



Exploring External Factors

PrePARED AKEM, February 2024



External factors

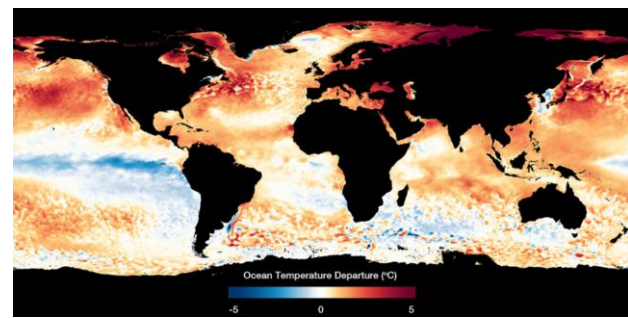
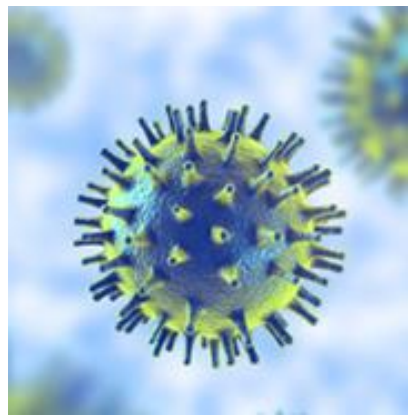
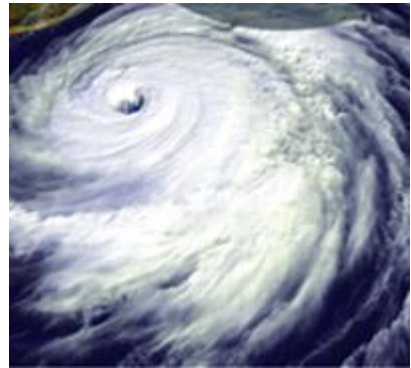
Effects of Offshore Wind don't operate in isolation

External factors operating simultaneously.

Particular challenges with extreme shocks:

