OWSMRF III Scope of Work 5b

Improving understanding of the at-sea distribution of immature and sabbatical seabirds for use in offshore wind impact assessments – feasibility study

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Evidence Quality Assurance:
This document is compliant with JNCC's Evidence Quality Assurance Policy.

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Definitions

Age class: A group of individuals from the same species that are of similar age.

Life stage: A life stage is characterised by specific development milestones and behaviours. Typically, in seabirds, key life stages are chicks, juveniles, sub-adults and adults.

Breeding status: A group of adult individuals from the same species that are either “breeding” or “not breeding” in a given year.

Breeder: An adult bird of breeding age that attempts to breed in a given year.

Non-breeder: A bird, either sexually mature or not, that does not breed in a given year. For the purpose of this work, non-breeders include immatures and sabbatical birds, as opposed to birds during the non-breeding season.

Immature (or pre-breeder): A bird that is not yet physiologically mature and has not reached breeding age. Immatures include juveniles and sub-adults.

Sabbatical bird: An adult bird of breeding age that does not attempt to breed in a particular year but may attempt to breed in subsequent years.

1 Background

1.1 The context

Offshore wind farms (OWF) are a key part of the transition to renewable energy generation as the UK seeks to achieve clean power by 2030 and Net Zero by 2050 (The Crown Estate 2024). These ambitious targets have fostered the rapid expansion of offshore wind developments in the UK, and the geographic spread is set to increase further offshore with the advent of floating wind. However, there is still considerable uncertainty around the environmental impacts of large-scale developments, particularly on marine birds. To inform the planning process of the potential impacts of proposed offshore wind farms, detailed Environmental Impact Assessments (EIAs) and Habitats Regulations Assessments / Appraisals (HRA) are required. EIAs assess potential impacts to the wider environment, whilst HRAs assess whether a plan or project has the potential to have an adverse effect on the integrity of a site (Special Protection Areas, or 'SPA') protected under The Conservation of Habitats and Species Regulations (Amendment) (EU Exit) 2019 and The Conservation of Offshore Marine Habitats and Species Regulations 2017 (as amended).

Seabird impact assessments for offshore wind comprise several stages, including site characterisation surveys, predicting OWF impact mortalities from collision with turbines and from displacement and barrier effects (due to avoidance of the OWF area), apportioning predicted OWF mortality to different age classes and relevant protected sites (the latter within HRA only), and modelling population-level responses to predicted OWF impact through Population Viability Analysis (PVA). Uncertainty in each step of the impact assessment can lead to increased levels of precaution applied to consenting decisions, therefore risking the rapid roll out of offshore renewable energy that is needed to combat climate change.

Seabird research, conservation and management often focus on the breeding component of populations. In a given year, not all individuals reproduce; some are too young and have not reached sexual maturity (referred to as "immatures" or "pre-breeders"), while others are old enough to breed but skip breeding that year due to poor condition, lack of mate or suitable nesting sites, or low prey availability (referred to as "sabbaticals" or "skipped breeders"). Non-breeding birds form a large component of populations for most seabird species particularly in those that mature late and show high rates of skipped breeding. They play an important role in maintaining seabird populations, by representing a potentially large pool of future reproductive individuals ready to move in and/or supplement lost breeders, thus helping buffer against sudden adult mortality. Ignoring non-breeding portions of seabird populations risks false predictions of population response to change, therefore limiting the validity of offshore wind impact assessments. For the purpose of this work, non-breeders include immatures and sabbatical birds, as opposed to "birds during the non-breeding season".

Due to their lack of reproductive constraints, non-breeders are expected to represent a relatively larger component of seabirds observed further offshore compared to more nearshore areas (Hall & Ruffino 2026). This is a growing concern as future developments expand in offshore areas, potentially overlapping with non-breeder distributions. Non-breeders' behaviour at sea may also differ to breeders; their sensitivity to collision and displacement and therefore risk from OWF impacts may differ too. Furthermore, with predicted increased frequency of extreme weather events, and potentially diseases too such as HPAI, non-breeding rates, as well as non-breeder attendance at or near colonies, are likely to change. This is creating a challenge for undertaking robust assessments of seabird population status and trends.

