

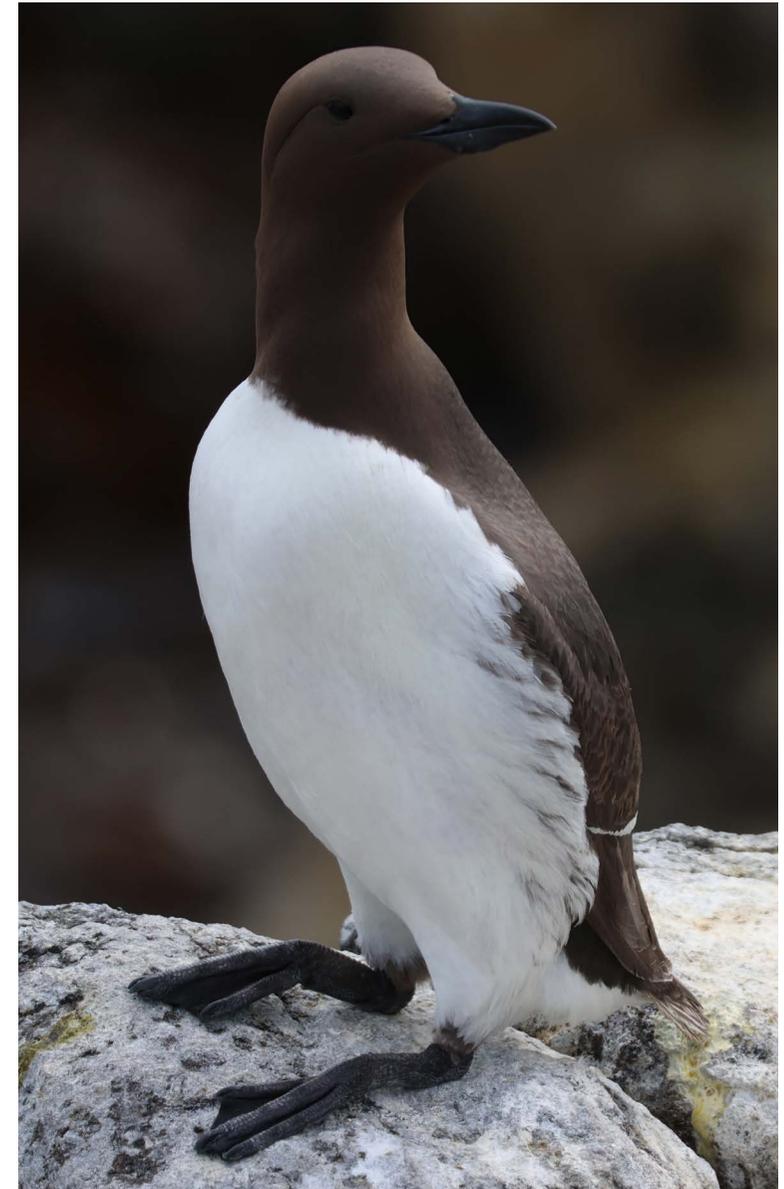
## *spmapper*: a spatial planning tool to indicate the foraging value of marine areas to breeding seabirds

This topic sheet summarises the methods and applications of a new tool, *spmapper* – developed in the ECOWINGS project – to assist with marine spatial planning of offshore wind farms and protected areas.

As we increasingly allocate marine space for offshore wind farms, it is challenging to deliver evidence-based spatial planning that balances growth in marine sectors with minimising impacts on protected species. Seabirds are particularly vulnerable to impacts from offshore wind farms due to the risk of collision with turbines and via displacement from foraging areas. Because of this, seabirds are the top consenting issue for offshore wind farm planning in the UK.

Importantly, during the breeding season seabirds are constrained to forage in areas that are accessible to their nest sites on coasts and islands. Acquiring sufficient prey for themselves and for the provisioning of their chicks is vital for seabird breeding success, which in turn is critical to the resilience of vulnerable species. It is therefore imperative to assess the potential impact of offshore wind farms on breeding seabirds.

Our new tool, *spmapper*, generates maps of prey consumption by three key seabird species that breed in the UK and Ireland. Users can compare prey consumption in areas of interest to inform the siting of marine developments and protected areas, to minimise impacts and protect breeding seabird foraging.



