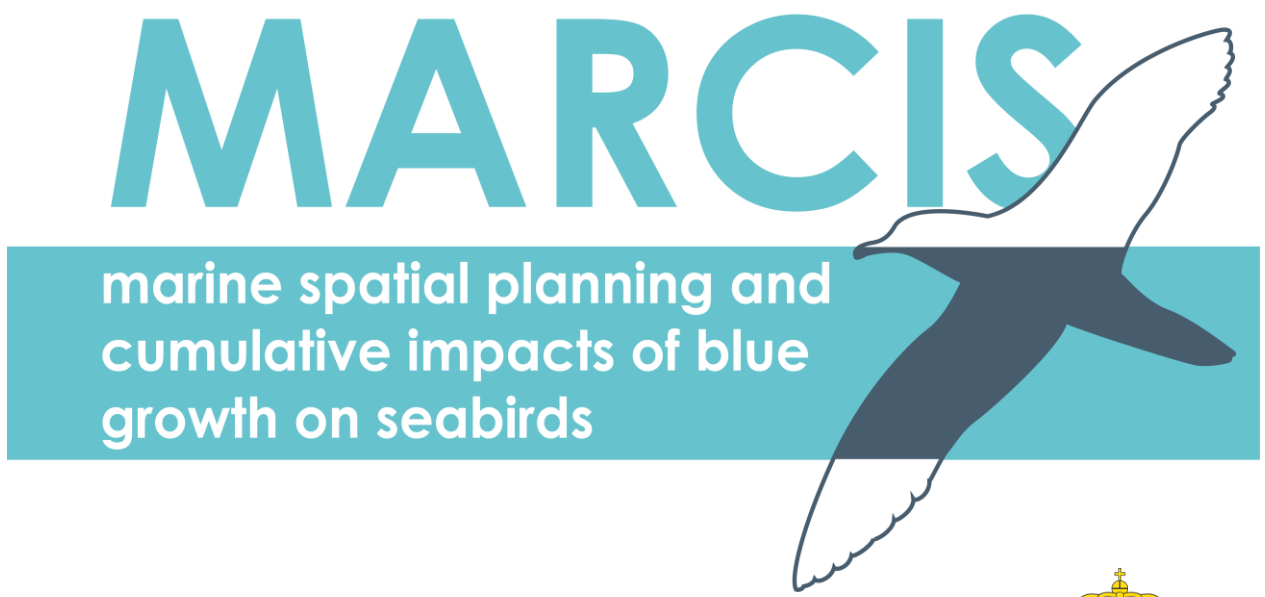
MARCIS

Marine Spatial planning and cumulative impact of blue growth on seabirds

MARCIS



Webinar 29.10.2025

Norsk institutt for naturforskning

Overarching project aims

- **Trans-disciplinary collaboration**
- **Development of a CIA tool for seabirds**
- **New knowledge**

Cumulative impact assessment (CIA)

Halpern et al. 2008. Science

$$I(x,y) = \sum_{i-1}^{n}\sum_{j-1}^{m} P_i * Ej * \mu_{ij}$$

Impact
- Spatially explicit

Pressure
- OWF
- Fishery
- Climate
- Shipping
- Oil rigs

Environment
- Seabird distribution

Impact weight
- Seabird population impact

Annual variability of climate and fishery harvest data

+

Annual timeseries data of demography

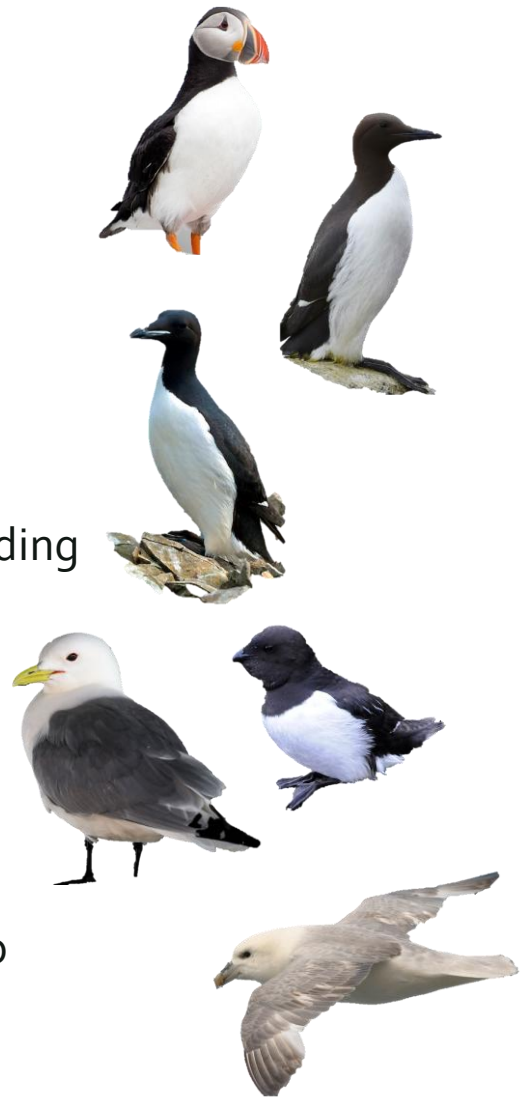
Enables quantifications of stressors that varies in time

