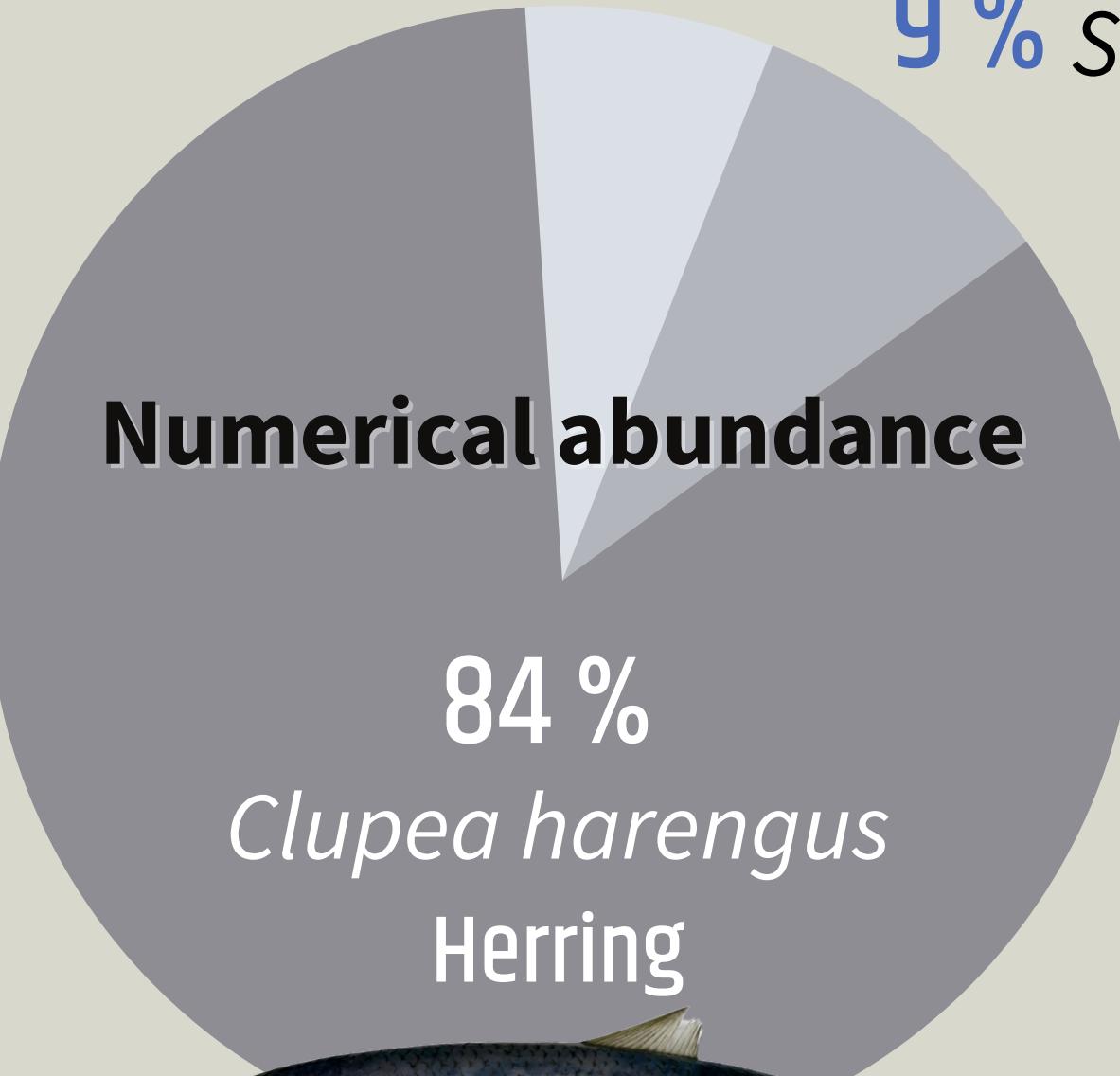
Other fishes

(including *Micromesistius poutassou*, Ammodytidae not identified)

7 %



9 % *Scomber scombrus*
Mackerel



n = 9 (5 ♀ - 4 ♂)

