

Tracking in seabirds



Tracking in seabirds

1. Introduction: seabird ecology
2. Seabirds at sea: Methods and examples of seabird tracking
3. Seabirds as indicators



Seevögel

Tracking

Indikatoren

Two thirds of the planet are oceans, but home to only 3% of bird species.



Two thirds of the planet are oceans, but home to only 3% of bird species.

Challenges of marine habitats

- Patchy, unpredictable food
- No protection from rain and wind
- Breeding impossible

Adaptations, e.g.

- Subcutaneous fat
- Large stomach, e.g. can carry Fulmar 20 % of body mass in food
- Near waterproof plumage
- Salt water excretion for drinking water
- Long pelagic flights or deep benthic dives

Seabirds

Tracking

Indicators

Two thirds of the planet are oceans, but home to only 3% of bird species.



Density-dependent depletion of prey stocks around colonies

OR

Pelagic seabirds: transport food to the breeding colony from distant foraging areas



Seabirds

Tracking

Indicators

Sphenisciformes



penguins

Procellariiformes



albatrosses
storm petrels
petrels, prions
shearwaters
fulmars

Charadriiformes



skuas
gulls, terns
auks

Pelecaniformes



gannets, boobies
pelicans
cormorants
frigatebirds

Hang on, they say we have a slow pace of life

Life History Characteristic

Age at first breeding

Clutch size

Incubation period

Nestling period

Maximum life span

Passerines

1-2 years

4-8

12-18 days

20-35 days

5-15 years

Seabirds

2-9 years

1-5

20-69 days

30-280 days

12-60 years



Although seabirds belong to several families that are not all closely related, they have **comparable breeding and life history parameters**, being colonial, long-lived, and exhibiting little or no sex dimorphism.

Seabirds

Tracking

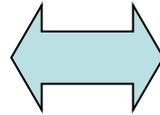
Indicators

Exploit the marine food web

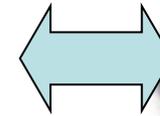
Breed on land

<http://www.ecomare.nl>

Nahrungs-
netz



Nesthabitat
Partner



Climate,
nutrients

competitors

Predators,
parasited

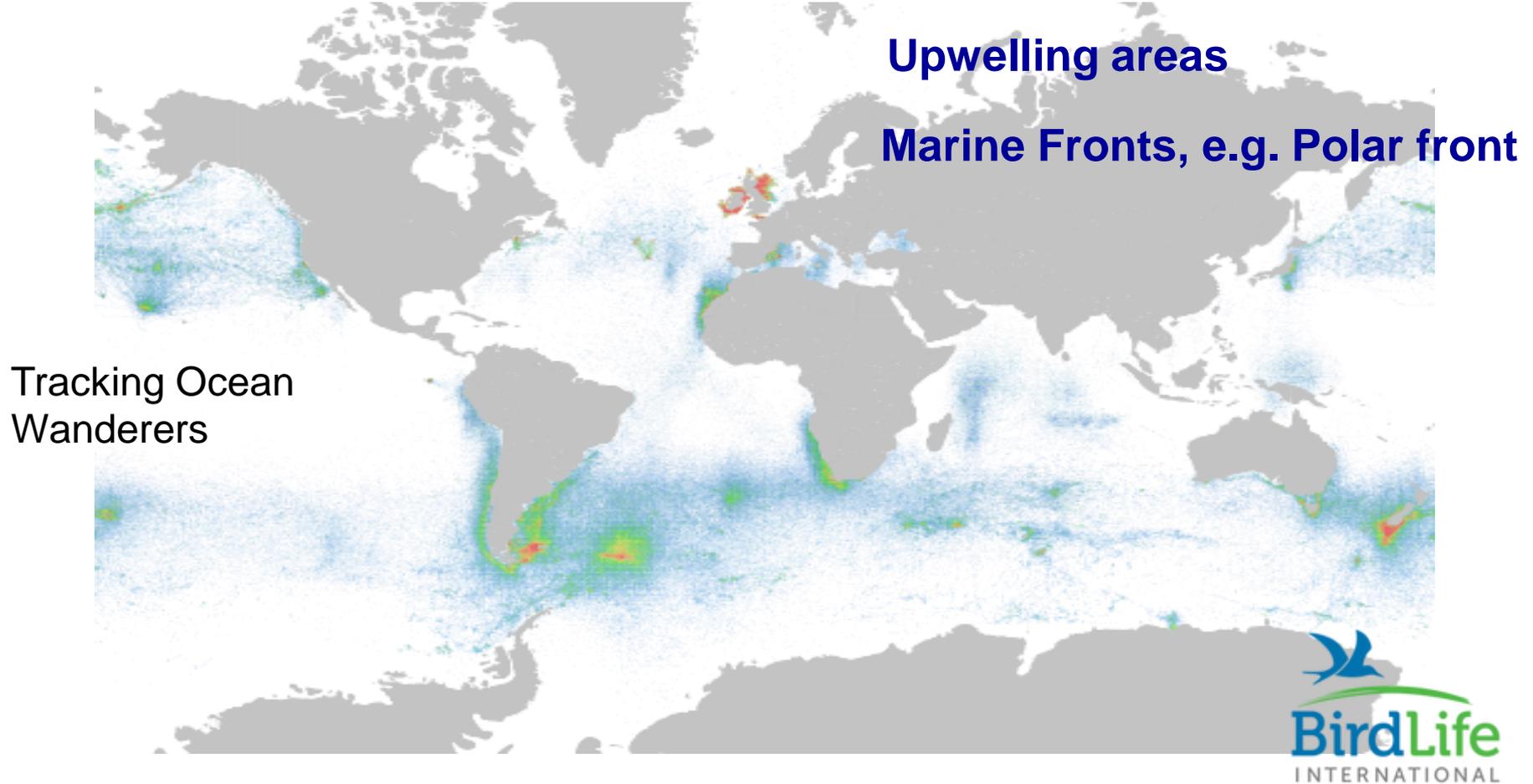
competitors



Climate change, ocean acidification,
→ Changes in the food web
(Regime changes)
pollution, disturbance, bycatch



invasive species,
Light pollution
Habitat loss

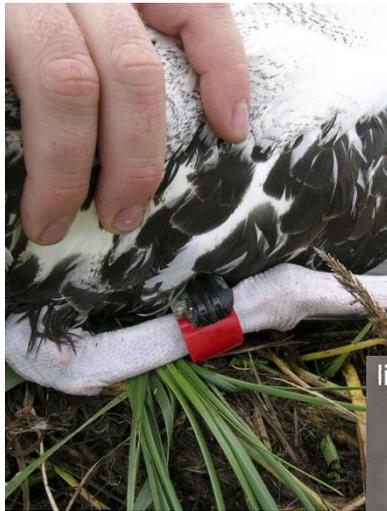


DATABASE: www.seabirdtracking.org
> 7 Mio data points, 17.000 seabirds of 104 species,
105 research groups

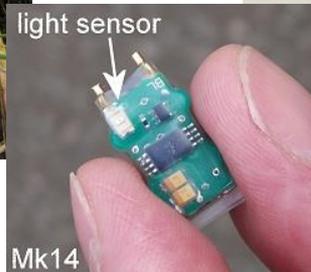
Seabirds

Tracking

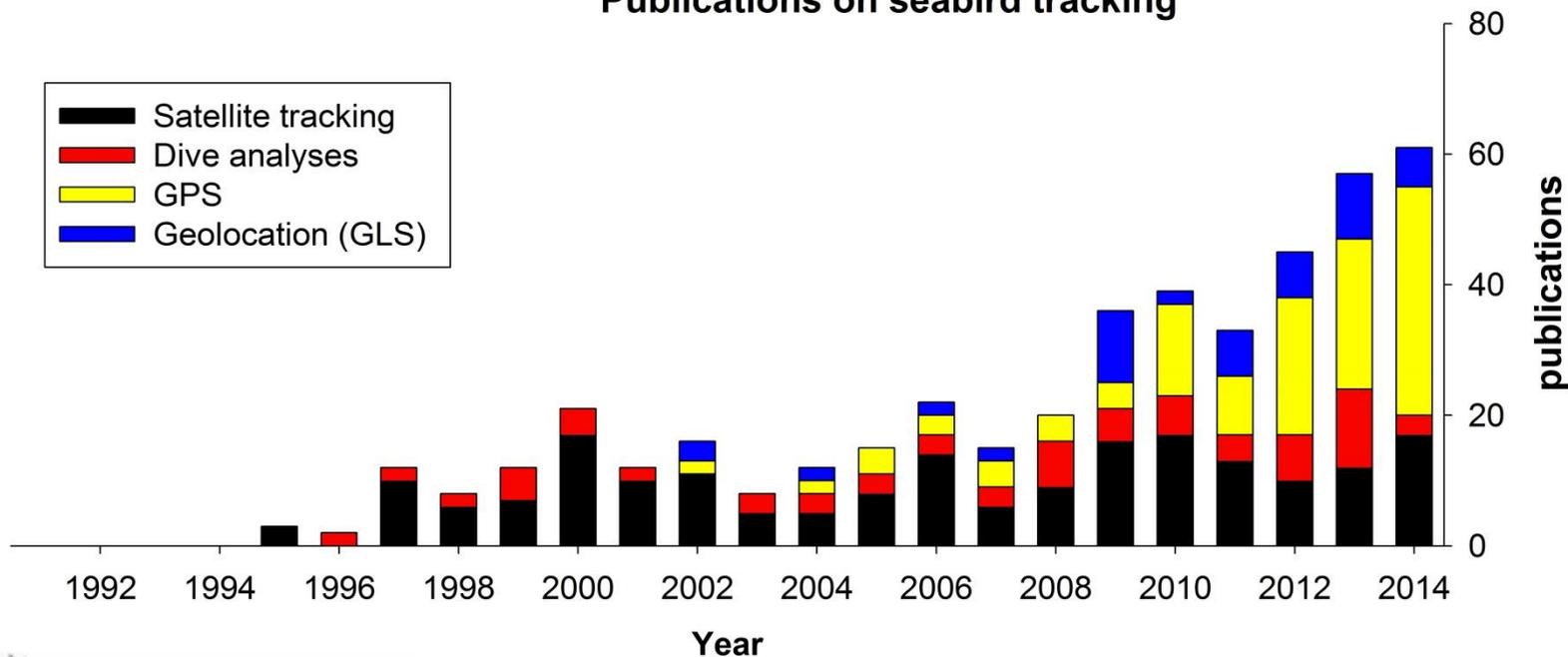
Indicators



<http://www.antarctica.ac.uk>



Publications on seabird tracking



<http://www.biotrack.co.uk/i>



<http://www.littlecompany.de/>



Seabirds

Tracking

Indicators

Radiotracking (1960s)