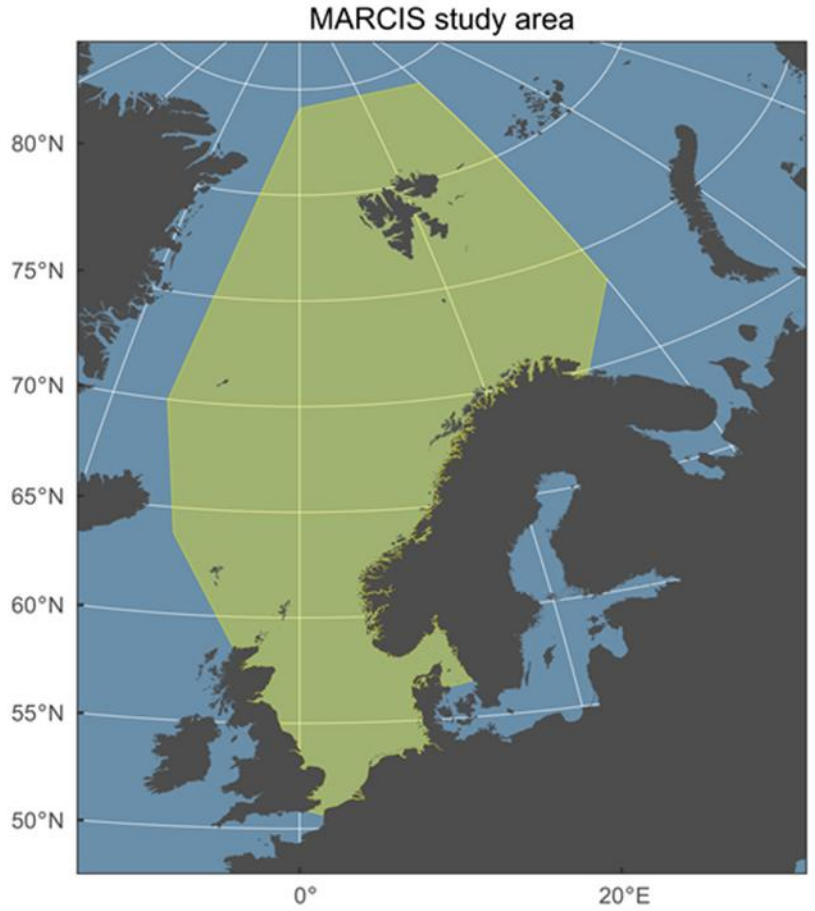
Demographic data
Demographic modelling
Activity data
IBMs

Receptors and input data

$$I(x,y) = \sum_{i-1}^{n}\sum_{j-1}^{m} P_i * Ej * \mu_{ij}$$

- **6 seabird species**
- Distribution and activity data (GLS – SEATRACK)
  - Year-round distribution
  - Mass-change
  - Mortality
- Timeseries data of demography and population trends (SEAPOP)
  - Reflect seabirds' status in both breeding and non-breeding season
  - Adult survival and reproduction
  - Population trends
- Migratory birds
  - Behaviour near OWF (Radar)
  - Migratory routes and risks related to OWFs





Receptors and input data

$$I(x,y) = \sum_{i-1}^{n}\sum_{j-1}^{m} P_i * Ej * \mu_{ij}$$

- **6 seabird species**
- Distribution and activity data (GLS – SEATRACK)
  - All year distribution
  - Mass-change
  - Mortality
- Timeseries data of demography and population trends (SEAPOP)
  - Both breeding and non-breeding season
  - Adult survival and reproduction
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- Migratory birds
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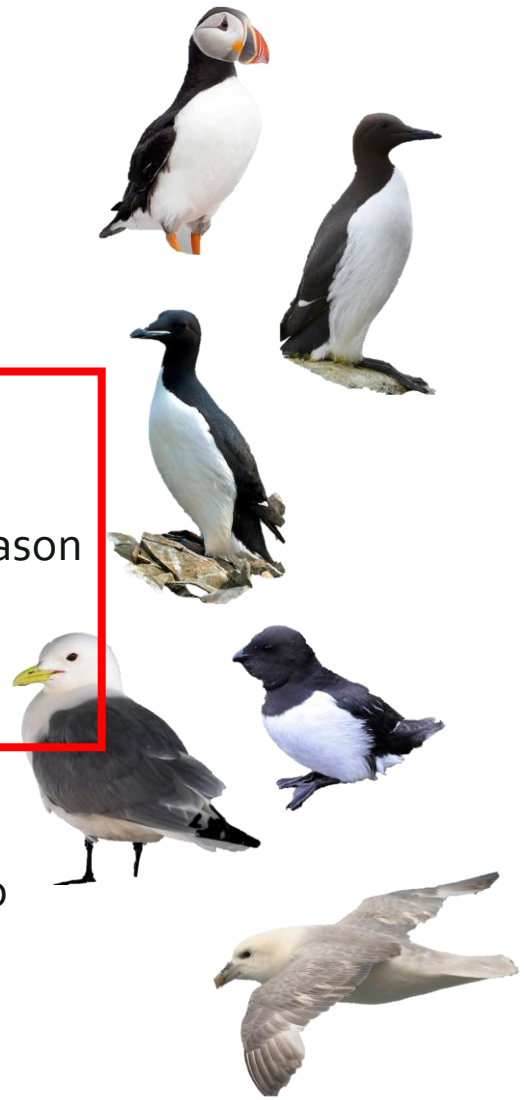
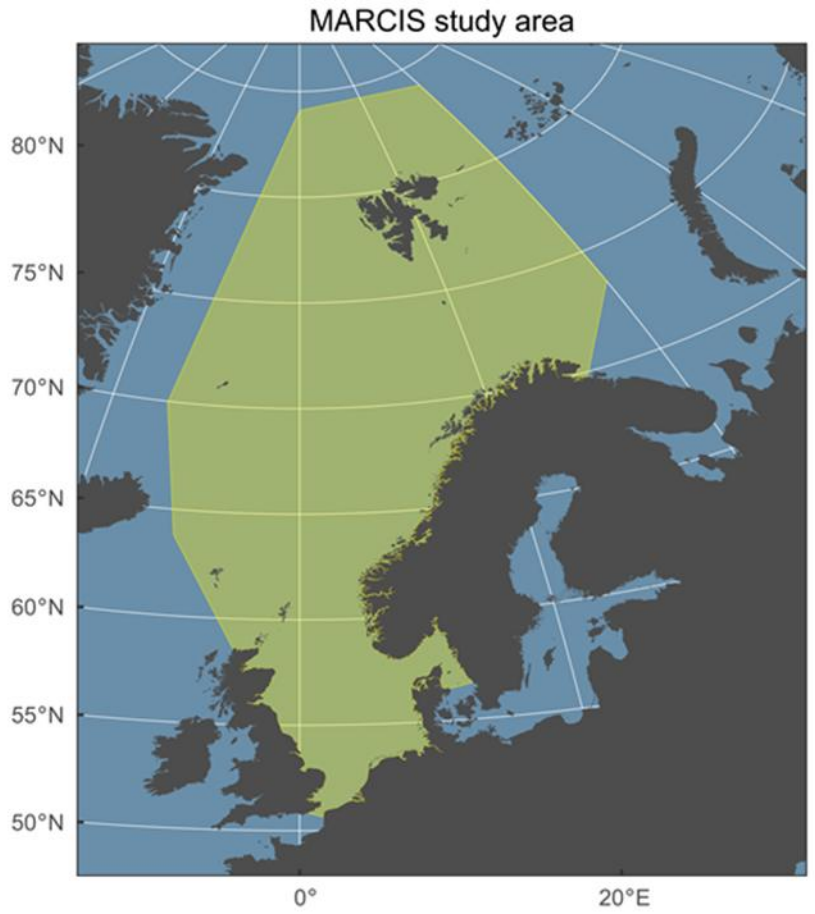