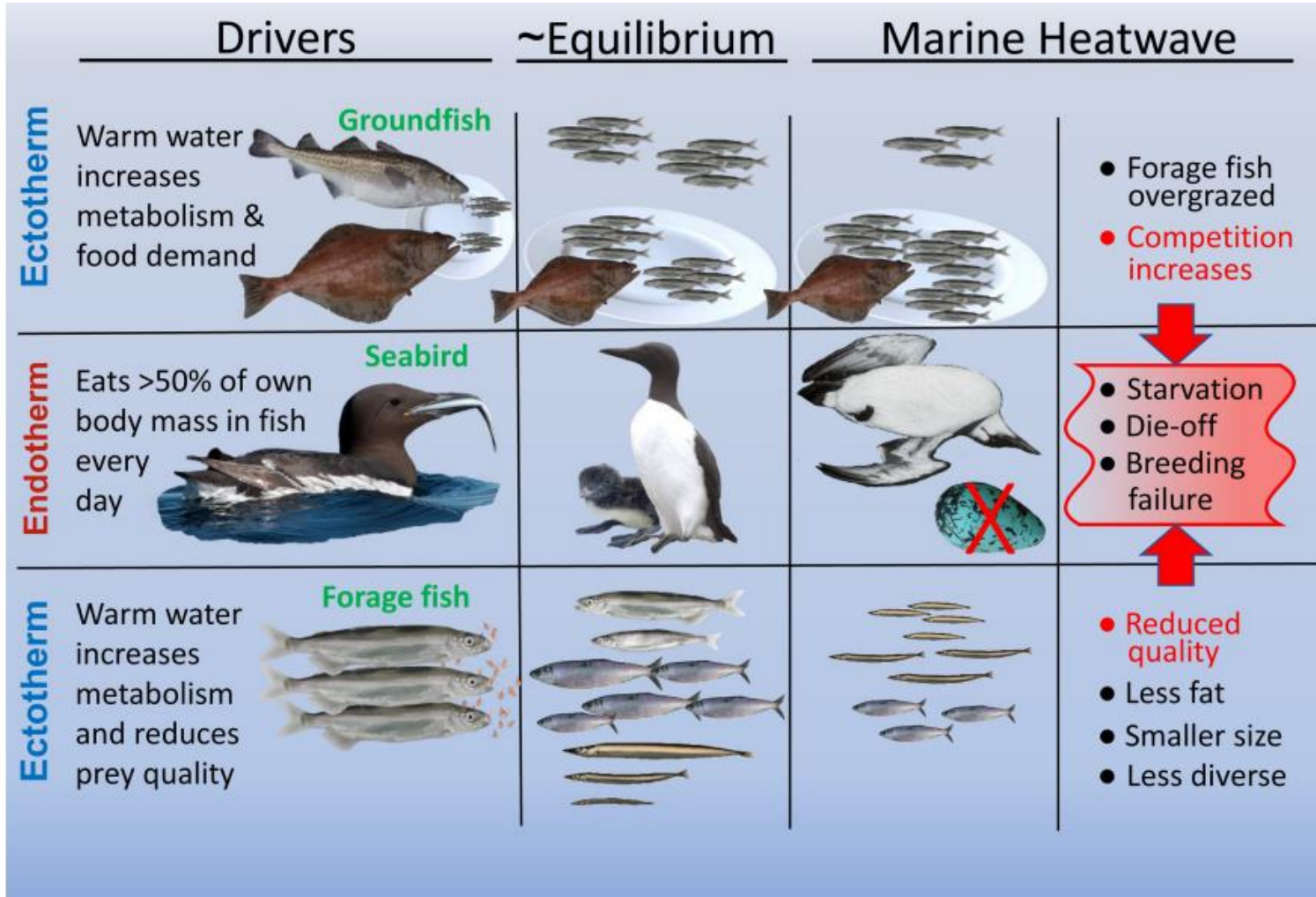
- marine heatwaves
- storms
- disease

Frequent events in recent years in North Sea



IUCN