The Offshore Wind Strategic Monitoring and Research Forum (OWSMRF) Phase III identified a fundamental lack of knowledge of the ecology, behaviour and population dynamics of non-breeding birds, which poses a challenge to OWF impact assessments. Detailed information on knowledge gaps, evidence required to fill those gaps and Research Opportunities (RO) for obtaining evidence is reviewed in the OWSMRF III Knowledge Gap 5 report (Hall & Ruffino 2026) and summarised in JNCC (2026). The report describes several ROs which will help improve understanding of non-breeders, their behaviour in relation to offshore wind farms, the proportion of the whole population that they make up, and their role in seabird populations.

The OWSMRF III Developer Group, after discussions with OWSMRF stakeholders, asked JNCC to produce detailed scopes of work for a selection of ROs. The present scope of work synthesises and elaborates on RO5.1 (At sea distribution of immatures) and RO5.2 (At sea distribution of sabbaticals), as described in Hall and Ruffino (2026), by providing a more detailed set of aims and objectives, possible methods that might be employed and important aspects (e.g. risks, dependencies) that would need to be considered. It should provide the information that is required to draft an invitation to tender and to judge the quality of applications, should any interested funding party wish to proceed with this project.

1.2. The issue

1.2.1. Apportioning stages on an impact assessment

As part of an OWF impact assessment, there can be a requirement to assign predicted levels of impacts to different components of seabird populations, including breeding adults, immatures and sabbaticals, separately. This requires being able to quantify relative proportions of each age class and breeding status occurring at a proposed development area to assess whether differential levels of exposure to OWF impacts are expected.

There are limitations in the approaches currently used to apportion predicted levels of impacts of OWFs to age classes. Digital Aerial Surveys (DAS) can only be used to distinguish between immatures and adults observed at a proposed development for those species with age-specific plumage characteristics (e.g. northern gannet *Morus bassinus*; large gulls). Alternatively, classical population theory, using stable age structures in population modelling, can be applied to estimate proportions of multiple age classes in seabird populations, but it is unclear how well these estimated population compositions reflect actual proportions observed at specific areas of sea and times of year. In northern gannet for example, a mismatch has been reported between predicted proportions of immatures in UK waters derived from stable age structures (Furness 2015) and site-specific DAS-based observations (e.g. HiDef & West of Orkney Windfarm 2024).

As for sabbatical birds, not much is known about how they use the marine environment year-round, and current at-sea survey approaches do not allow differentiating between breeding and non-breeding adults. Alternatively, a sabbatical rate may be applied to estimate relative numbers of non-breeding adults versus breeding adults within a proposed OWF site. However, there is limited evidence to estimate robust sabbatical rates across species, and uncertainty remains over the appropriateness of applying generic sabbatical rates to estimate proportions of sabbaticals at specific at-sea locations.

In addition, there are limitations in the approach currently used in impact assessments to apportion birds observed at sea back to colonies. Within HRA, predicted OWF impacts on SPA populations are assessed. For this, birds observed at a development location during baseline surveys are linked back to relevant SPAs. The predominantly recommended

apportioning method for the breeding season has been developed for breeding adults and is based on central-placed foraging theory. This presents a challenge when apportioning large numbers of birds observed at a far offshore OWF site where they occur outside typical breeding foraging ranges; these birds could be immatures and/or sabbaticals linked to an SPA. There is currently no standard mechanism for apportioning impacts on non-breeders in this context.

Better understanding of non-breeder at-sea distributions is crucially needed to validate apportioning assumptions and improve confidence in estimates of OWF impacts on seabird populations. However, it can be onerous to understand seasonal patterns in at-sea distributions for a range of species and being able to link these distributions to colonies they most likely relate to. Particularly for sabbaticals, new tagging work could take many years, and sample sizes required could be large for species that have low sabbatical rates. On the other hand, a large volume of tracking data has been collected across species in UK waters, some of which may have covered sabbatical periods. Through numerous seabird tracking research programmes and at-sea survey campaigns, at-sea distribution information has also been collected on immatures around UK waters. A key aspect of this scope of work is to make use of historic datasets and existing knowledge to synthesise and consolidate current understanding of non-breeder at-sea distributions for a range of key UK species. This will then be used to generate best practice guidance for improving non-breeder apportioning approaches in the context of offshore wind impact assessments.