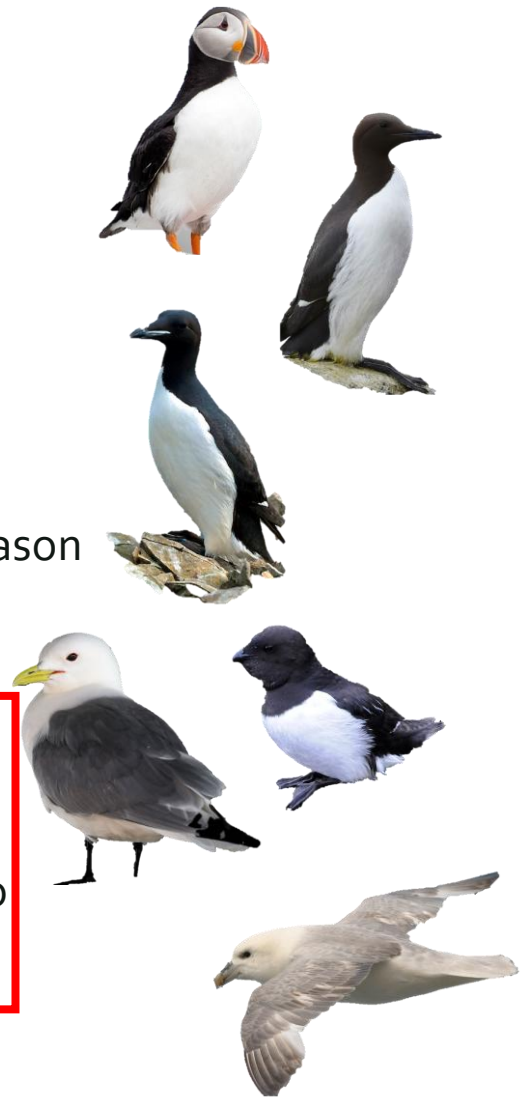
Receptors and input data

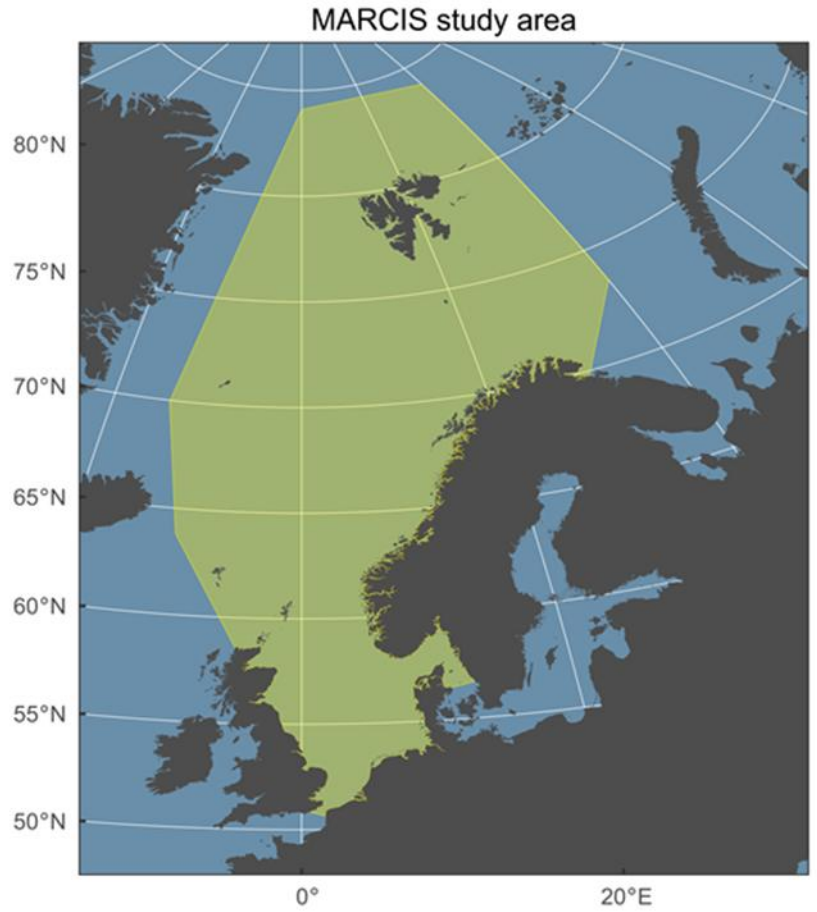
$$I(x,y) = \sum_{i-1}^{n} \sum_{j-1}^{m} P_i * Ej * \mu_{ij}$$