Light (<1g for seabirds)



short recording (days-weeks)

Ca. 1-2 km

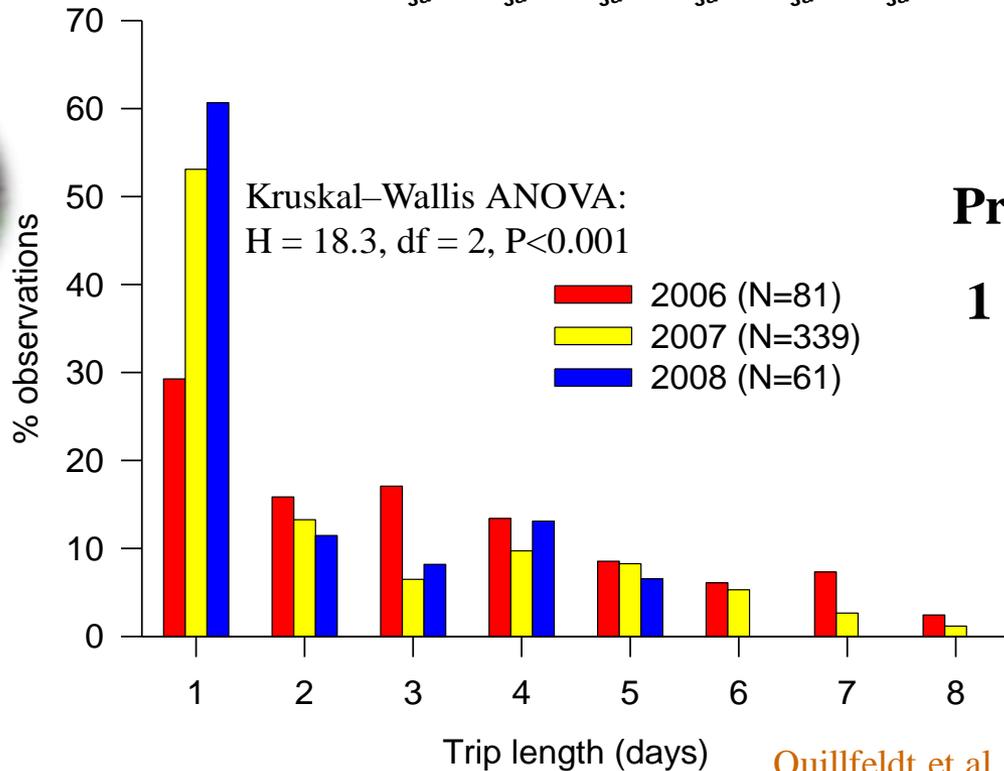
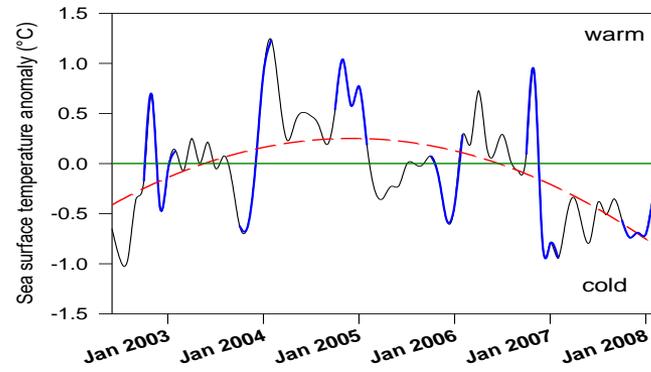
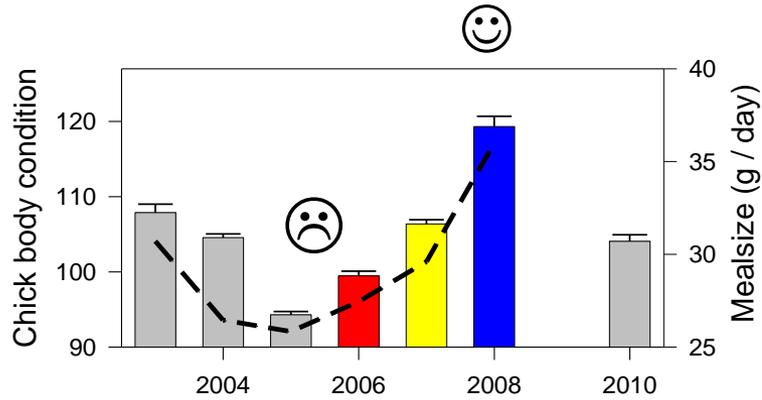
→ Colony attendance



Seabirds

Tracking

Indicators



Provisioning rate:
1 - 8 days

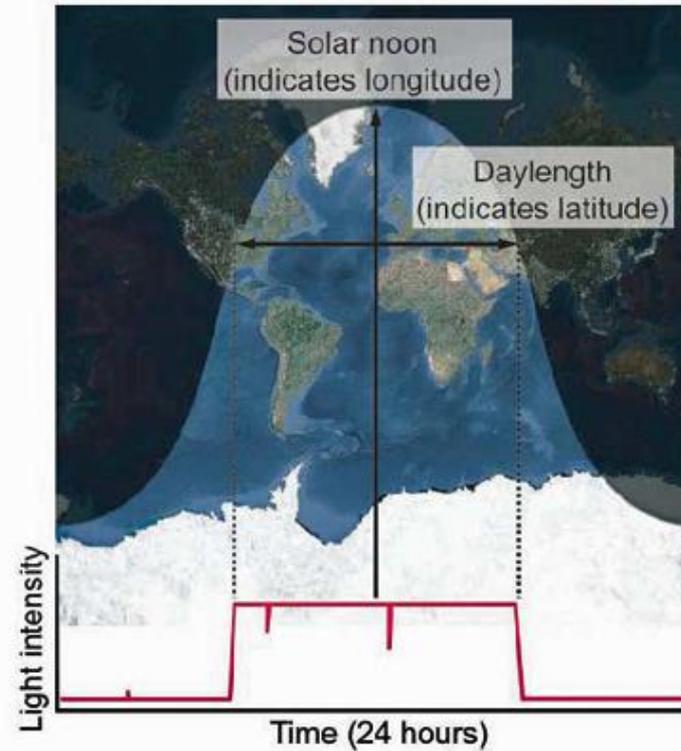
Geolocation:



Light (1g for seabirds)
Long recording (1-5 years)
Often combined with immersion
Or dive depth (Lotek)



~ 150 km, equinox excluded
Need to recover



Seabirds

Tracking

Indicators

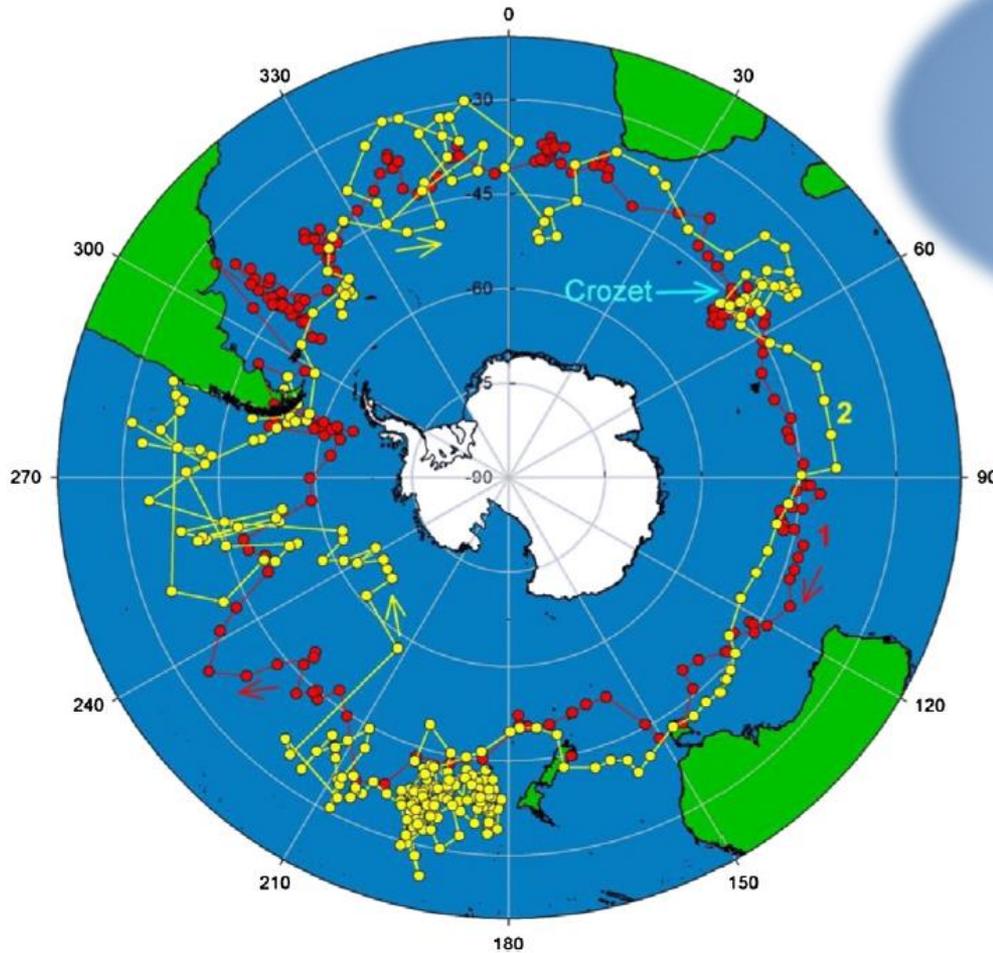
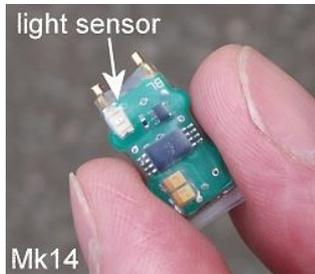
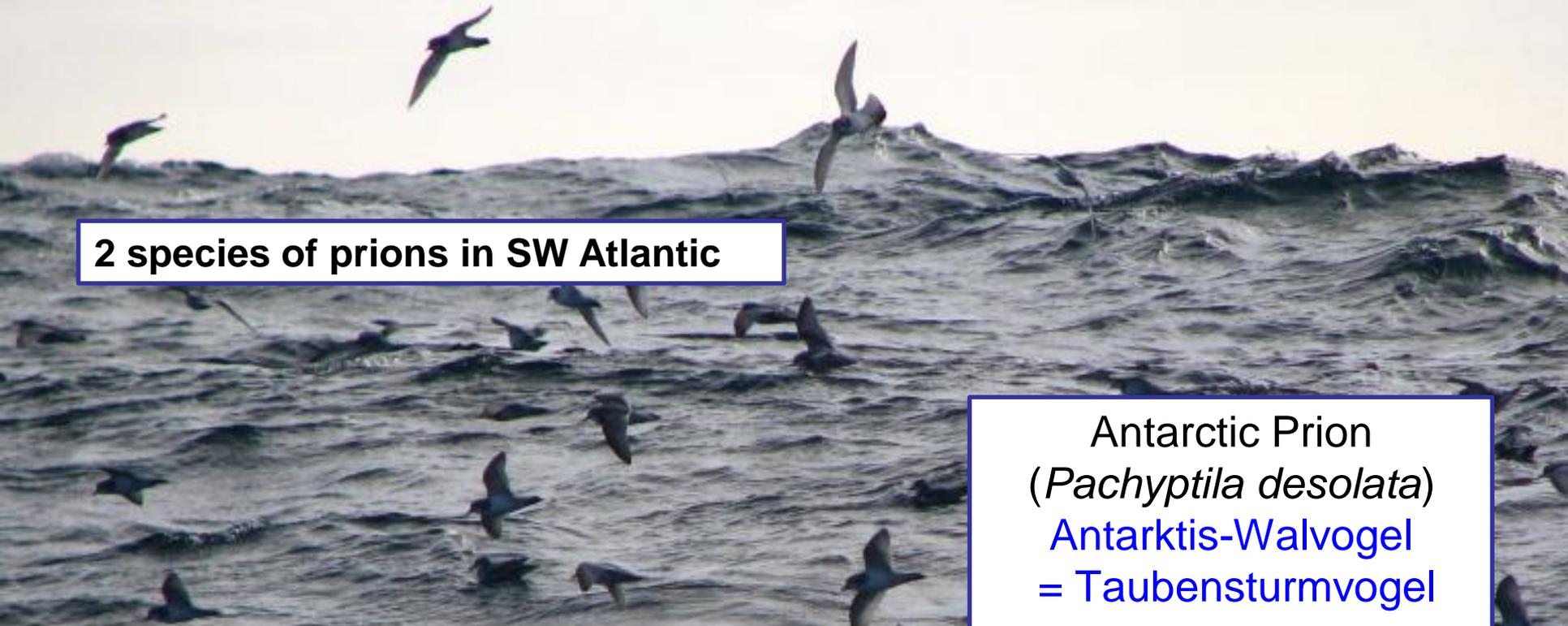