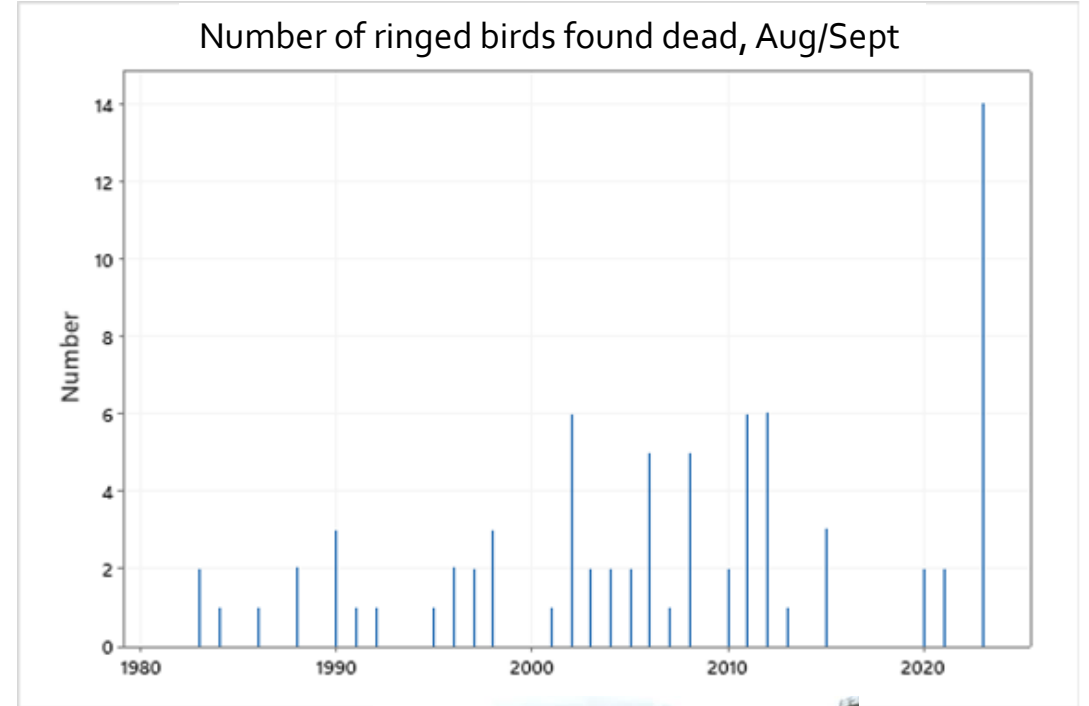
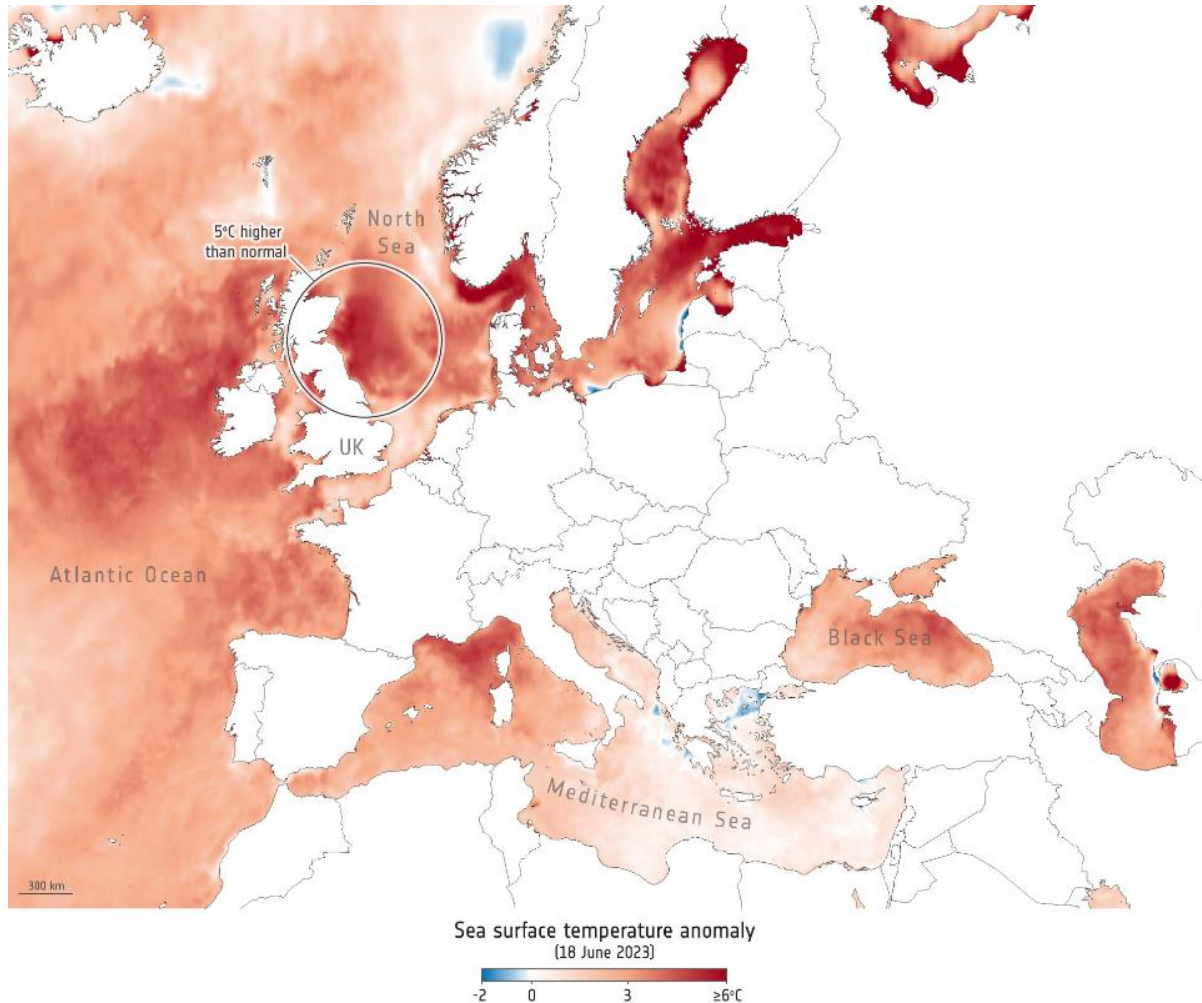
Marine heat waves: indirect and direct effects