Occurrence



Herring

89 %



Mackerel

68 %

Other fish

56 %



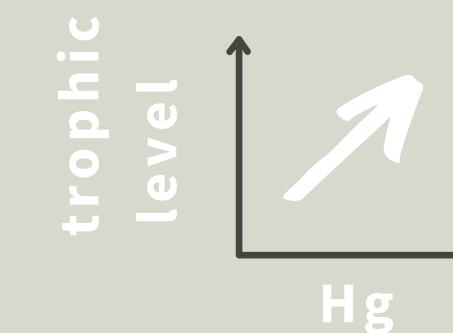
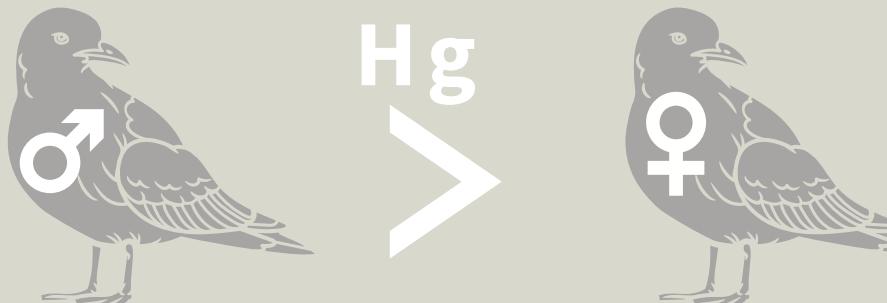
TAKE HOME MESSAGE



Describe the Hg blood levels



Evaluate the influences of environmental and biological factors



Complete the knowledge on the feeding ecology



Herring

84 %



Mackerel

9 %



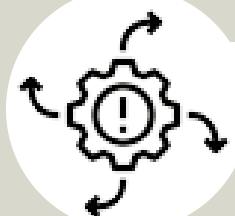
PERSPECTIVES



Multi-year & long-term follow-up



Origin of the contamination?



Vulnerability of the colony?



Occurrence and toxicity of historical and emerging perfluoroalkyl substances (PFAS) in seabirds: a large-scale study in metropolitan and overseas France (O. Chastel)

Migratory behavior (GLS tracking)

Hg concentration in preys

Physiological studies

Telomere & hormonal analysis

Analysis of other contaminants (PFAS)



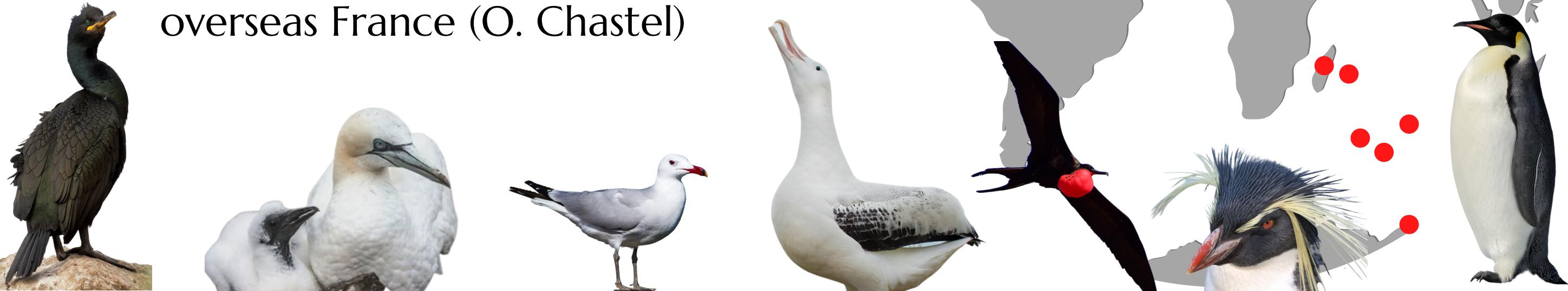
O. Chastel (coordinateur, CEBC), P. Labadie (EPOC), P. Bustamante (LIENSS), D. Costantini (MNHN) & C. Barbraud (CEBC)