Fig. 6. Double circumpolar movements of a male Crozet wandering albatross during the sabbatical period. The bird did two circumpolar trips around Antarctica, rapidly during the first tour (red), and then stopping off at eastern New Zealand in the second tour (yellow).

Weimerskirch, H., Cherel, Y., Delord, K., Jaeger, A., Patrick, S. C., & Riotte-Lambert, L. (2014). Lifetime foraging patterns of the wandering albatross: life on the move!. *Journal of Experimental Marine Biology and Ecology*, 450, 68-78.



2 species of prions in SW Atlantic

Antarctic Prion
(*Pachyptila desolata*)
Antarktis-Walvogel
= Taubensturmvogel



Thin-billed Prion
(*Pachyptila belcheri*)
Dünnschnabel-
Walvogel



2 species of prions in SW Atlantic

MK10 Geolocators (1g, British Antarctic Survey, Cambridge, UK)

25 *P. belcheri* (Thin-billed prions, 130g)
New Island, Falkland/Malvinas

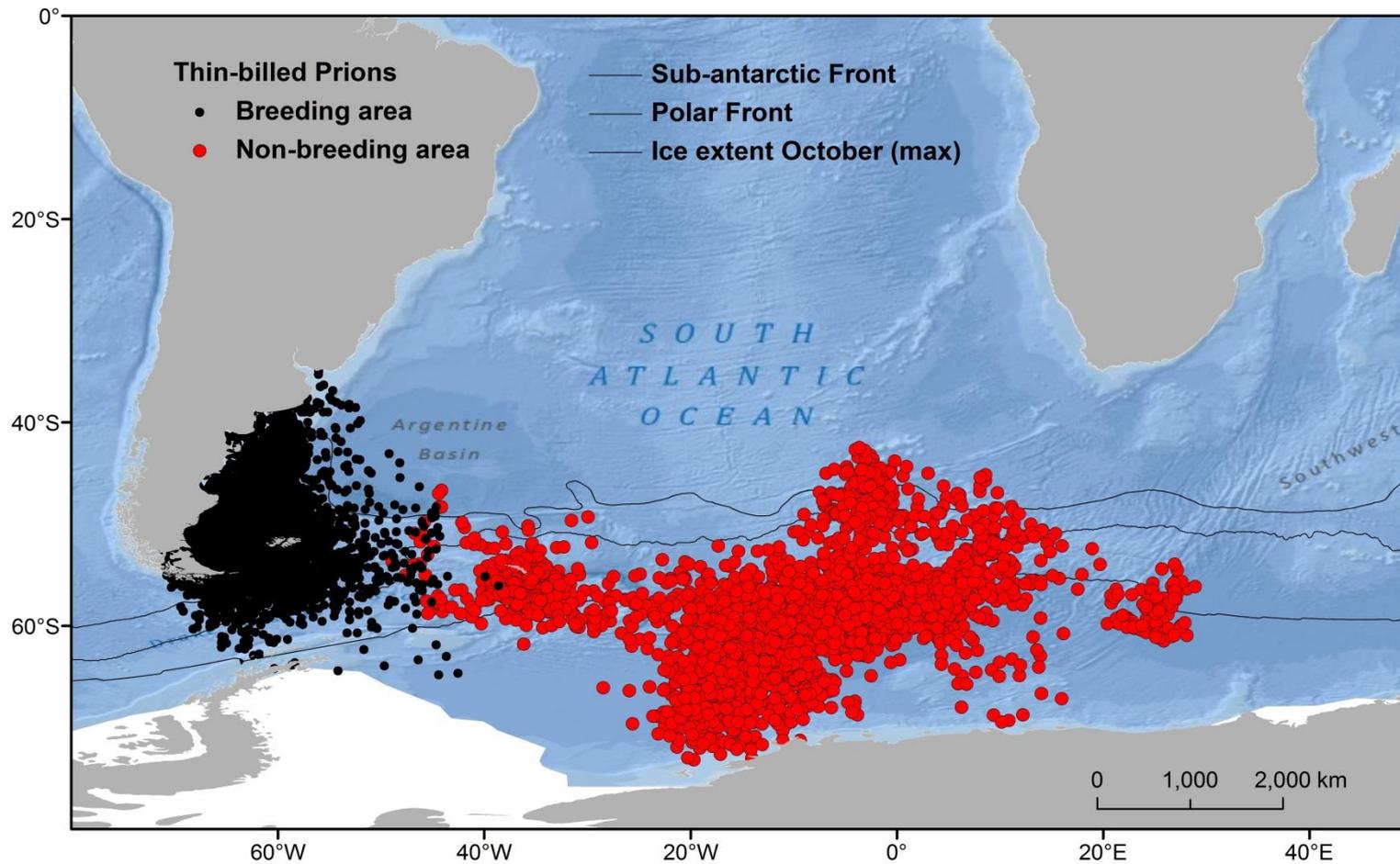
20 recaptured

14 *P. desolata* (Antarctic prions, 160g)
Bird Island, South Georgia
(Joan Navarro, U Barcelona
Richard Phillips, BAS)