1.2.2. Marine spatial planning

Better understanding of non-breeder at-sea distributions, and likely exposure to offshore wind development, will aid marine spatial planning. For example, do non-breeders tend to aggregate in certain areas at specific times of year? Can these hotspots be considered when identifying future development opportunities?

1.3. Synergies

This scope of work is complementary to two sister OWSMRF III scopes of work, and we encourage interested parties to review the aims and objectives of these scopes and engage with these proposals or projects (as/when they are delivering), to build on any available outputs and maximise synergies. **Before progressing any of this work, it is also advisable to get in touch with JNCC (feedback@jncc.gov.uk) to receive the latest updates on the status of OWSMRF III scopes of work**.

OWSMRF III produced the following two scopes of work:

- SoW5a: Role of non-breeders in population persistence and their treatment in offshore wind impact assessments. Apportioning impacts is a crucial aspect of impact assessments and is recognised in the present scope of work (SoW5b). SoW5b looks more specifically into immature and sabbatical at-sea distribution and connectivity to colonies, while SoW5a focuses on population modelling processes within an impact assessment.

- SoW5c: Feasibility study for improved understanding of non-breeding birds through the development of novel colony monitoring technologies. This focuses on the collection of new empirical data from colonies to infer proportions of immatures and sabbaticals in populations. Population-level non-breeding rates derived from modelling (SoW5a) and colony monitoring (SoW5c) could then be compared to site-specific proportions of individuals observed at sea (SoW5b).

2 Aim and objectives

2.1 Aim

This scope of work aims to explore the feasibility of using existing datasets to improve understanding of the at-sea distribution of immature and sabbatical birds for use in the apportioning stages of an impact assessment. Outputs of this study will inform the process of quantifying proportions of birds observed in baseline surveys to be characterised as immatures, sabbaticals and breeding adults, and allow for improvements in the SPA apportioning stage of an HRA. This work will also improve understanding of exposure of immatures and sabbaticals to offshore wind, helping establish how non-breeders distribute at-sea year-round and identify important marine areas, therefore informing marine spatial planning.

This scope of work comprises five sequential Objectives, ultimately aiming to generate improved understanding of non-breeder at-sea distributions. Completion of some of these tasks requires access to some data; therefore, a key requirement for this work is for interested Bidders to demonstrate how they could access and make use of existing datasets. It is envisaged that this work would be best delivered by a consortium of project partners, holding access to seabird tracking and/or DAS datasets in UK waters.

2.1.1 Objective 1 – Review, collate and summarise available data

What datasets currently exist that could be used to infer at-sea distributions of immatures and sabbaticals in UK waters?

2.1.2 Objective 2 – Analyse and map available evidence

Can existing data be mapped to infer seasonal distribution patterns of immatures and sabbaticals around UK waters? Extract available datasets, analyse data and create synthetic maps.

2.1.3 Objective 3 – Identify gaps, challenges and opportunities

With the data that is known to exist and could be explored in further mapping work, what are the remaining gaps? Undertake a gap analysis, identify any challenges and collaborative opportunities to augment the volume of at-sea usage data that could be used to improve understanding of immature and sabbatical at-sea distributions.

2.1.4 Objective 4 – Develop conceptual frameworks for non-breeder apportioning and facilitate uptake in impact assessments

Can existing data be used to inform the apportioning stages on an impact assessment? Develop methodological standards for quantifying proportions of non-breeders observed at sea and apportion them to relevant colonies. Test candidate frameworks and provide recommendations for developing robust non-breeder apportioning approaches.

2.1.5 Objective 5 – Plan future work

Is novel data collection warranted, achievable and if so at what cost? Building on the recommendations from Objectives 1–4, consider the requirements of future data collection and prioritise further work in terms of importance of the evidence gap to be addressed, likelihood of success, timeframe and cost.

3 Detailed tasks

The Project would involve a series of tasks to meet the objectives listed above.

3.1. Objective 1 – Review, collate and summarise available data

This work is to identify datasets that might be made available for mapping out current understanding of the at-sea distributions of both immatures and sabbaticals for a range of priority seabird species in UK waters. This task will primarily focus on at-sea movement data derived from tracking studies but would also explore feasibility of obtaining at-sea usage data from DAS (for those species for which DAS can be used to age birds). Therefore, a key requirement for this work is for the Contractor(s) to hold access to some UK seabird at-sea usage data, which could be extracted easily to produce seasonal at-sea distribution patterns. However, there will be a wealth of other sources of information, outside the immediate remit of Contractors' research projects, therefore this task also involves seeking additional datasets, using a combination of online searches and expert engagement.