ToxSeabird

Occurrence and toxicity of historical
and emerging perfluoroalkyl substances

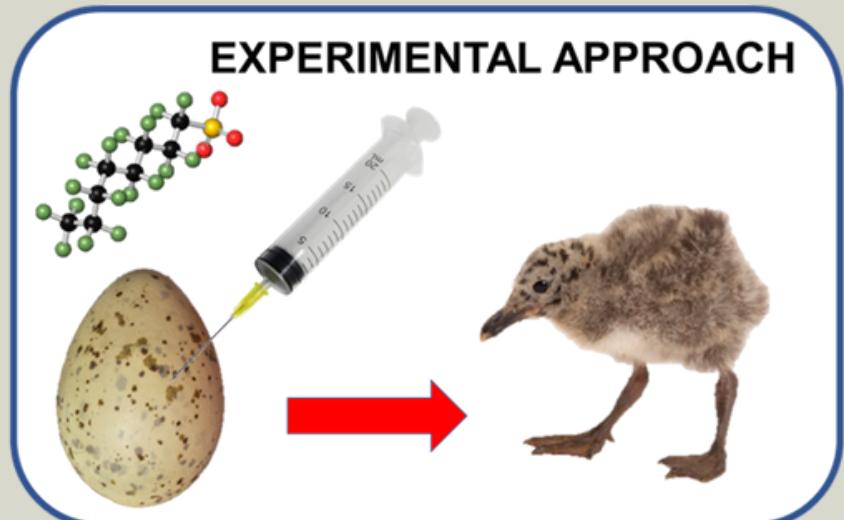
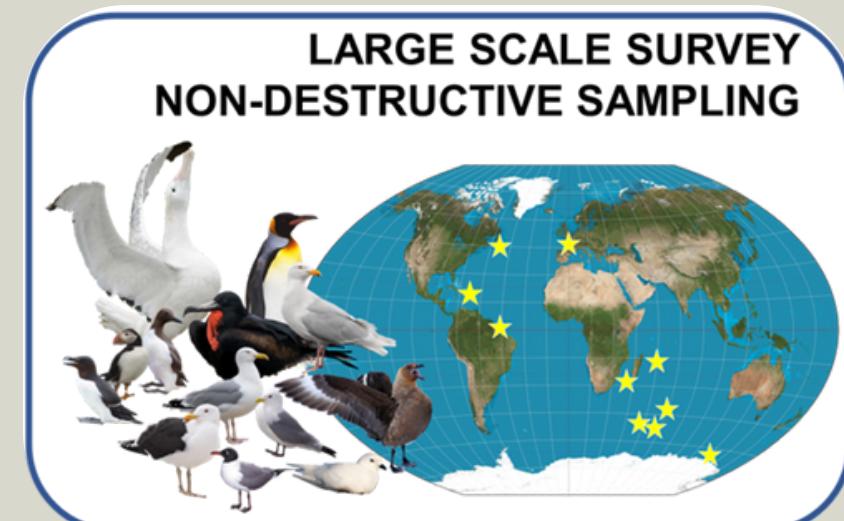
(PFAS) in seabirds:

a large-scale study in metropolitan and
overseas France (O. Chastel)