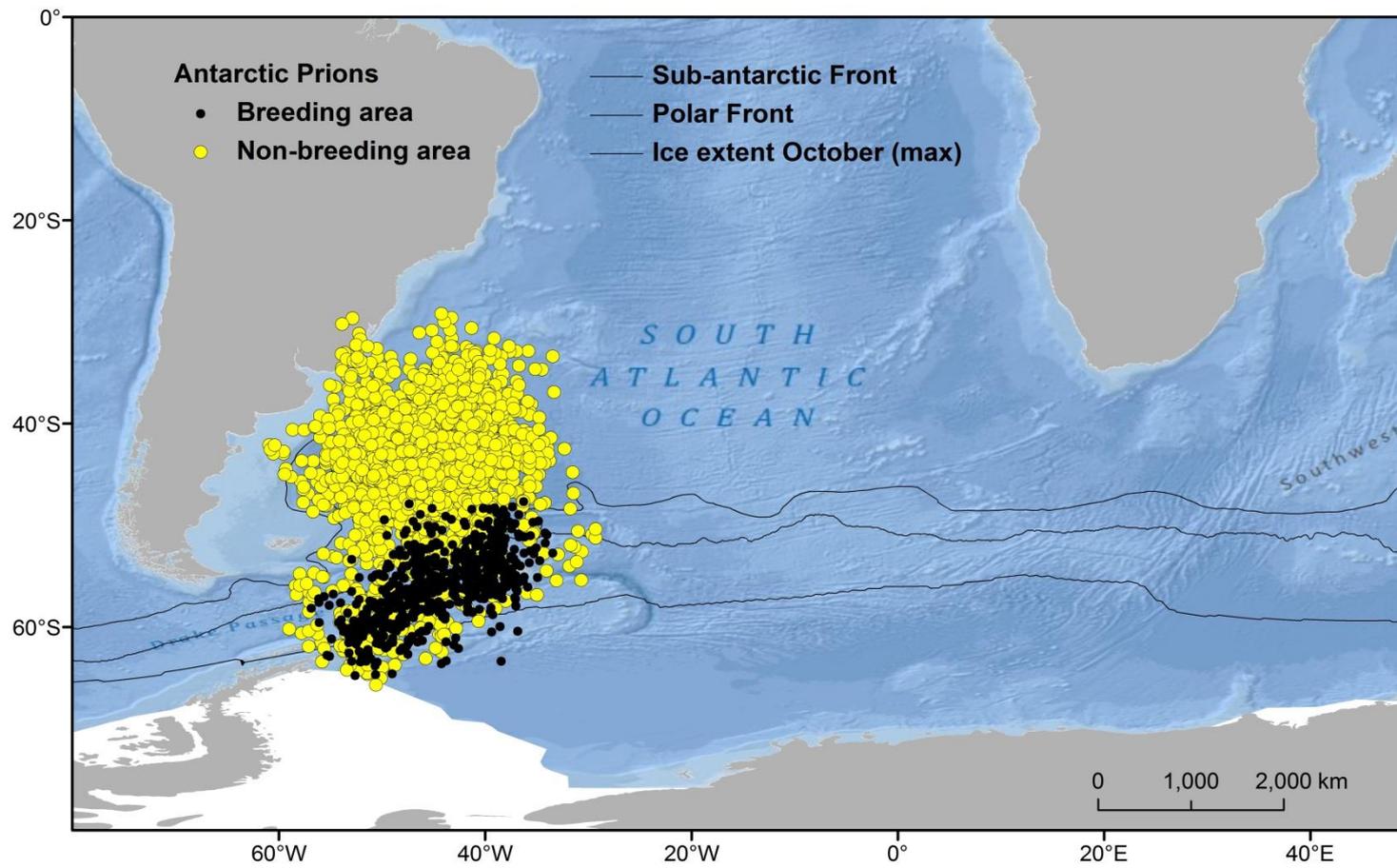
10 recaptured



Thin-billed Prion



Antarctic Prion

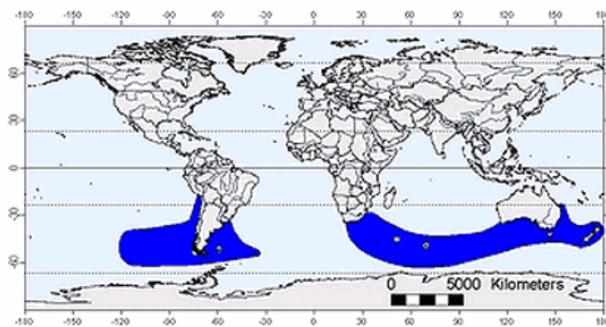
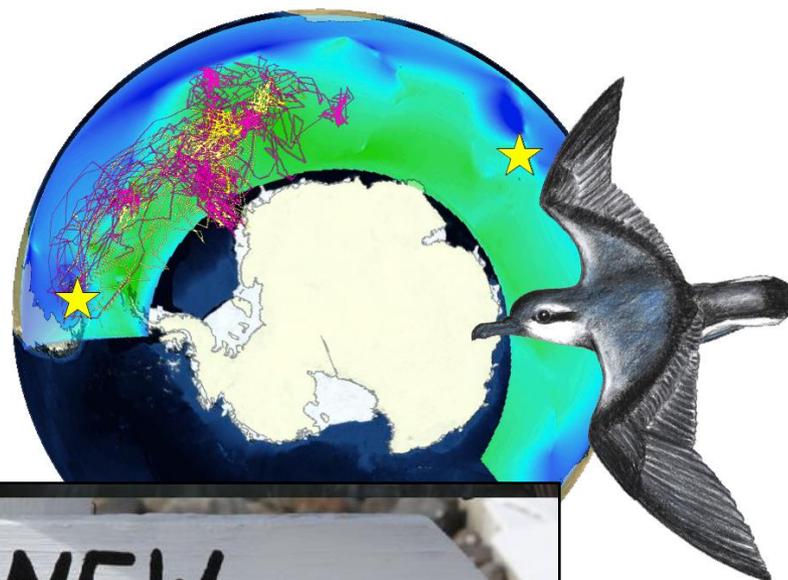


Seabirds

Tracking

Indicators

Kerguelen

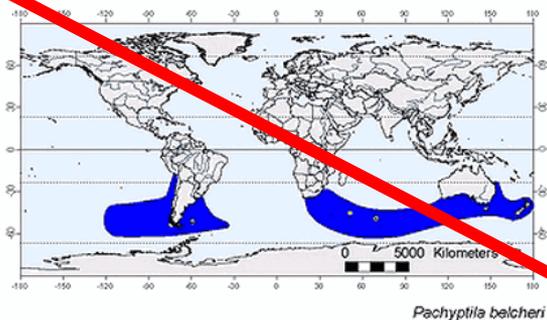


Pachyptila belcheri

Seabirds

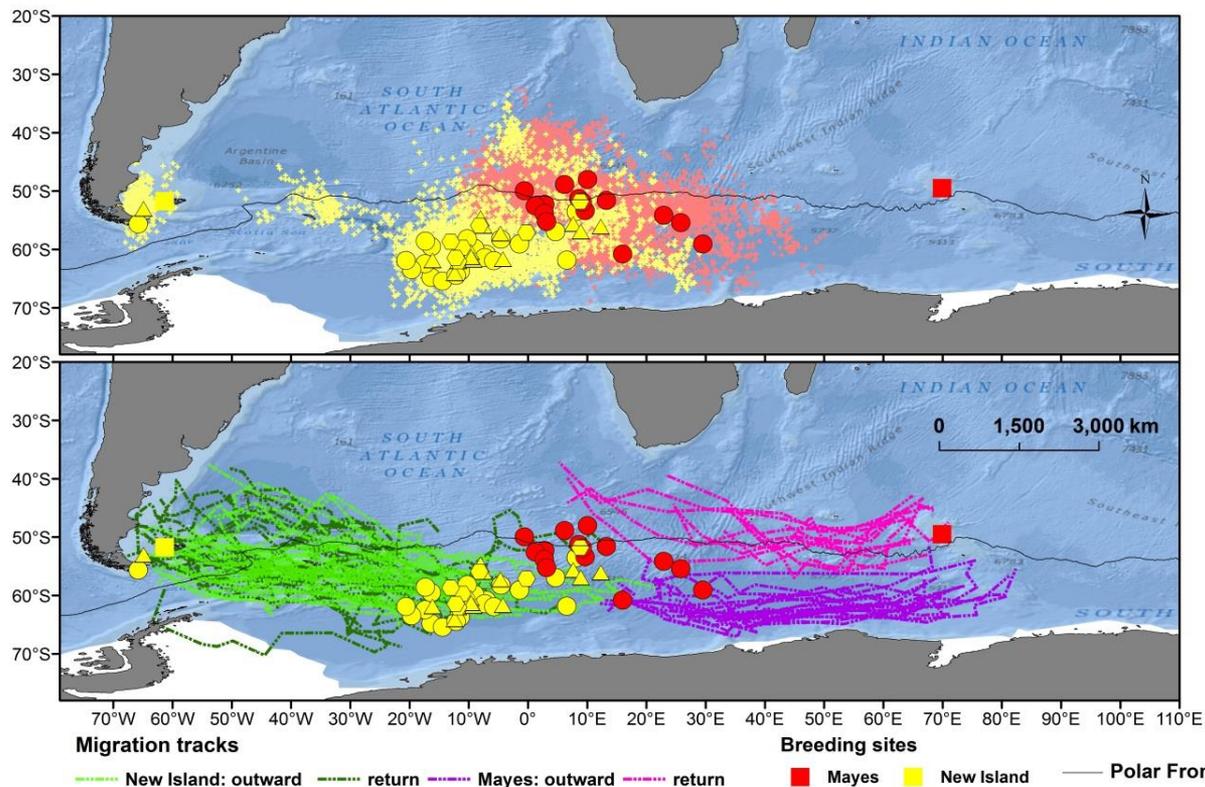
Tracking

Indicators



Nonbreeding area centroids

of birds from ● Ile Mayes, Kerguelen ● New Island (2010) ▲ New Island (2011) ● New Island (2013)



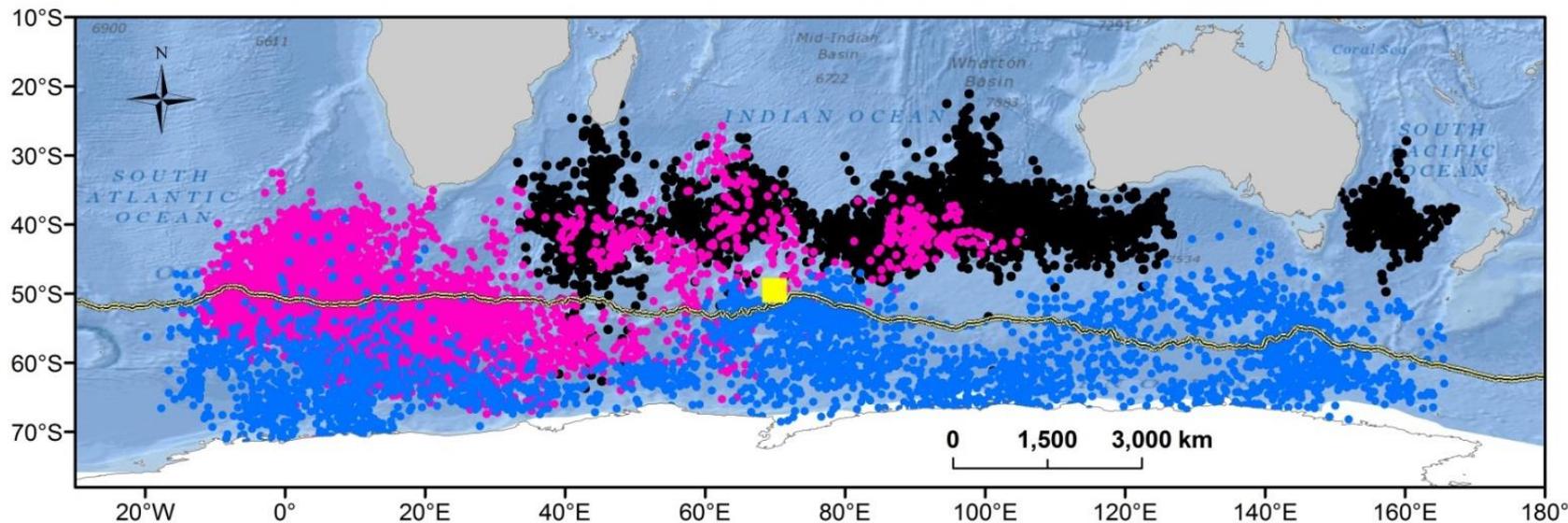
Seabirds

Tracking

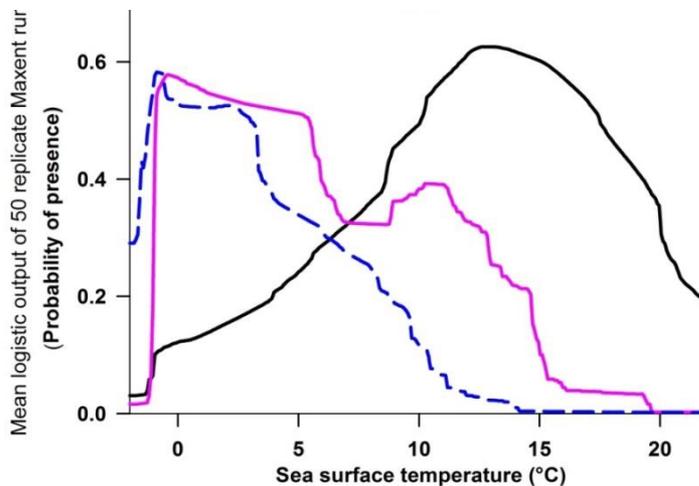
Indicators

Breeding site

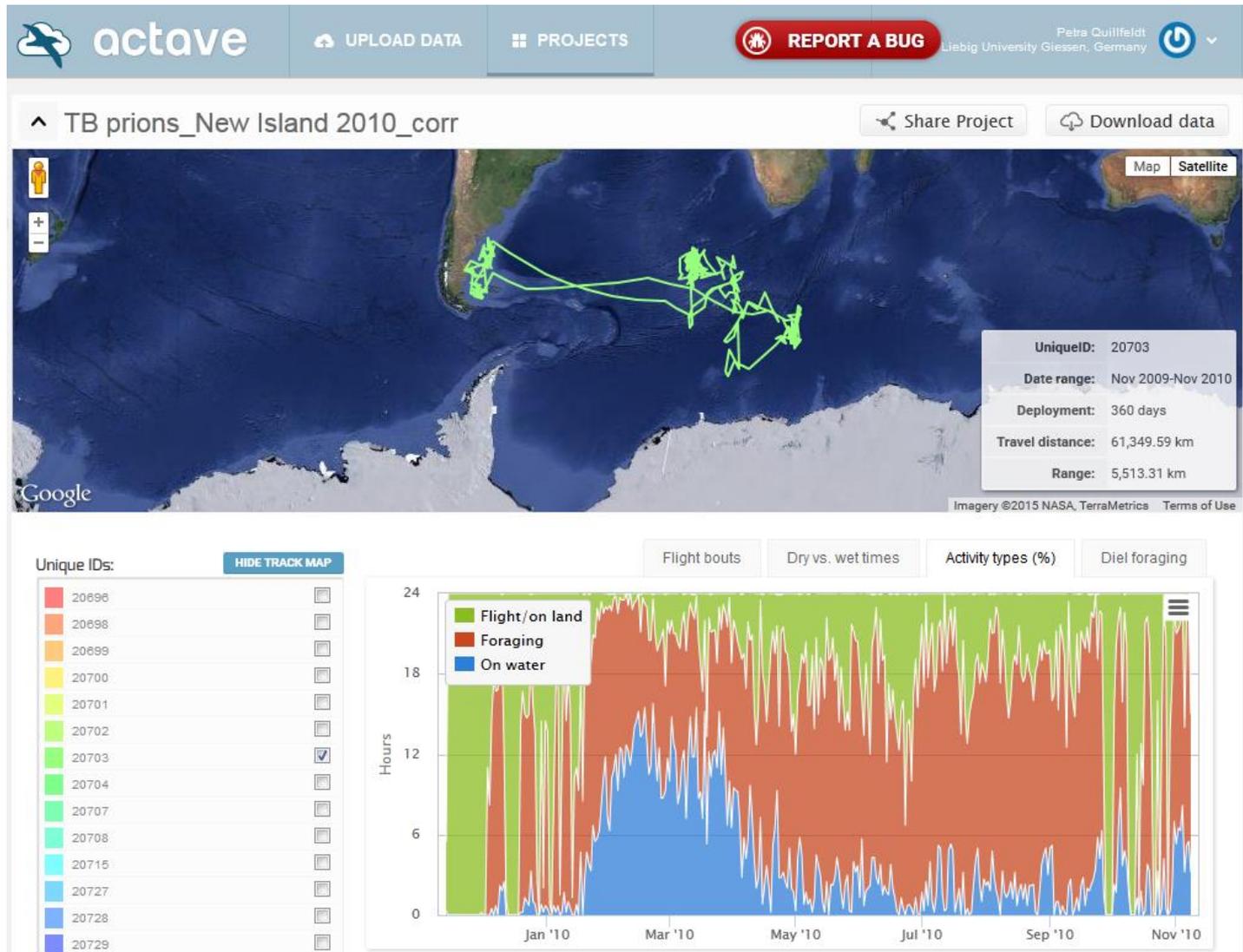
- Kerguelen
- Antarctic prions
- Thin-billed prions
- Blue petrels
- Polar Front



Most important parameter:



Active webtool e.g. Thin-billed prions



GPS (2000s):



Limited number of data points
ca. 5 m



Heavier (from 6g for seabirds)
Needs satellite reception
Recapture
or download to base station

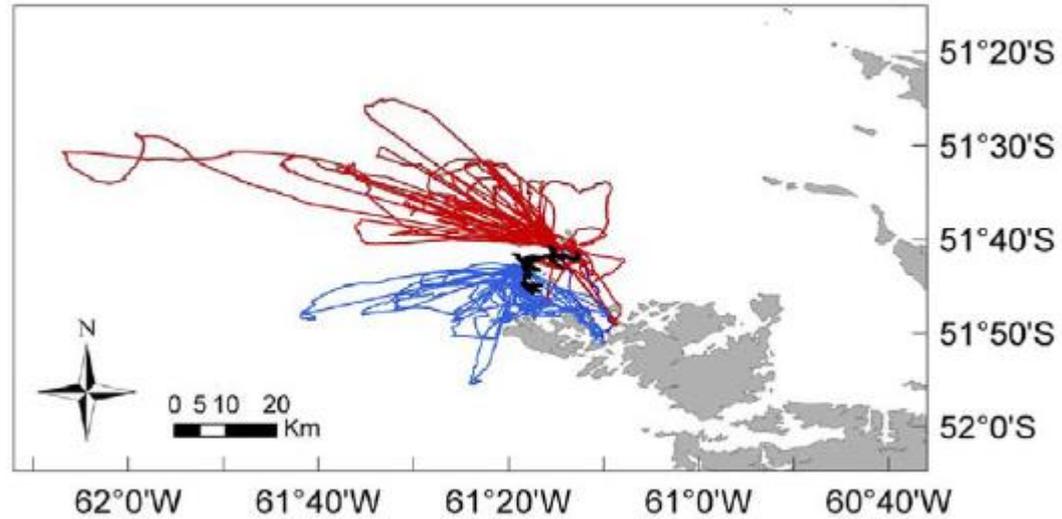


Rockhopper
penguin
Felsenpinguin

Seabirds

Tracking

Indicators

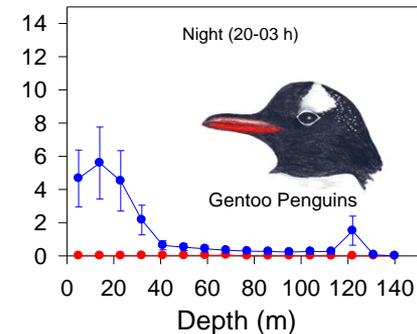
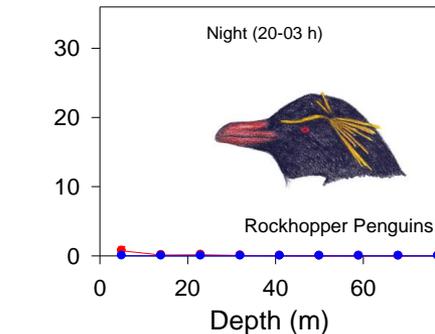
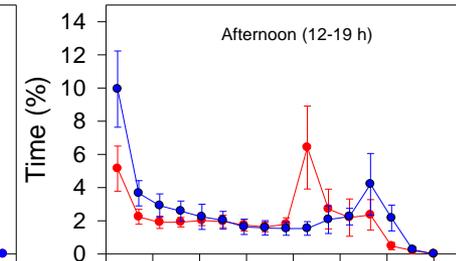
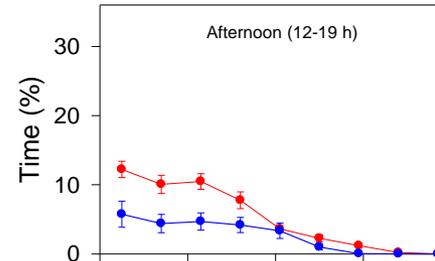
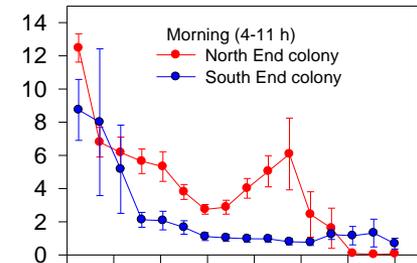
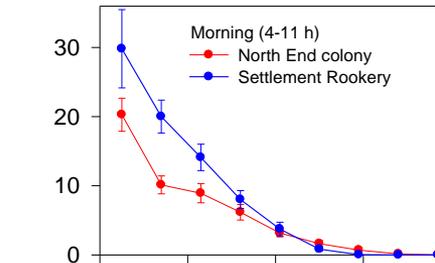
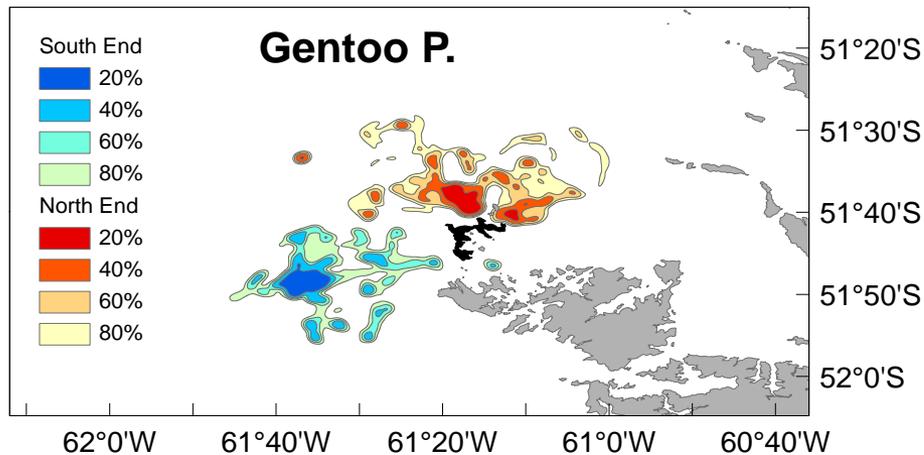
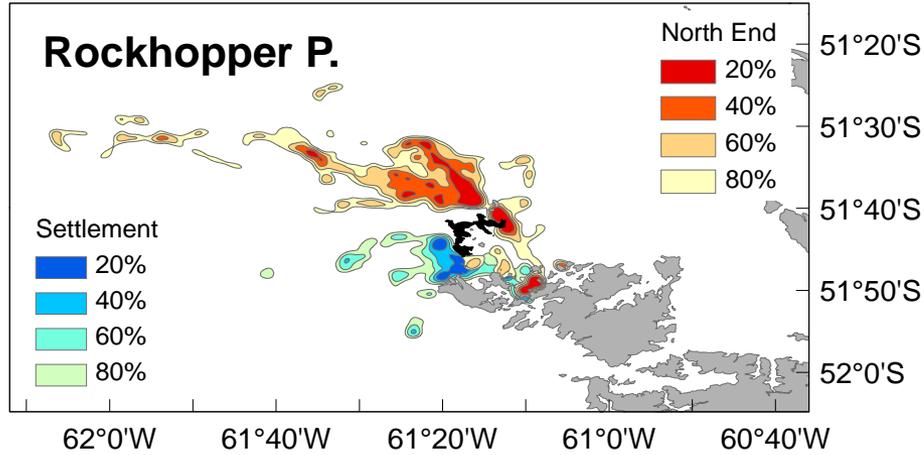