Proposed activities are:

- Agree a list of priority species for this project.
- Search readily available datasets and extract information.
- Identify and search additional relevant datasets; collate available information.
- Synthesise the information collated.

3.1.1 Agree list of priority species

An initial task will be to agree a list of priority seabird species that are most relevant to this work; these could be for example species where non-breeders are likely to show different seasonal at-sea distribution patterns compared to breeding adults, species of concern for offshore wind impact assessments, and/or species for which DAS can be used to age birds. It is suggested that this work attempts to include northern gannet, common guillemot (*Uria aalge*), razorbill (*Alca torda*), Atlantic puffin (*Fratercula artica*), black-legged kittiwake (*Rissa tridactyla*) and possibly Manx shearwater (*Puffinus puffinus*) too.

3.1.2 Search readily available datasets and extract information

This will involve screening datasets that the Contractor(s) have access to through their own research projects, and then extract metadata, to understand whether the data in hand could be used to infer at-sea distributions of non-breeders. In the case of sabbaticals, Contractor(s) will explore whether existing tracking data covers sabbatical years, and whether a bird is a sabbatical or not can be understood from tracking data. Concurrent colony monitoring, where available, may need to be brought in to provide context on the populations, confirm the status of individuals and assess at what point in time a bird becomes a sabbatical.

3.1.3 Search additional datasets and collate information

The work would progress by searching multiple online sources of information to identify additional datasets, such as:

- seabird tracking databases, such as SEATRACK, Movebank and BirdLife's Seabird Tracking Database;
- the Offshore Wind Environmental Evidence Register, a publicly accessible UK-wider register of evidence gaps and relevant past and on-going research projects;
- the Marine Data Exchange portal, a central repository of offshore industry survey data, research and evidence (from e.g. The Crown Estate's Offshore Wind Evidence and Change programme);
- published and grey literature to identify relevant tracking and DAS studies, which may have not been captured by previous searches.

While online searches would provide some understanding of what might be available elsewhere, a wealth of data may have been collected on non-breeder at-sea distribution but not readily available. Therefore, a critical element of this work is to seek contributions from seabird research programme managers and data holders to identify additional sources of at-sea data. A small group of experts will be formed and queried around existing evidence, through a combination of questionnaires, e-mails, phone calls and working groups, or alternatively a specialist workshop.

3.1.4 Synthesise the information collated

This work will then seek to synthesise the information collated through various means, focusing on the following aspects:

3.1.4.1 Age class/breeding status

- for each of the priority species identified, has at-sea distribution data been collected for immatures?
- can sabbatical years be identified from tracking and colony monitoring studies?

3.1.4.2 Access to and format of data

- is the data readily available (i.e. is it in the public domain and can it be accessed)?
- is the available data in its raw form or processed?
- with processed data, how is the information presented? Are figures/maps presented in scientific papers? Can further details be easily extracted if needed?

3.1.4.3 Coverage and data quality

- are species of interest well represented in available DAS data?

- what is the geographic spread of the data? Does it include UK waters, and if so what specific marine regions?
- what is the timeframe of the dataset? How many days of tracking/DAS over a single season and year, and how many years of data collection?
- how many birds have been tracked in tagging studies, and from how many different colonies?
- what resolution is the tracking data?

3.1.4.4 Technology

- what types of loggers have been deployed on birds (GPS, GLS, other)?
- have tag effects been reported, and do important caveats need to be considered when interpreting results of tagging studies?

3.2. Objective 2 – Analyse and map available evidence

This work will seek to represent current understanding of the UK at-sea distribution of immatures, and if possible, sabbaticals, through a mapping exercise of species-specific evidence that will have been collated as part of Objective 1. It will also explore seasonal and yearly patterns in distributions, if deemed feasible with the data in hand.