- **6 seabird species**
- Distribution and activity data (GLS – SEATRACK)
  - All year distribution
  - Mass-change
  - Mortality

- Timeseries data of demography and population trends (SEAPOP)
  - Both breeding and non-breeding season
  - Adult survival and reproduction
  - Population trends

- Migratory birds
  - Behaviour near OWF (Radar)
  - Migratory routes and risks related to OWFs – ringing data

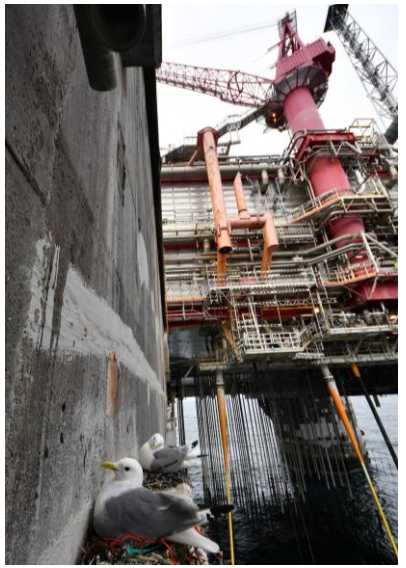


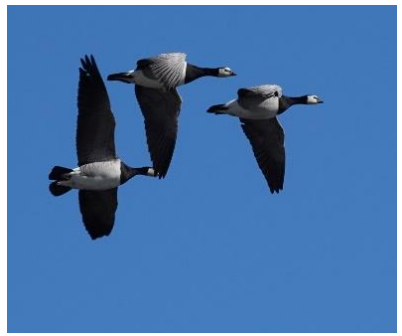


MARCIS – trans-disciplinary collaboration

Forskningsrådet

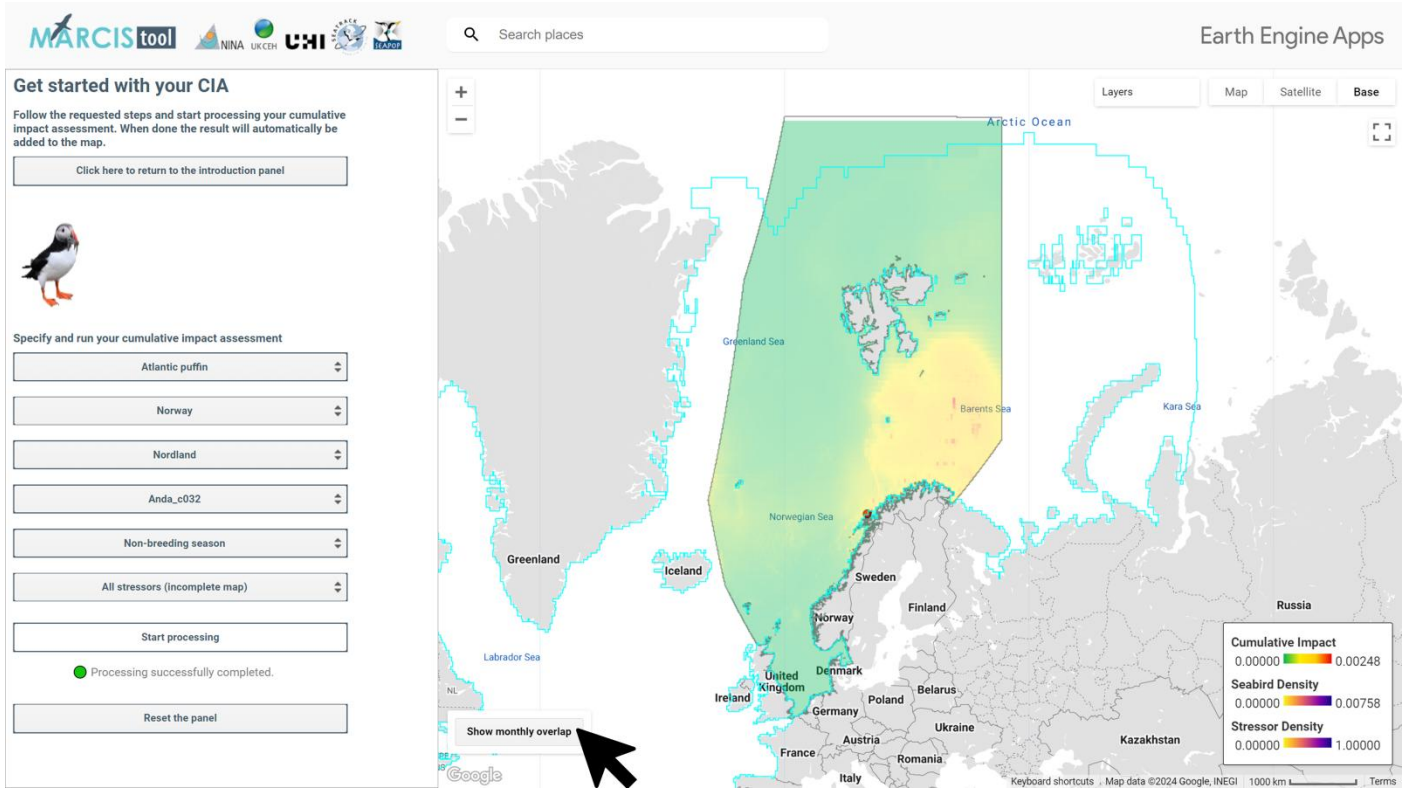
MARCIS - a collaborative research project between research institutes, industry, management authorities, NGOs and interest groups.