Rockhopper penguin
Felsenpinguin

Seabirds

Tracking

Indicators



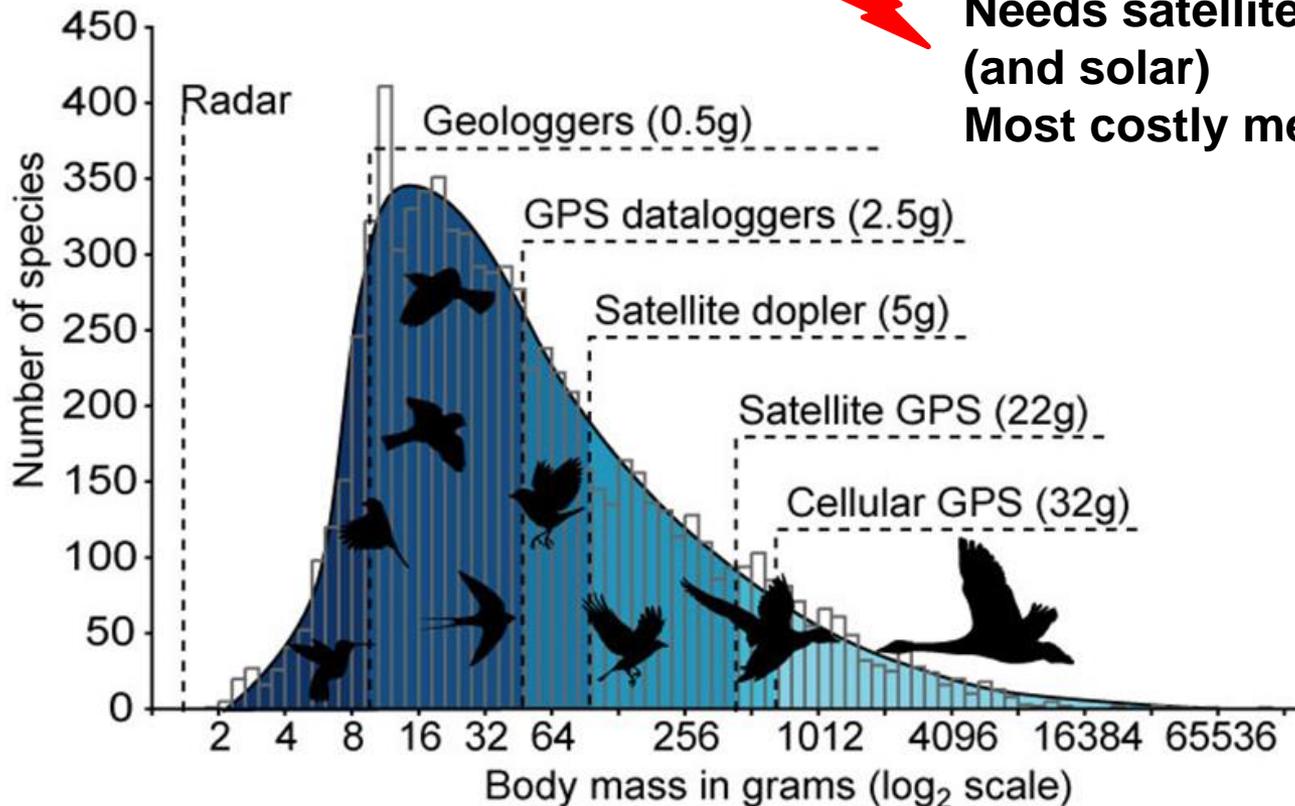
GPS-TD:
Temporal and spatial segregation

letters to nature

Nature 343, 746 - 748 (22 February 1990); doi:10.1038/343746a0

Satellite tracking of Wandering albatrosses

PIERRE JOUVENTIN & HENRI WEIMERSKIRCH



Satellite tracking (1990s)

No recapture necessary
200 m under best conditions



Heavier (from 5g solar, 20g battery)
Needs satellite reception
(and solar)
Most costly method



ICARUS INITIATIVE

INTERNATIONAL COOPERATION FOR ANIMAL RESEARCH USING SPACE



June 2017:

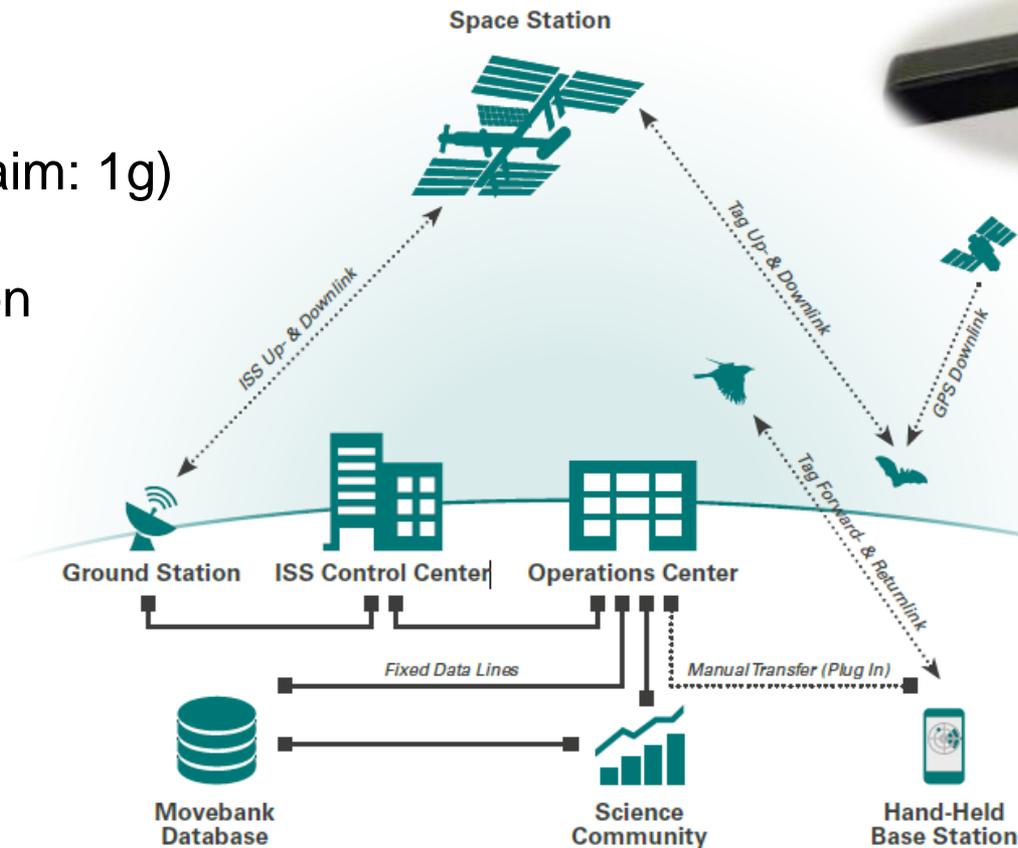
ICARUS

Prototype: 5g (aim: 1g)