Common guillemot ©Oliver Leedham

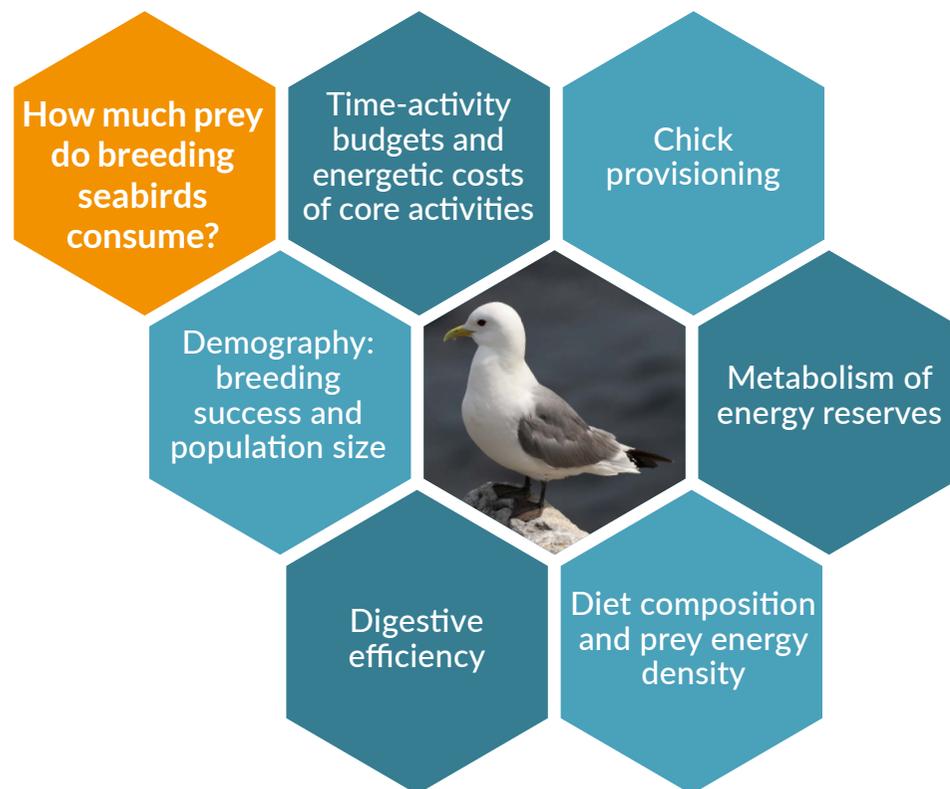
# Estimating prey consumption by breeding seabirds

To address the challenge in observing how seabirds forage in the marine environment at a broad, UK shelf-seas scale, we have developed a method to estimate the quantity and spatial distribution of fish prey taken by chick-rearing seabirds.

*spmapper* generates maps of prey consumption for three key seabird species of consenting risk in the UK and Ireland: black-legged kittiwake, common guillemot and razorbill.

To provide the foundation for seabird prey consumption maps, we developed an energetics model that first estimates how much energy a typical breeding adult of each species requires. These calculations integrate a range of data concerning the behaviour, metabolism, diet and demography of the study species (figure 1).

Using information on seabird diets and their fish prey, the daily energy requirement per adult is then converted into mass of fish prey consumed. Prey mass quantities are then scaled across the full breeding season and species network breeding population size.



**We have published a dataset of the seabird behavioural and energetic traits that underpin *spmapper*:**

Leedham, O.; Searle, K.R.; Harris, M.P.; Newell, M.; Wanless, S.; Mobbs, D.C.; Butler, A.; Daunt, F. (2025). *Time-activity budgets and energetics of common guillemot, razorbill, Atlantic puffin, and black-legged kittiwake*. NERC EDS Environmental Information Data Centre. doi: [10.5285/07b1105a-4a14-47e3-b491-9af59be90aff](https://doi.org/10.5285/07b1105a-4a14-47e3-b491-9af59be90aff)

Figure 1: Summary of key inputs used to estimate the mass of prey consumed by key seabird species in *spmapper*

Kittiwake ©Oliver Leedham

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# spmapper: overview and applications



We developed a new, freely-available spatial planning tool, *spmapper* (R package), to allow stakeholders to compare the importance of marine areas to three species of breeding seabirds. *spmapper* combines estimates for the mass of fish prey taken by breeding seabirds, with UK and Ireland scale maps of space use (created by RSPB) by each species during their chick-rearing period (figure 2). These maps show the distribution of prey that breeding seabirds capture at the shelf-seas scale, indicating the foraging value of marine areas.