CIA tool for seabirds

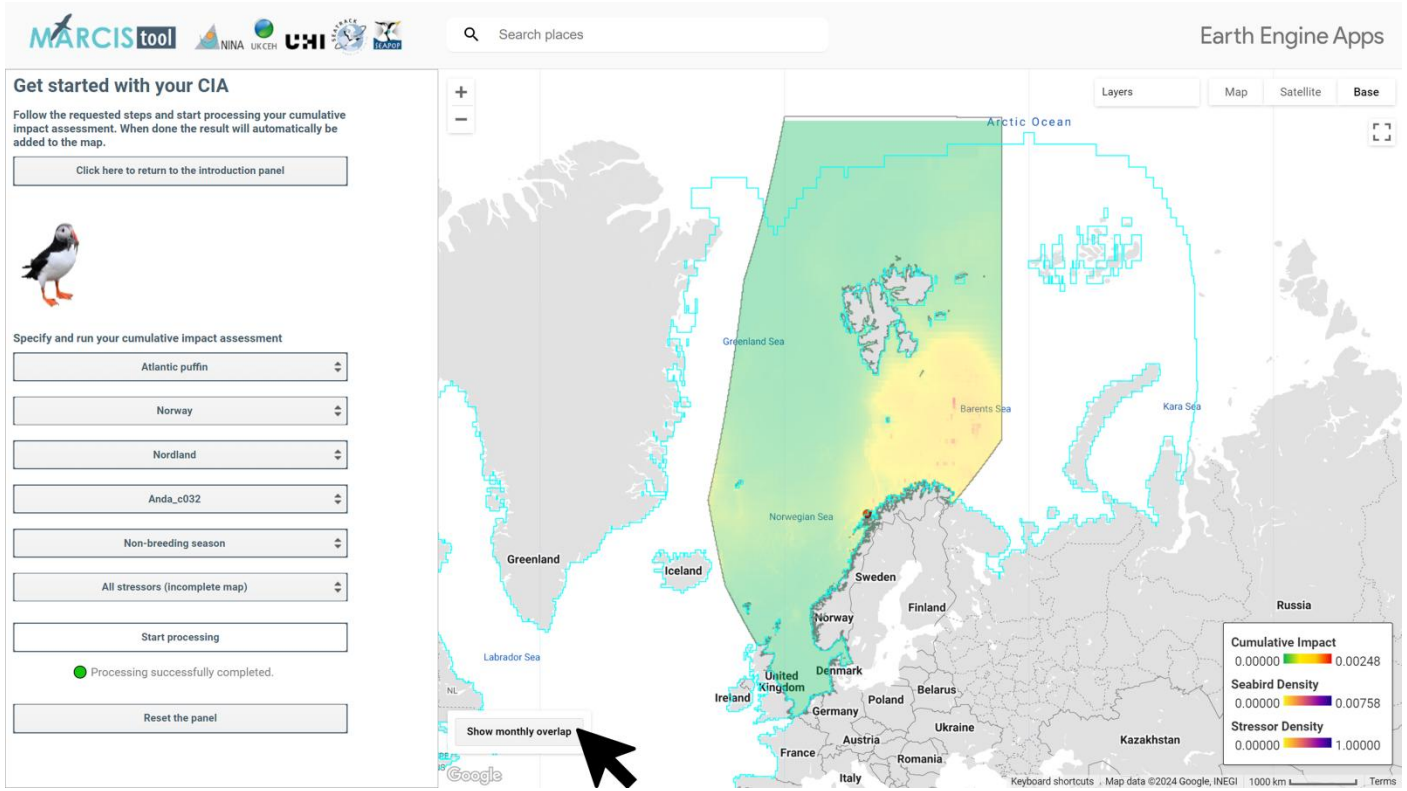
- Desition support tool for marine spatial planning
- Compiled maps of seabird distribution and stressors
- Impact of stressors
  - Single impact
  - Cumulative impact
  - Colony specific impact
  - Species average impact



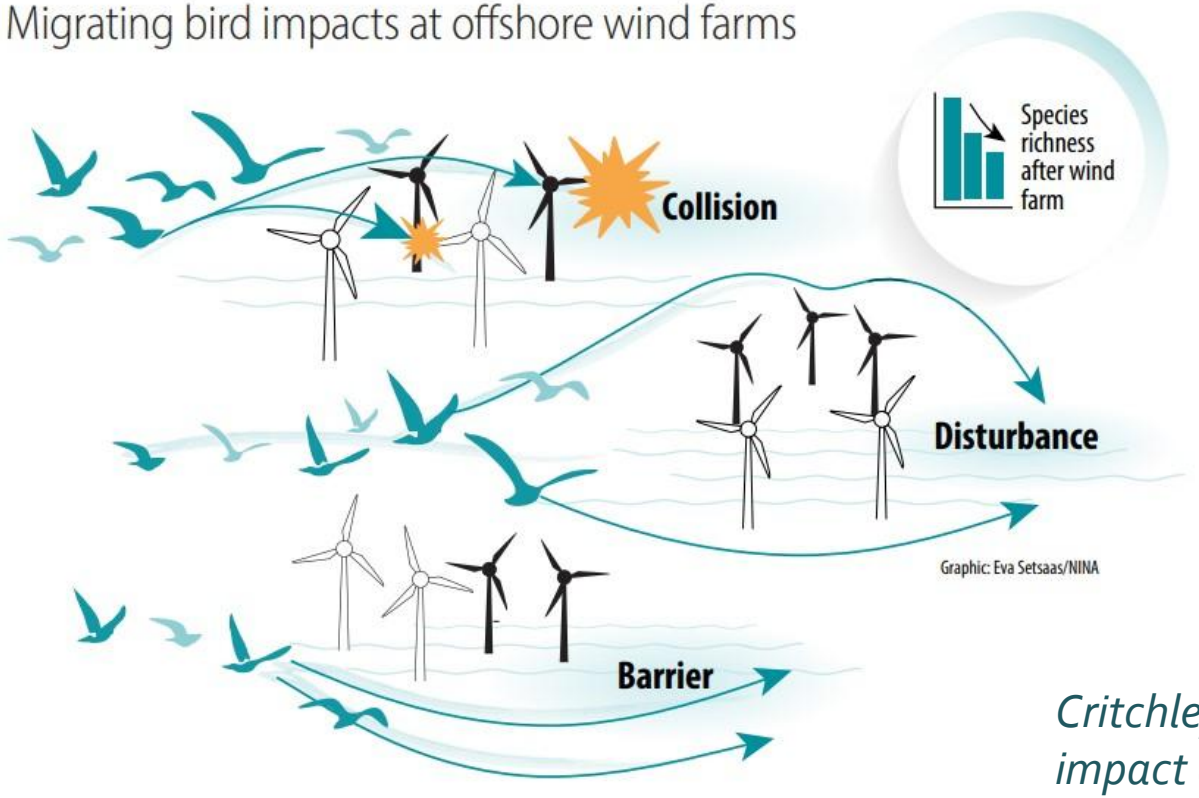
CIA tool for seabirds

- The MARCIS tool will be presented and made available for testing during the MARCIS meeting 7th of November