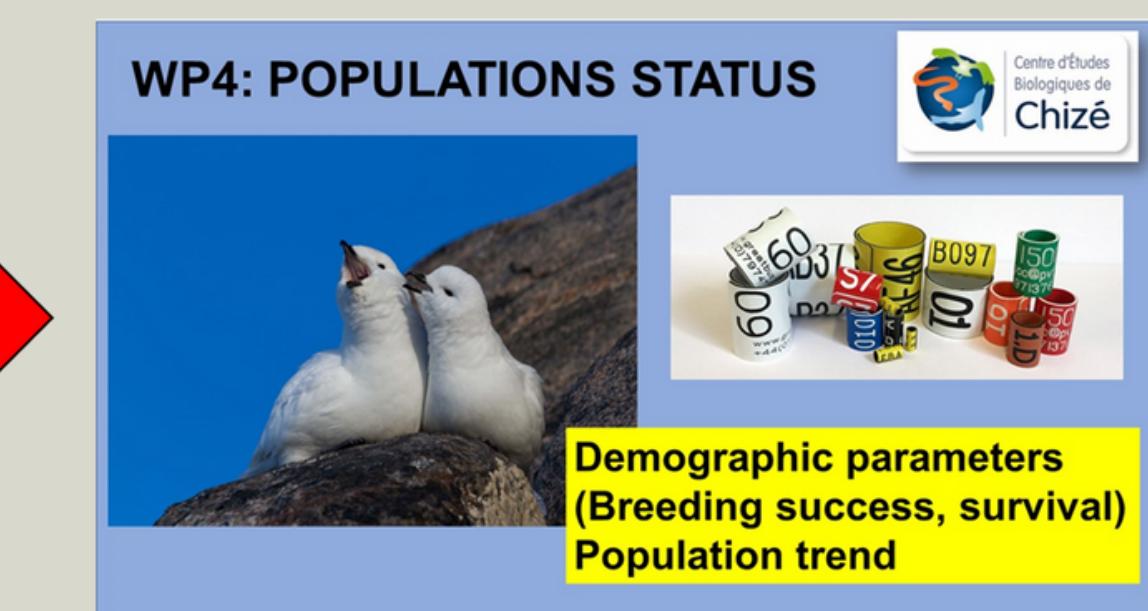
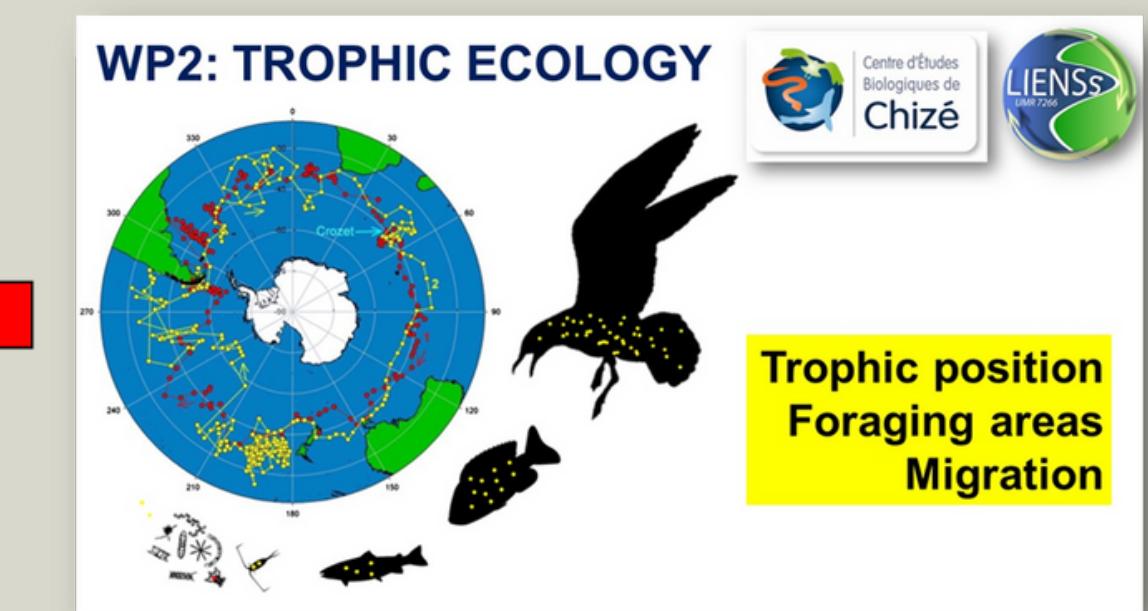
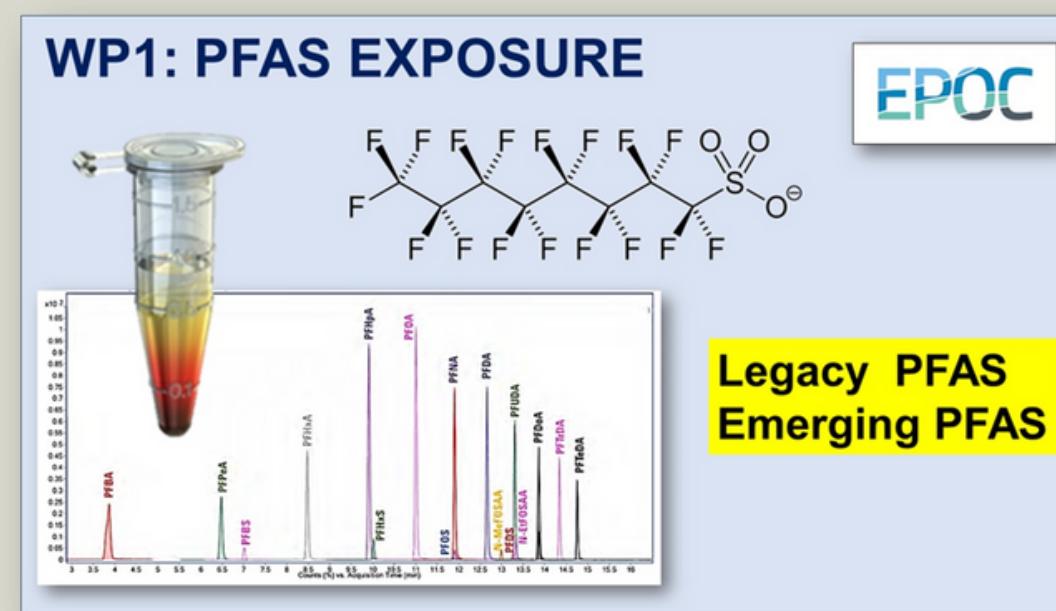




METHODOLOGY



WORK PACKAGES





Thanks to the contributors of this project



and



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ALICE CARRAVIERI
NATHAN LEGROUX
ALAIN WARD
SARA PISCHUITTA

Prescillia LEMESLE
 prescillia.lemesle@cnrs.fr



Thank you for your attention
Questions...