- Many species may need to manage thermal stresses
 - Balance issue of losing heat to the environment
 - Unclear how heatwaves challenge these species



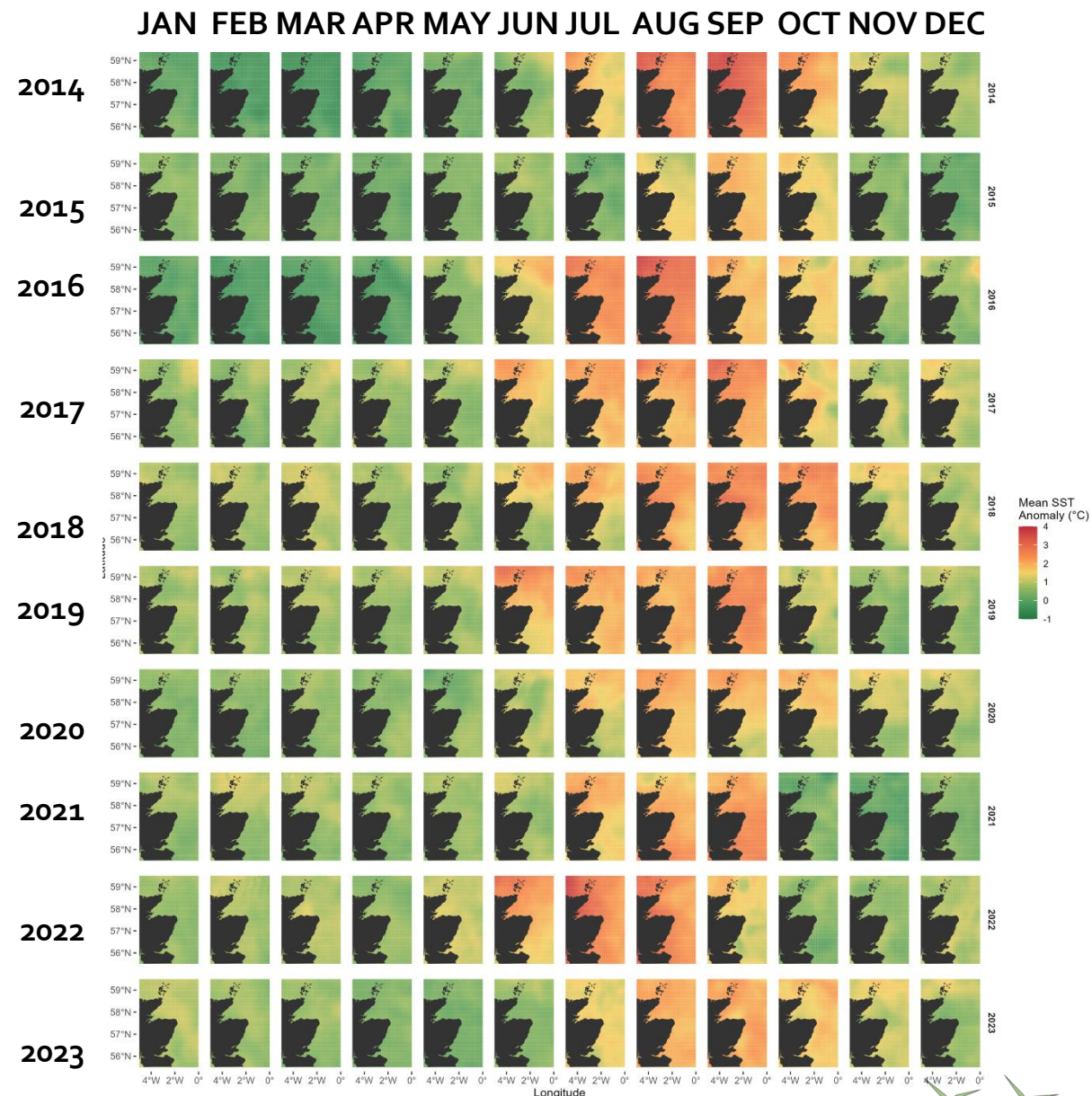
Extreme marine heatwave: 2023



European Space Agency

SST anomaly

- SSTA anomalies throughout past decade
 - Comparison with 1985-2012
 - June – October particularly anomalous
- Most measures are "skin" measures of SST
 - monitoring top mm of the water column
 - may not be indicative of non-surface
- In PrePARED: in situ loggers to measure seabed