It may be that, for some species, at-sea distribution data cannot be accessed in its raw form or is only available in a processed format, for example through figures presented in published papers, and therefore cannot be readily combined in spatial analysis. The collated data will be assessed and split out to establish how much of that data is available in different forms, for each species:

- raw DAS data;
- processed DAS data;
- raw tracking data;
- processed tracking data.

When processed data is available only, an attempt would be made to synthesise available information in a visual manner, for example using synthetic high-level figures. On the other hand, when raw data are available and accessible, this work will undertake spatial analyses to map current understanding of non-breeder at-sea distribution per species, capturing spatial (marine regions) and temporal (seasons, years) variation when feasible. Including important covariates (e.g. environmental factors, fishing vessels, distance to coast) should also be considered to refine understanding of non-breeder at-sea distributions.

For species for which DAS data can be used to age birds, such as gannet, this work will then examine the feasibility of combining tracking and DAS datasets to improve mapping outputs. This work could build on the modelling framework developed by the ORJIP “Integration of tracking and at-sea survey data (InTAS)” project, for making use of at-sea survey and telemetry data to improve understanding of seabird distributions.

Once a comprehensive understanding of the volume and format of data has been established, and data has been synthesised or analysed, then a series of conclusions will be drawn, regarding the feasibility of:

- extracting information from the tracking and DAS datasets available to infer immature at-sea distributions;
- inferring sabbatical distributions with the data in hand;
- combining different datasets to refine mapping outputs.

3.3. Objective 3 – Identify gaps, challenges and opportunities

For each of the priority species, work under Objectives 1–2 will have identified the datasets that might be available for further mapping work and assess the quality and suitability of the data available. While some data may already exist, they may not be readily usable for the purpose of this work, due to, for example, gaps in coverage or biases in data, or readily accessible, due to e.g. legal constraints of sharing data. Follow-on work (Objective 3) is to undertake a gap analysis, identify any challenges but also collaborative opportunities to augment the volume of existing data that could be used in future mapping work.

With the data that is known to exist and could be explored for further mapping work, what are the remaining gaps? This includes:

- species
- specific immature age classes (0–1, 1–2, 2–3, etc.)
- sabbaticals
- colony monitoring data, specifically productivity data (to help for example identify whether a bird tagged has taken a sabbatical year) and survival studies (to identify gap years from colour-ringing studies)
- spatial coverage: any important colonies or marine regions not covered at all or not sufficiently covered?
- sample sizes and temporal coverage: is the total number of individuals tracked (over a season, and multiple years) enough to be representative of a particular area?
- spatial and temporal resolution: types of tag, frequency of data collection, level of precision in spatial data
- how much uncertainty there is around currently available data?

As with Objective 1, this assessment will require engagement with seabird experts and data holders, especially if datasets are not published.

Some of the identified datasets may not be readily available or accessible at the time when this project is undertaken (e.g. data is due to be analysed as part of another project, embargo on data release, restricted use of data beyond agreed purposes). This feasibility assessment would need to include a thorough investigation of the main barriers to obtaining

access to tracking and at-sea survey data (in both a research setting and an industry context), including legal implications of sharing data (e.g. data sharing agreements, licensing agreements, intellectual property protection). It will progress with an investigation of potential solutions to identified bottlenecks and explore future collaboration opportunities with both research and industry partners, if additional datasets were to be sought to update existing maps (as developed under Objective 2).

3.4. Objective 4 – Develop conceptual frameworks for non-breeder apportioning and facilitate uptake in impact assessments

This work is to develop methodological standards for:

i) apportioning non-breeders observed at sea to relevant colonies, and
ii) apportioning birds observed at sea to age classes and breeding status.

Conceptual frameworks will then be tested, leading to recommendations on suitable apportioning methods for non-breeders, and priority evidence needs, for use in impact assessments.