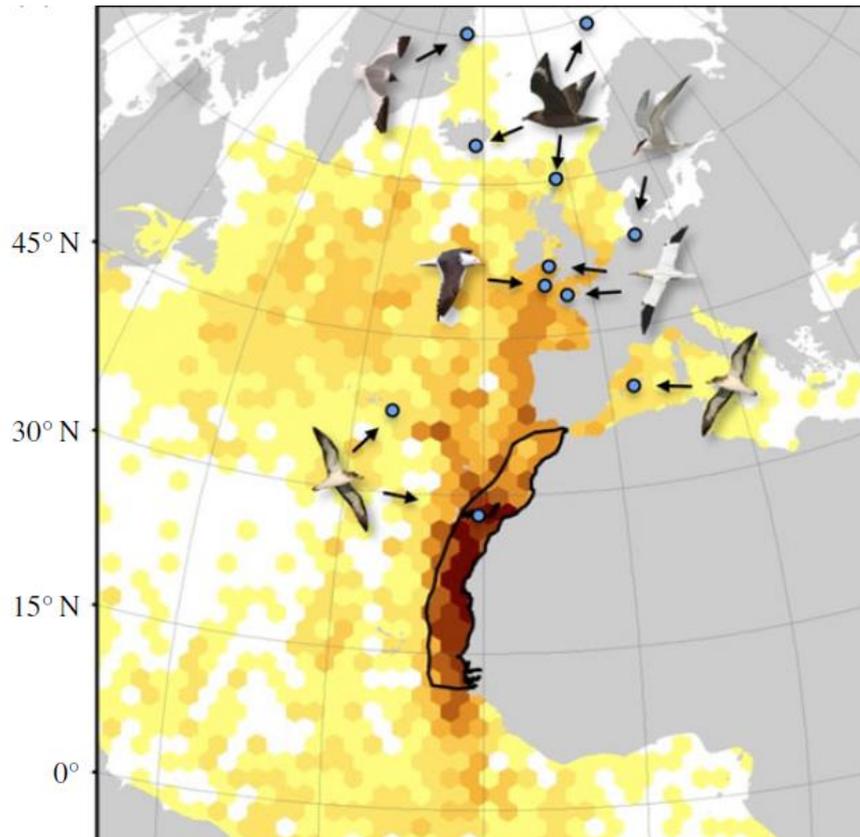
500-700 EUR

Incl. acceleration

56° N- 56° S



 **Climate change, ocean acidification,
→ Changes in the food web
(Regime changes)
pollution, disturbance, bycatch**



Grecian et al. 2016
Biol Letters

**Marine Important
Bird Areas**

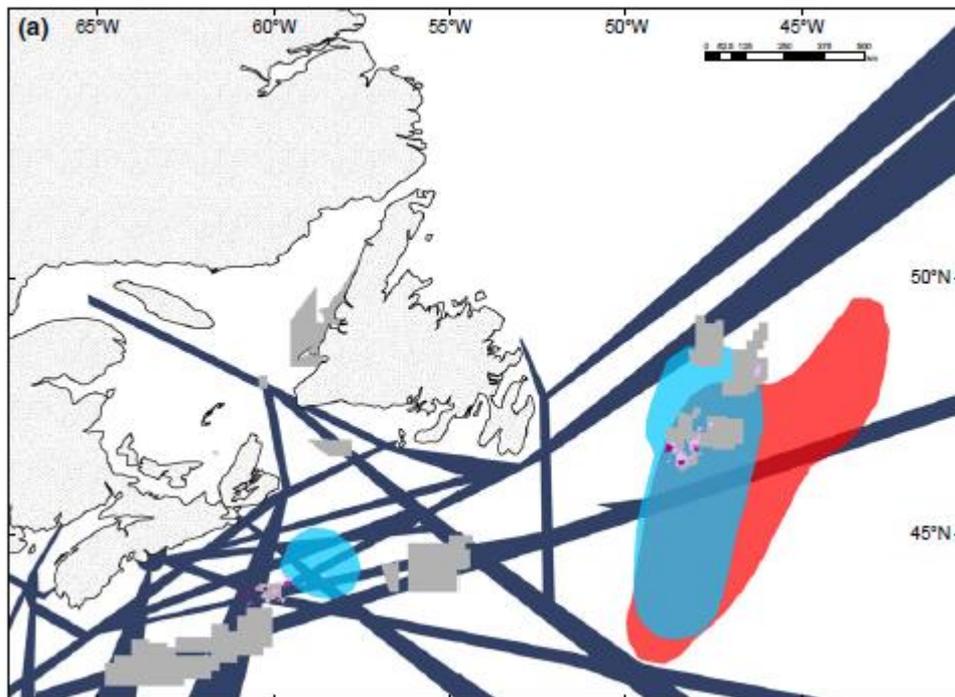
**→ Marine
Protected areas**

Little auk (Krabbentaucher)

Diversity and Distributions, (Diversity Distrib.) (2013) 19, 1322–1332



Multicolony tracking reveals potential threats to little auks wintering in the North Atlantic from marine pollution and shrinking sea ice cover



Tracking

→ key areas (blue+red)

→ e.g. off Newfoundland)

overlap extensively with areas of intensive human activities, including oil and gas extraction (grey) and shipping (blue lines)



Pawel Kuczynski, 2010

Advantages of Biomonitoring:

- Reflects availability in the food web
- Higher concentration (bioaccumulation) enables exact measurements
- Several time scales and sites accessible

Persistent organic pollutants (POPs)

Blood, eggs, fat

**Legacy POPs
Emerging POPs**

microplastics

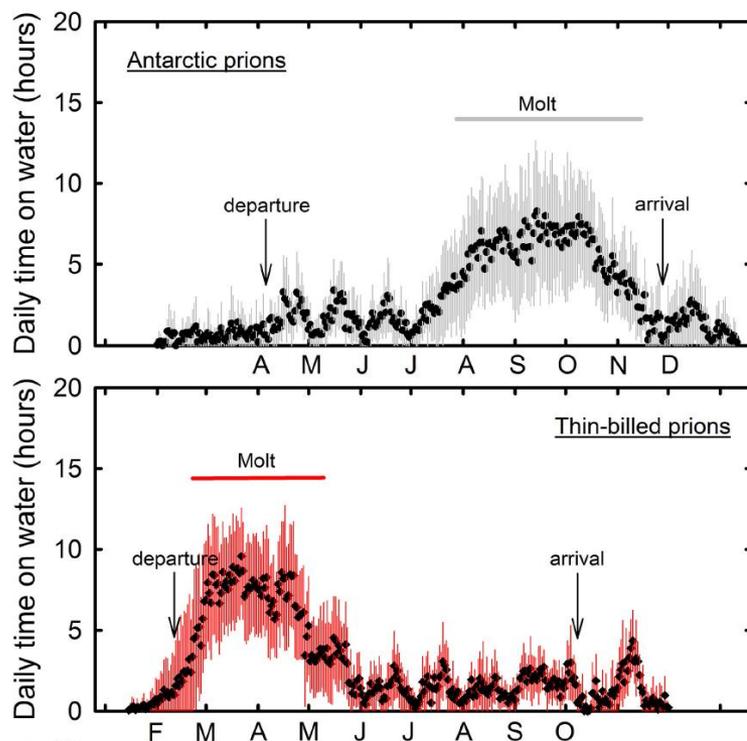
Heavy metals

Feathers

**Mercury,
Aluminium**

Combination of At-Sea Activity, Geolocation and Feather Stable Isotopes Documents Where and When Seabirds Molt

Yves Cherel^{1*}, Petra Quillfeldt², Karine Delord¹ and Henri Weimerskirch¹



actave

Welcome to the actave α

[Click here to watch a screencast providing a brief introduction to actave functionality and data format requirements.](#)

What is actave?

actave performs pre-analysis and visualisation of activity and GLS data recorded with animal-borne data loggers.

actave was developed for the analysis of data recorded with BAS/Biotrack GLS data loggers that are equipped with a wet/dry sensor which checks for immersion in salt water every 3 s, and integrates this information over 10 min intervals (Afanasyev 2004).



actave processes raw activity data files generated by the M-Series BASTrack software. Using geographic data from the loggers' GLS component activity patterns will be analysed in a spatial context.



actave produces daily summaries of wet vs dry times, ratios of flight, foraging & resting activities, and temporal distribution of foraging activity across night, twilight hours and daytime.

Sign Up!

Want to give actave a whirl? Sign up by completing the following fields:

Log in

Already registered? Log in using the fields below:

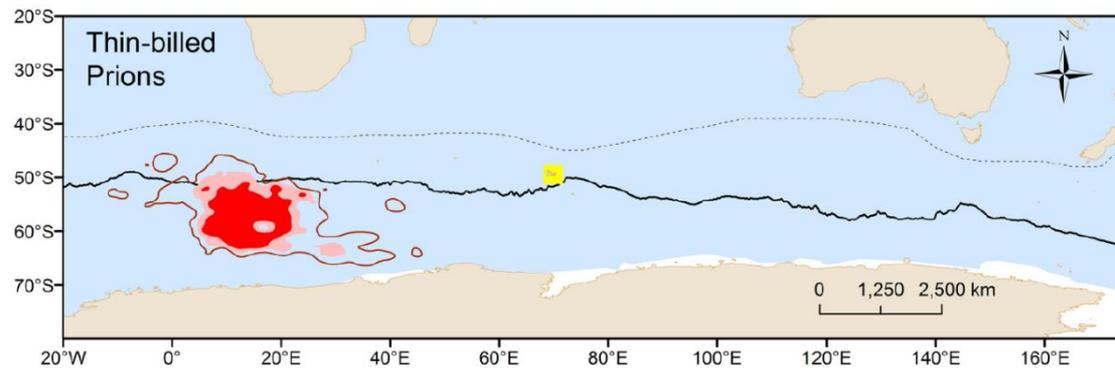
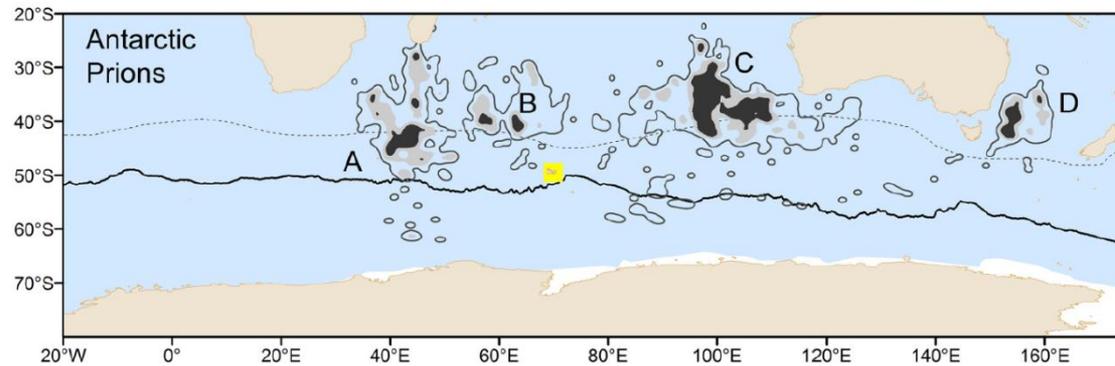
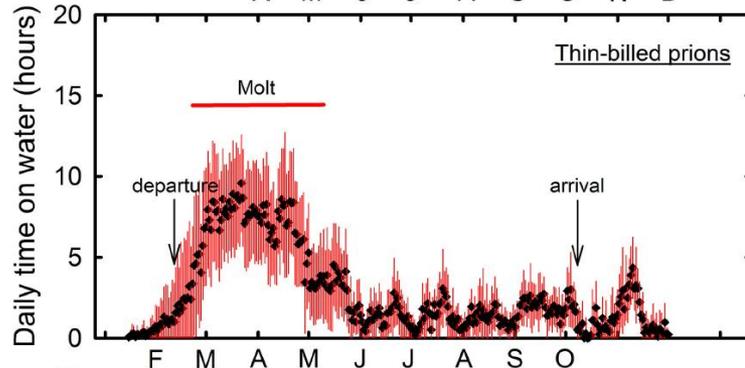
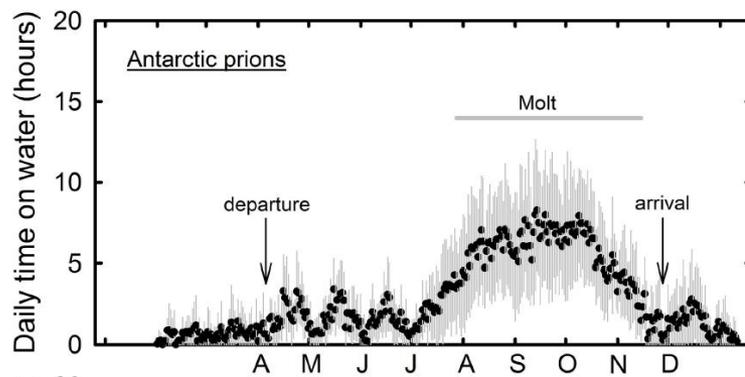
© 2014 actave.net