<https://www.ghrsst.org/ghrsst-data-services/for-sst-data-producers/>



Marine Heatwave: 2021



Date Range	Guillemot	Razorbill	Puffin	Total
01-15 Aug	1	0	1	2
16-31 Aug	98	8	0	106
01-15 Sep	1386	109	5	1500
16-30 Sep	807	952	4	1763
01-15 Oct	929	49	4	982
16-31 Oct	358	27	1	386
01-15 Nov	21	2	6	29
16-30 Nov	5	2	3	10
01-15 Dec	8	2	25	35
16-31 Dec	15	5	100	120
Total	3628	1156	149	4933

Extreme storm events

Short-term weather

Immediate mortality effects

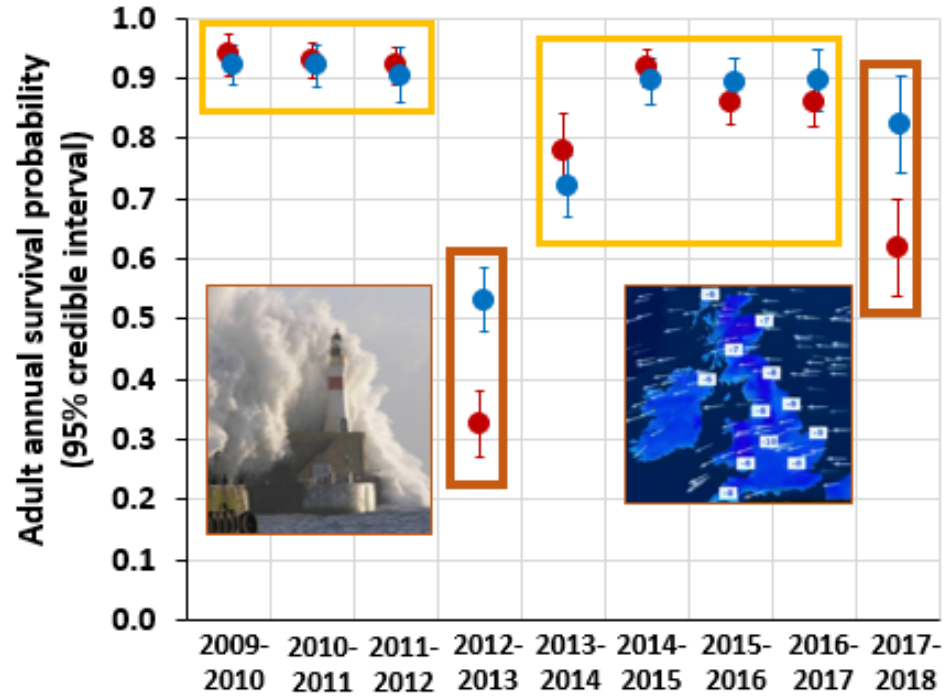
Frequency and severity predicted to increase



Extreme storm events

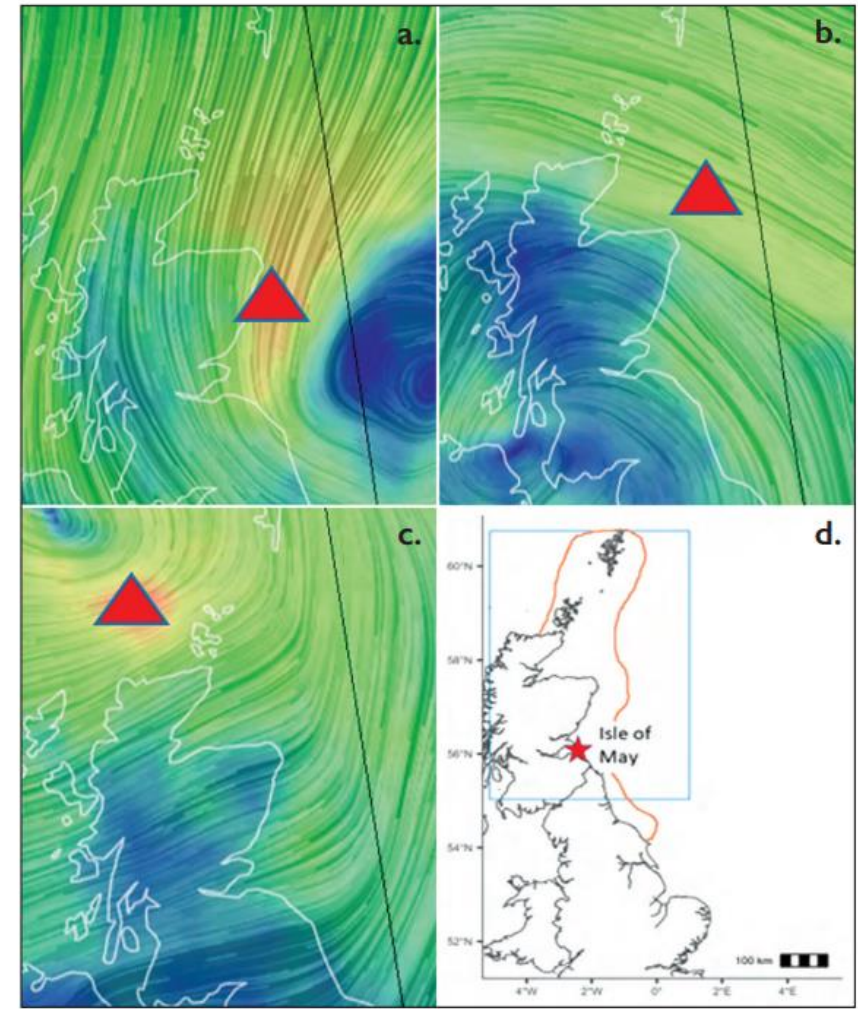


Sam Langlois



Acker et al (2021) *Journal of Animal Ecology*

Puffin mortality, Storms Arwen and Barra, Dec 2021
Shag mortality: Storm Babet, Oct-Nov 2023