3.4.1 Developing methodological standards

Proposed activities include:

- exploring the use of various sources of at-sea usage information, such as tracking and DAS data but also novel technologies such cameras mounted on structures at sea, for deriving apportioning metrics:
    - identifying data requirements for impact assessments: what information is needed to assign immatures or sabbaticals observed at sea to SPAs where they have some connectivity to (i.e. they are contributing to the present year or will contribute the following years to breeding numbers of that SPA colony)? What information is needed to calculate relative proportions of breeding adults, immatures and sabbaticals at a proposed OWF site? This will require close engagement with impact assessment practitioners (e.g. UK's Statutory Nature Conservation Bodies) through a dedicated expert workshop.
    - identifying any additional data needs for this task: what information is already available through Objective 1–2, and what additional information needs to be collated (e.g. colony data, at-sea distribution of breeding adults)?
    - assessing pros and cons of each source of information (tracking, DAS, other), including assumptions, limitations (e.g. presence versus presence/absence data, spatial and temporal coverage, sample sizes) and implications for deriving robust apportioning metrics.
- reviewing existing apportioning frameworks and identify how these could be adapted to immatures and sabbaticals.
- identifying candidate approaches or combination of approaches to aid non-breeder apportioning and developing methodological standards for two conceptual frameworks; i. apportioning non-breeders to colonies, and ii. apportioning birds to age classes and

breeding status. Priority should be given to adapting existing apportioning frameworks, rather than developing new ones, when this is feasible.

Close engagement with UK's Statutory Nature Conservation Bodies will be essential throughout this Objective to ensure rapid uptake of any new tools produced.

Apportioning birds observed at a proposed OWF site to different non-breeder versus breeder classes requires, for a given species, quantifying relative proportions of immatures, breeding adults and sabbaticals in any given area of sea and time of year. For this, knowledge of at-sea distribution of breeding adults will be required, and Bidders will need to propose a robust approach for comparing breeding and non-breeding distributions in this context. Contemporaneous immature and breeding adult tracking data, possibly DAS data too if available, could be interrogated as these would have similar environmental conditions to the immature and sabbatical data collated. Alternatively, this may be through published distributions of breeding adults, such as for gannet: Wakefield *et al*. (2013), Grecian *et al*. (2012) or Niven *et al*. (2025).

3.4.2 Testing of candidate apportioning frameworks

Both conceptual frameworks will be tested with the data collated throughout this project. This will include, for each framework:

- comparing apportioning outcomes derived from different sources of data (e.g. tracking versus DAS versus combined);
- identifying where data availability may be limiting robust testing.

3.4.3 Providing recommendations

Based on the outcomes of the previous activities within this Objective, this last task will produce detailed recommendations on suitable non-breeder apportioning methods for use in impact assessments and will require close engagement with impact assessment practitioners (e.g. UK's Statutory Nature Conservation Bodies).

This includes:

- a detailed description of what robust non-breeder apportioning methods would look like, with recommendations on data requirements (e.g. data collection method, resolution, coverage, minimal sample sizes);
- an assessment of whether existing apportioning methods and tools developed for breeding adults need amending to consider non-breeders, or whether new apportioning methods or tools need to be developed;
- assessing how new approaches could be integrated within impact assessments, through development of an implementation road map;
- identifying priority evidence needs to augment currently available datasets and allow further testing of approaches.

3.4.4 Delivering non-breeder apportioning tools (as required) and engaging with stakeholders to maximise uptake in impact assessments

If the testing of new conceptual frameworks is successful, and there is appetite from stakeholders to roll out non-breeder apportioning tools in impact assessments, then the Contractor(s) should deliver the required tools, and make sure they are both accessible to and usable by the end-user community. This includes providing best practice guidance on how to use the new tool(s), with recommendations on data standards and interpretation, illustrated with worked examples. Upon publication of the tools, a series of engagement events will need to be arranged, through webinars, presentations to marine industry groups and interactive hands-on practice/tool demonstration sessions.

3.5. Objective 5 – Plan future work

Building on the recommendations developed under Objectives 1–4, this last Objective is to provide a detailed plan to address key evidence gaps through additional data collection, focusing on immature birds in the first instance, but also considering what may be required for sabbaticals. Where should future data collection efforts be targeted to help further testing of apportioning frameworks, validate assumptions, and ultimately reduce uncertainty during the apportioning stages of an impact assessment?

This work will look at the feasibility of conducting novel data collection for several candidate species, through for example tagging studies and DAS. Specifically, considerations will be given to the feasibility of tagging immatures caught at colonies. In a few seabird species, immature birds do not return to the colony at all, therefore alternative methods through, for example, remote download technology and tagging of chicks/fledglings may be required. This review may also include the use of remote at-sea monitoring technologies (such as cameras mounted on artificial structures and AI-aided data analysis) to generate additional data on presence/absence and abundance of non-breeders at sea.

Considerations should be given to:

- where to tag and/or survey
- minimum sample size requirements
- tag/equipment deployment effort
- which tags/technology to use
- resolution and scale of data acquired
- any technology development
- any foreseeable important technological risks/challenges
- any resource, health & safety and ethical/welfare considerations

Ultimately, this assessment should provide enough details to answer the question: “is novel data collection warranted, achievable and if so at what cost?”. The Contactor(s) will present a number of evidence gathering avenues in terms of their level of priority (is this additional evidence absolutely essential, or nice to have), likelihood of success (high, medium, low), timescale (can the evidence be delivered in the short-, medium- or longer-term?) and indicative cost (low, moderate, high). This will help prioritise future work.

4 Outputs

The Contractor(s) will produce a series of resources that include the following:

- Objective 1: a list of all at-sea distribution datasets identified for several key species, and a detailed account of available data and metadata. The approach to searching for datasets, including how additional information was obtained from experts, should be described.

- Objective 2: a list of collated tracking and DAS data per species presented by type, format and volume, and a series of informative mapping products, presenting existing information on seasonal at-sea distributions of immatures, and potentially sabbaticals too if data are available. This should be accompanied by a list of conclusions regarding the feasibility of inferring at-sea distributions of immatures and sabbaticals, with the data in hand.

- Objective 3: a clear and detailed presentation of identified gaps and challenges for making use of existing data to generate robust understanding of seasonal at-sea distributions of non-breeders in UK waters. An indication of how the use of additional datasets could be maximised through future collaborative projects.

- Objective 4: description of methodological standards for i) apportioning non-breeders observed at sea to relevant colonies, and ii) apportioning birds observed at sea to age classes and breeding status. An assessment of what additional data may be needed to improve confidence in apportioning approaches, with clear recommendations for developing robust non-breeder apportioning methods for use in impact assessments, including a road map for implementation. Delivery of new tools, as they become available, with associated guidance and stakeholder engagement to facilitate uptake.

- Objective 5: a detailed assessment of what would need to be considered in future data collection campaigns. A summary table presenting a few evidence gathering avenues in terms of their level of priority, likelihood of success, timescale and indicative cost.

Additional presentations and updates will be given throughout the course of the project, typically following completion of major milestones to allow for any emerging issues to be addressed promptly.

5 Timescale

An indicative timeline of work is provided below, and the Contractor(s) should provide a detailed Gantt chart, showing how long each objective will take to deliver and when delivery will take place. The key objectives, milestones and deliverables of this contract are:

- Week 1: start-up meeting
- Week 8: initial review of existing datasets completed (Objective 1)
- Week 20: additional information from experts gathered (Objective 1)
- Week 36: analyses of existing data competed (Objective 2)
- Week 40: gaps, challenges and opportunities identified (Objective 3)
- Week 42: draft report to stakeholders
- Week 47: stakeholder consultation on apportioning tool requirements for impact assessments (Objective 4)
- Week 55: conceptual apportioning frameworks developed and tested (Objective 4)
- Week 63: recommendations for future work delivered (Objective 5)
- Week 65: draft report to stakeholders
- Week 71: dissemination and engagement; final outputs and project close

6 Contractor requirements

The Contractor(s) would need to demonstrate the following requirements:

- Excellent knowledge of seabird ecology, particularly UK breeding species.
- Experience in spatial data analysis, particularly with analysing seabird tracking and at-sea survey (e.g. DAS) data.
- Understanding of best practice and issues around undertaking seabird tracking studies and at-sea surveys.
- Track record of undertaking seabird tracking studies in the UK, and can demonstrate access to tracking data for use in non-breeder at-sea distribution analyses.
- Can demonstrate access to DAS datasets for use in this project (including northern gannet in UK waters).
- Can demonstrate access to breeding adult at-sea distribution data for use in this project (see Objective 4).
- Demonstrated network of contacts/expertise, ability to identify and contact relevant experts for further information; ability to work in partnership.
- Ability to access relevant literature, including scientific journals and grey literature (e.g. industry, NGO or government reports).
- Good understanding of offshore wind impact assessments.
- Good understanding of the interactions between offshore windfarms and seabird populations.
- Previous experience with delivering similar work.

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