- Launched 4. Decemeber



New knowledge:
How offshore wind energy affects migratory bird diversity in the North Sea

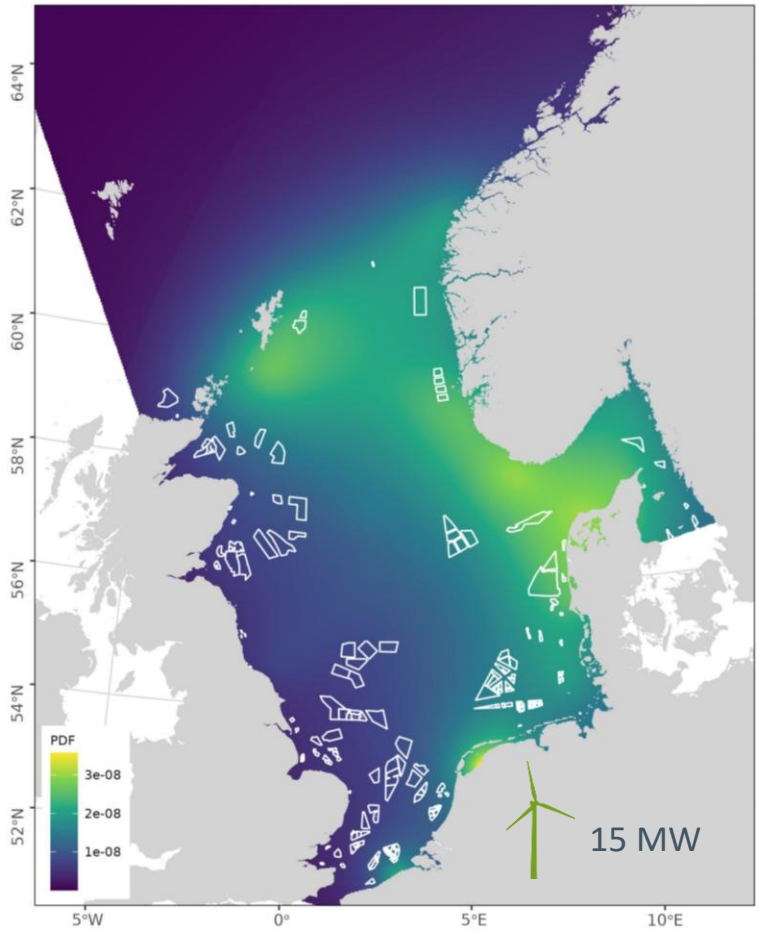


- Only impact from OWF
- Long-term ringing data
- 123 species –-> 12 groups
- Life-cycle impact analysis
  - ➢ Calculated loss of species richness

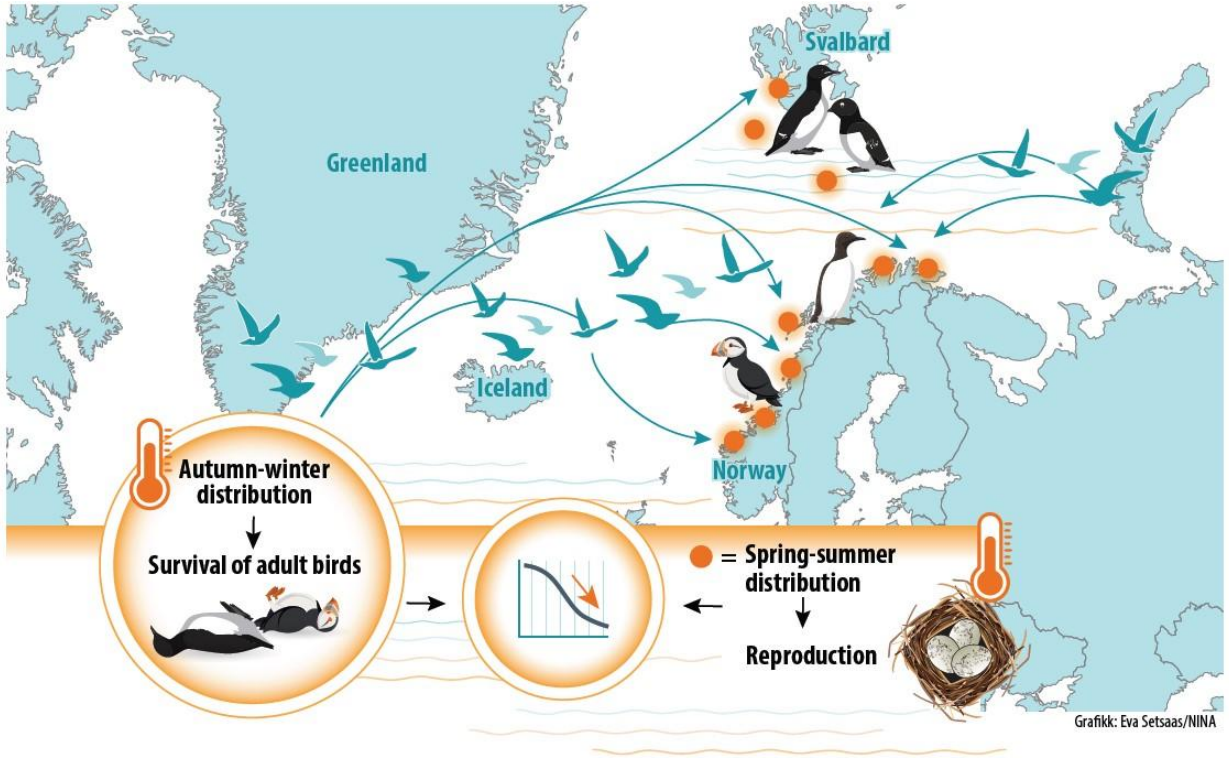
Critchley, E.J., Nilsson, A., Helberg, M., May, R., 2025. Life-cycle impact assessment of offshore wind energy development on migrating bird diversity in the North Sea. Journal of Applied Ecology, 62(6). https://doi.org/10.1111/1365-2664.70087

LCA – Impact & Relevance

- Provides a globally applicable framework for assessing impacts to migrating birds from offshore wind farms at multiple scales
- Assessment of existing & future impacts to migrating birds in the North Sea basin
- Maps of areas most utilised by birds on migration across the North Sea



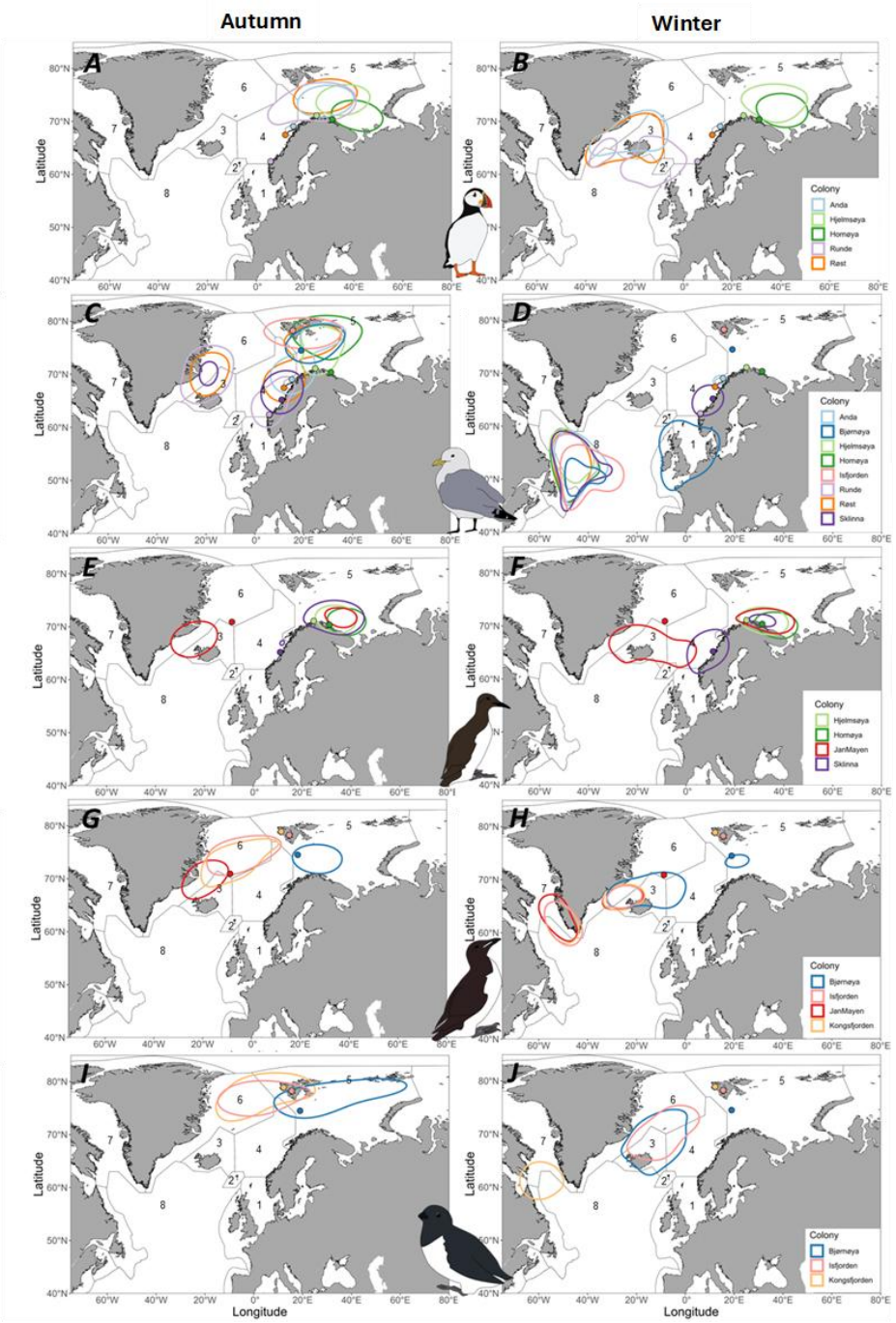
New knowledge:
Seabird populations affected differently from ocean warming