Harris et al (2023) *British Birds*

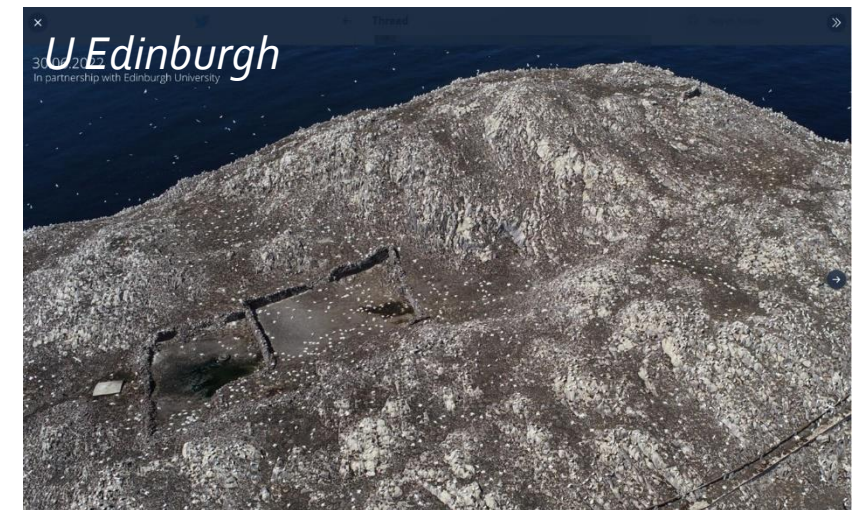
Avian flu in seabirds: 2021-2023

First found in great skua in 2021

Widespread in 2022, particularly affecting great skua, gannet, terns, kittiwake, guillemot

New species in 2023 – particularly large gulls, but less evidence in species affected in 2022

Evidence of immunity of surviving adults in gannets (Lane et al. *Ibis* 2023)



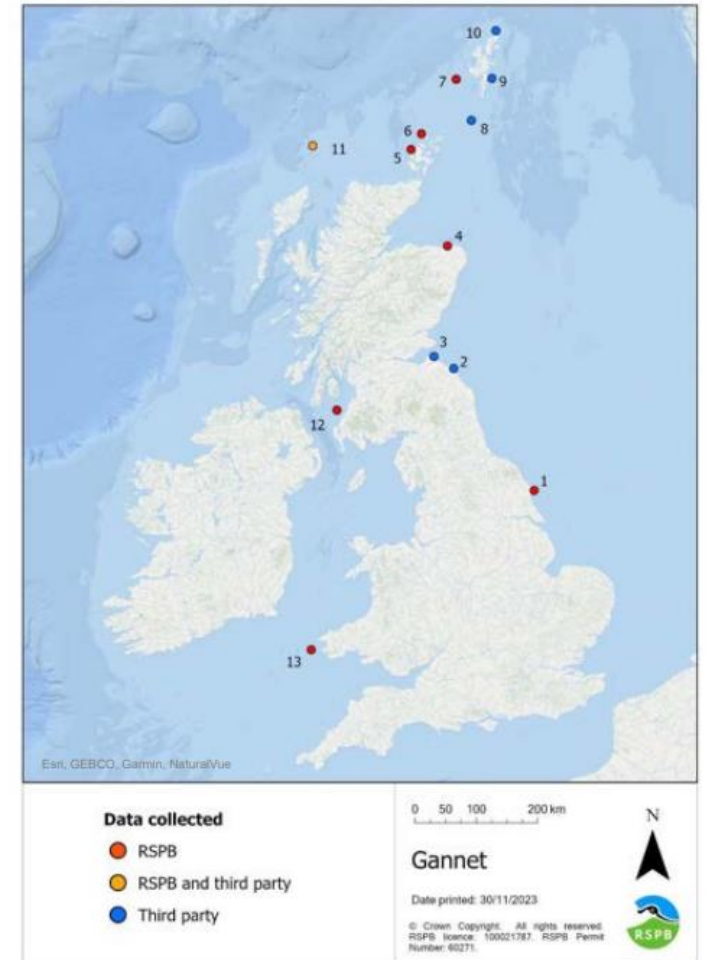
Avian flu in seabirds: population change

Survey effort led by RSPB in 2023 (Tremlett *et al.* 2024)

Survey coverage: Roseate Tern (98%), Sandwich Tern (92%), Great Skua (81%), Gannet (75%), Guillemot (52%) and Black-headed Gull (50%)

Species	% decline
Great Skua	76%
Common tern	42%
Sandwich tern	35%
Arctic skua	28%
Northern gannet	25%

Tremlett *et al.* (2024) RSPB Research Report 74



Tremlett *et al.* (2024) RSPB Research Report 74

External factors in seabirds: relevance to OWF assessments

First order impacts:

- reduction in population size:
 - shifting baseline
 - changing age structure
- reduction in density: effects on surviving individuals:
 - reduced competition
 - loss of collective memory
- changes in body condition of surviving individuals

Second order impacts:

- predators
- prey
- competition