Mattern et al. 2015 Methods Ecol Evol:
www.actave.net



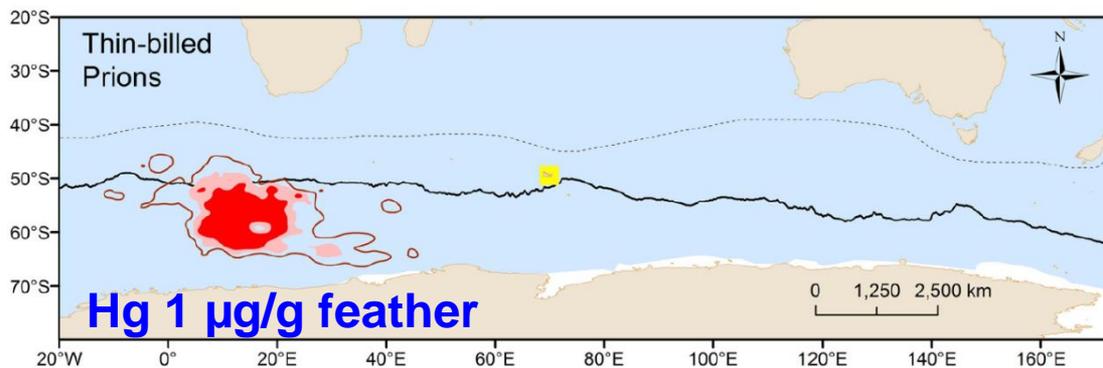
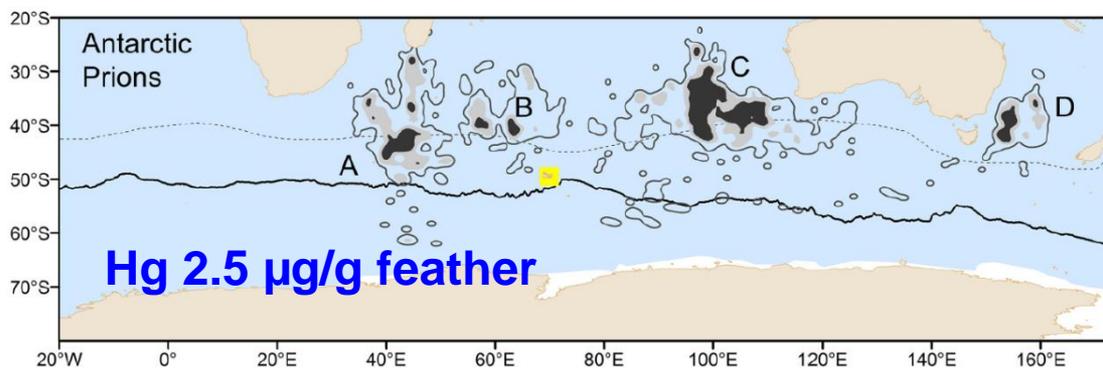
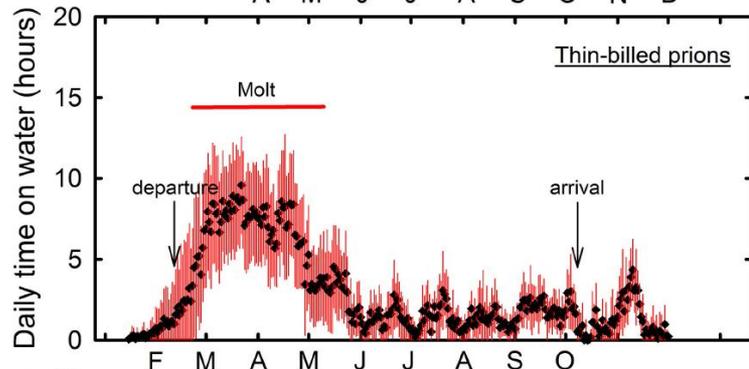
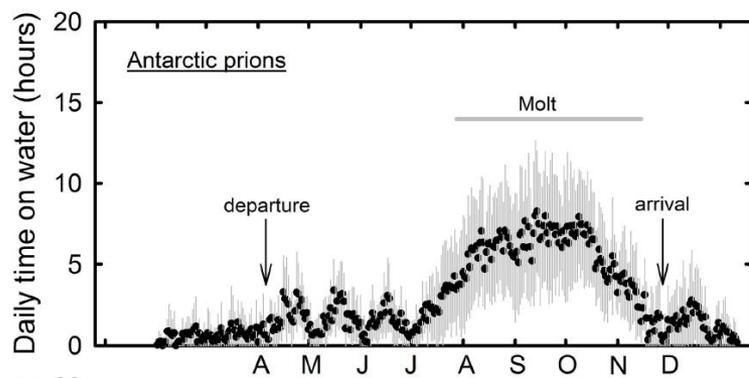
Combination of At-Sea Activity, Geolocation and Feather Stable Isotopes Documents Where and When Seabirds Molt

Yves Cherel^{1*}, Petra Quillfeldt², Karine Delord¹ and Henri Weimerskirch¹



Combination of At-Sea Activity, Geolocation and Feather Stable Isotopes Documents Where and When Seabirds Molt

Yves Cherel^{1*}, Petra Quillfeldt², Karine Delord¹ and Henri Weimerskirch¹



Streaked shearwaters (Weißgesicht-Sturmtaucher)

ENVIRONMENTAL
Science & Technology



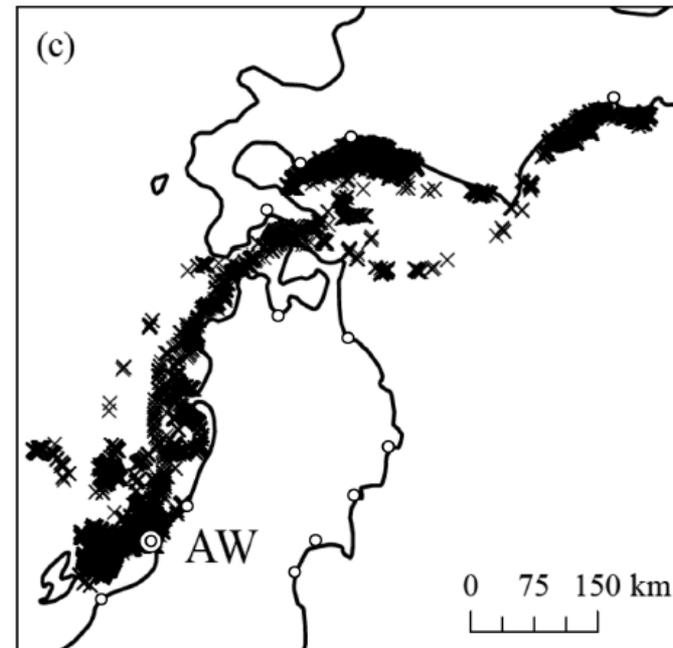
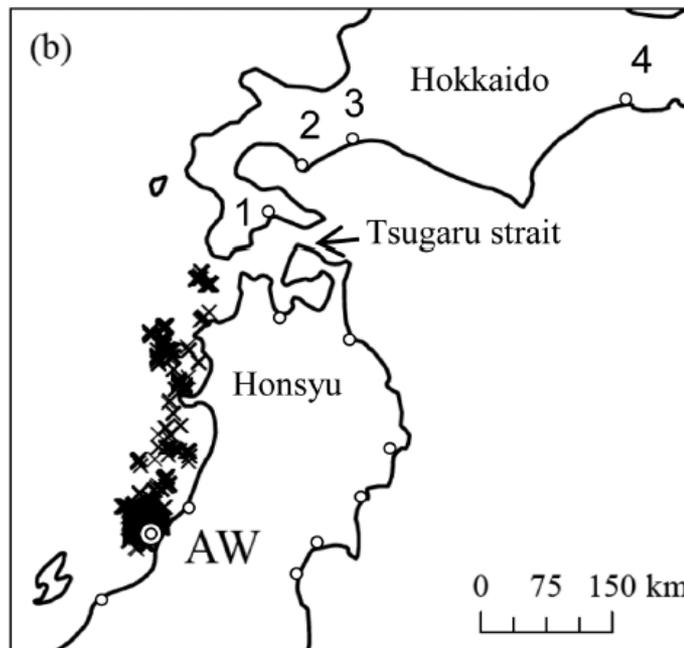
Article

pubs.acs.org/est

Contaminants in Tracked Seabirds Showing Regional Patterns of Marine Pollution

Ito et al. 2013

Cities 1-4
Hakodate,
Muroran,
Tomakomai,
Kushiro





Contaminants in Tracked Seabirds Showing Regional Patterns of Marine Pollution

Ito et al. 2013

AW-P

AW-J

area

sex

Persistent organic pollutants (POPs) Increase

PCBs	469 ± 177	25 ± 68	$F_{(1,7)} = 12.990,$ $P = 0.009$	$F_{(1,7)} = 0.315,$ $P = 0.592$
HCHs	45 ± 40	15 ± 30	$F_{(1,7)} = 4.657,$ $P = 0.068$	$F_{(1,7)} = 2.540,$ $P = 0.155$
DDTs	700 ± 380	87 ± 271	$F_{(1,7)} = 7.819,$ $P = 0.027$	$F_{(1,7)} = 1.520,$ $P = 0.257$

PCB group
(26 substances)

Hexachlorocyclohexanes
(α -, β -, γ -, δ -HCHs)

DDT group
(DDT, DDE, DDD)

Seabirds

Tracking

Indicators

Vielen Dank

Finanzielle Unterstützung

DFG, MPG, NERC (UK), OTEP (UK),
Falkland Islands Government ...