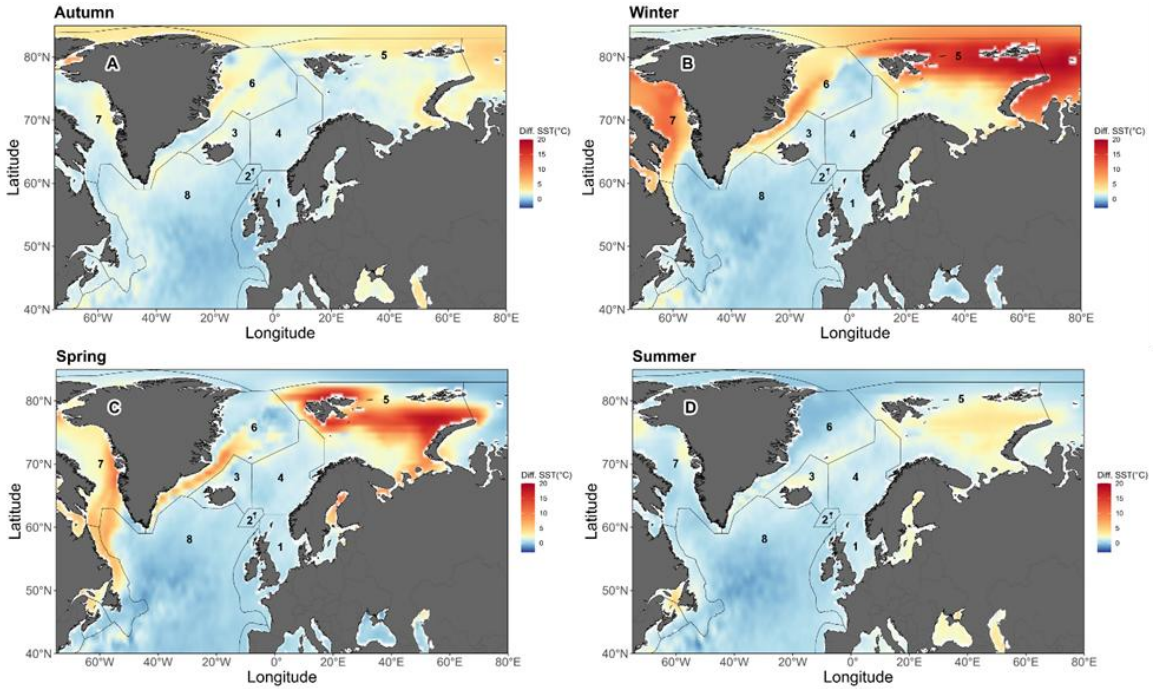


- Affected through different demographic pathways
- Affected through different areas and seasons during non-breeding season
- Shows the importance of combining tracking and demographic data

Layton-Matthews, Regan, Ballesteros, Hodges, Descamps, Tycho Anker-Nilssen, Benjaminsen, Daunt, Barrett, Buckingham, Bråthen, Christensen-Dalsgaard, Dehnhard, Erikstad, Fayet, Helgason, Kjellstadli Johansen, Lorentsen, Lorentzen, Moe, Systad, Strøm, Searle, Reiertsen. Seabirds in hot water: are ocean warming hotspots associated with population decline? (Submitted, PNAS)

Seabird populations show varying degree of vulnerability to climate change





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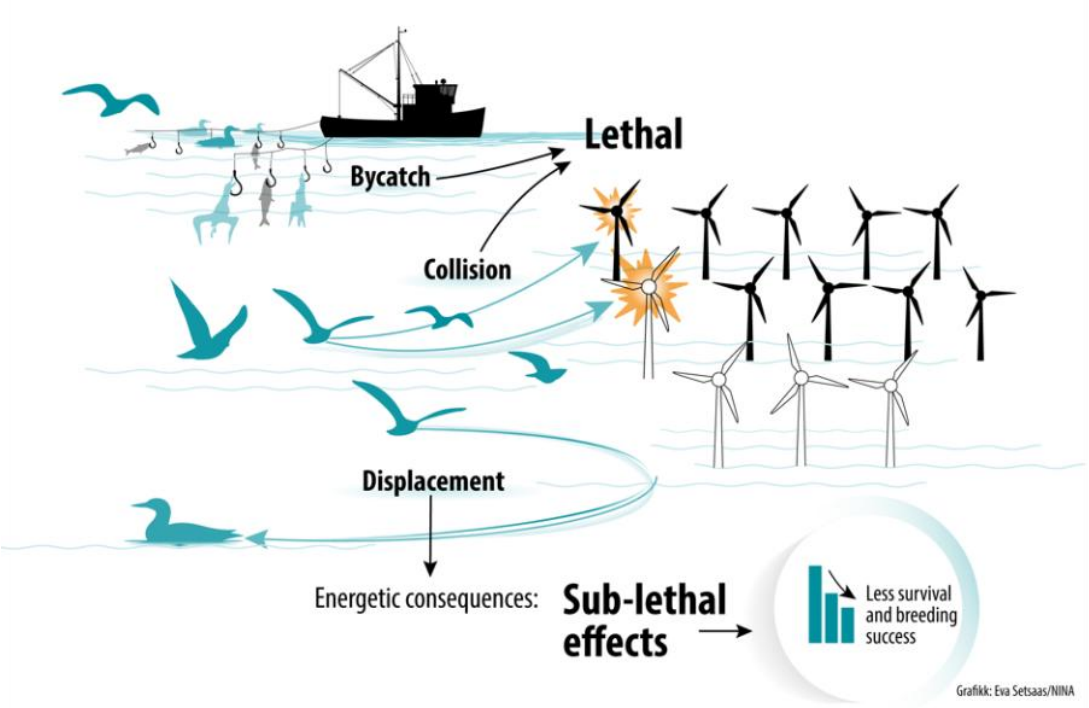
New knowledge: combined impacts of bycatch and offshore wind farms



- Modelled with IBMs
- Mortality or change in body mass

Buckingham, L., Masden, E.A., Layton-Matthews, K., Bringsvor, I.S., Bråthen, V.S., Dehnhard, N., Fauchald, P., Lorentsen, S.-H., Reiertsen, T.K., Tarroux, A., Searle, K.R., Christensen-Dalsgaard, S., An individual-based model to quantify the non-breeding season impact of wind farms on seabirds.
(In Revision Ecological Solutions and Evidence)

Usefulness of the MARCIS tool

- Marine spatial planning related to cumulative impact on seabirds
- Can also be used for future EIA
  - Case specific
- Framework can be further developed
  - Other data, more species, expand area etc

Takk til alle prosjektdeltakere, partnere og interessenter!