By allowing users to retrieve and compare quantities in areas of interest, these outputs indicate the prey consumption that may be at risk of being lost to breeding seabirds if they are displaced from offshore wind farms. Alternatively, *spmapper* results may be used to indicate prey consumption that could be protected by the expansion of protected areas. *spmapper* can therefore be used to assist with the challenges of siting offshore wind farms and new protected areas.

## Using *spmapper*

### 1. Select species



**Common guillemot**  
*Uria aalge*

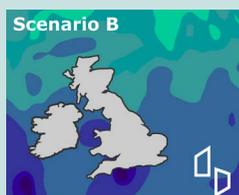


**Razorbill**  
*Alca torda*



**Black-legged kittiwake**  
*Rissa tridactyla*

### 2. Input candidate spatial areas



### 3. Compare prey consumption within spatial area

#### Scenario A



#### Scenario B

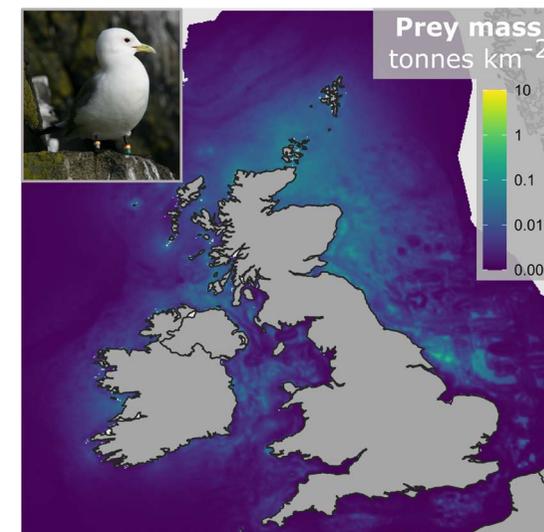


Figure 2: Example prey consumption map Black-legged kittiwake

*spmapper* is now freely available via GitHub and can be accessed via our website, which includes further information on methods and applications of the tool, including a full worked example. Access here: [nerc-ceh.github.io/spmapper-pkg](https://nerc-ceh.github.io/spmapper-pkg)



The NERC Ecological Consequences of Offshore Wind (ECOWind) programme is addressing two challenges:

- How will offshore wind expansion, combined with other anthropogenic pressures, affect species interactions and marine ecosystems?
- How can understanding these consequences enable robust approaches to marine environmental restoration and net environmental gain?

It aims to provide evidence to inform marine policy and management of increasing pressures on UK marine ecosystems from a combination of offshore wind, other anthropogenic stressors, including environmental responses to climate change.

Outcomes will inform how we manage human activities impacting UK waters and achieve net zero, while ensuring net environmental gain and how to address the lack of progress toward achieving Good Environmental Status in several biodiversity indicator areas, including pelagic habitats and food webs, and marine birds.



Offshore renewable energy is playing a critical role in UK energy security and net zero goals. However, uncertainty surrounding the effects on protected species and the marine ecosystem remains a key concern. Seabirds represent a serious risk to consenting due to impacts from collisions, displacement and barrier effects. ECOWINGS is investigating the effects of offshore wind farms on seabirds and their prey to inform cumulative impact assessment at the North Sea scale that is robust to climate change, and delivering evidence to shape strategic compensation and marine net gain. The specific objectives of the project are:

- Transforming the evidence base on cumulative effects of offshore wind on key seabird species.
- Establishing pathways for strategic compensation to ensure net gain for seabirds and the wider marine ecosystem.
- Ensuring that the assessments of offshore wind effects, and associated compensatory measures, are robust to future projections of climate change.

## Project partners:

