Offshore Renewables Joint Industry Programme

Strategic Joint Industry Project No.1: Bird avoidance behavior and collision impact monitoring at Offshore Windfarms

---

Final Draft

Scope drafted by Philip Bloor of Pelagica
and the Interim Working Group

December 2012

Important Note: This scope of works has been drafted based on recommendations given by the Strategic Ornithological Support Services (SOSS), a forum of ornithologists with expertise in environmental planning and consenting of offshore wind farms. This is the second and final draft following consultation with the offshore wind farm industry and Statutory Nature Conservation Bodies. Final comment and acceptance of the scope is now needed from consultees before appetite of industry is assessed to proceed to procurement.

Scope of Work

Bird avoidance behaviour and collision impact monitoring at Offshore Windfarms

Aims and Objectives

The aim of this project is to quantify avoidance behaviours of key marine species at offshore wind farms. An integrated, multifaceted research programme will be required, enabling investigation of avoidance behaviour at all scales, ranging from estimation of macro avoidance to investigation of micro avoidance behaviour and collisions. This will require the deployment, at operating offshore wind farms, of a proven, practical and cost effective offshore monitoring system, comprising of more than one piece of monitoring equipment on a suitable number of turbines, which is capable of measuring both bird avoidance behaviour and collision impacts.

The aims of the project are to:

- Identify a number of offshore wind farms in the UK or overseas suitable for undertaking a monitoring programme whereby the collation of data obtained will be suitable for use to inform consenting of current and future projects.
- Select a range of suitable equipment that can be deployed in order to measure either or both micro and macro avoidance behaviour [1] and, if appropriate collision impacts.
- Measure the level of bird avoidance and collision at one or more offshore wind farms and provide robust evidence on the rates of avoidance and collision for a number of key species identified as being most at risk from collision with offshore wind turbines.

The objective of the project is to obtain data on avoidance behaviour and collision impacts at operating offshore wind farms using proven, practical and cost effective monitoring systems that can be used to inform the estimation of potential impacts of other offshore wind farms. This aims to reduce the uncertainty over the prediction of the impact of new offshore wind projects on key bird species, and the degree of precaution necessary in assessments in the light of that reduction in uncertainty. In order to meet the objectives of the project a clear rationale for the preferred statistical methods will also need to be presented, that demonstrates a clear understanding of how data collection, using different methods, will be analysed and interpreted in order to maximise the overall usefulness.

The results from the monitoring undertaken during the project will provide robust, substantive evidence on the levels of avoidance behaviour and collision impacts for a range of seabirds and, if appropriate, non-seabird species that currently pose

[1] There are no widely accepted definitions as to what micro and macro avoidance behaviours are. However, micro avoidance (also called near-field avoidance) is broadly considered to be the avoidance by birds within very close proximity of the turbines, some tens of metres and the avoidance of blades. Macro avoidance (also called far-field avoidance) is the avoidance of turbines by birds ranging from some hundreds of metres to a few kilometres of the turbines. Mesoscale avoidance is between rows of turbines.

significant uncertainty for developers, advisors and regulators during collision risk modelling for consent applications.

Background to the project

Potentially one of the most significant environmental impacts from offshore wind farms is the risk of birds colliding with the turbine blades. There is considerable uncertainty over the scale of any impact from collision mortality on birds due to the relatively few detailed monitoring studies so far undertaken. However, the results from those that have been undertaken indicate a very high level of avoidance behaviour. The results from these studies are used widely and extensively in wind farm applications to demonstrate that there will not be any significant or adverse effects arising from the proposed development.

To date the level of evidence to support the applications has been proportionate to the likely scale of impact and most applications have been approved based on the level of evidence available and precautionary avoidance rates of either 95% or, more recently, 98%. However, uncertainties over the scale of potential impact have caused significant delays in the consenting process. As the number of offshore developments increases, and consequently as does the scale of predicted cumulative impacts, there is in an ever increasing risk that the numbers birds predicted to collide, based on the current level of knowledge, will not result in future projects gaining consent under either the EIA or Habitats Regulations.

It is widely recognised that in order to minimise the future risk of offshore wind farm developments not being consented, further robust evidence on the level of avoidance behaviour is required. In order to achieve this, a large-scale project is required that will provide the level of evidence needed to ensure that future applications and EIAs are based on sound evidence based conclusions.

In 2010, the Strategic Ornithological Support Services (SOSS) commissioned a study to review methods to monitor collisions or micro-avoidance of birds at offshore wind turbines[2]. Following on from the recommendations of this report, a second study was commissioned to review the methods currently available to monitor collisions or micro-avoidance[3]. This second study examined the feasibility of a number of systems being developed to monitor collisions offshore and identified the steps required in order for the evolving technology to be successfully developed and deployed.

The conclusions from this study recognised that offshore testing and validation would be important in developing a suitable system and recommended the "*Offshore testing of one or more, or a combination of systems"*.

Furthermore,

"… *any system should be used as part of a focused research program, aimed at tackling the question of bird collisions at offshore turbines. Research should aim at identifying the factors related to collision events and their relative frequency, through comparisons with flight intensity and species composition. The above will not only determine what system is most applicable for the purpose, but also the structure of this program and analysis of data.*"

[2] Collier, M.P., Dirksen, S., Krijgsveld, K.L. (2011). *A review of methods to monitor collisions or micro-avoidance of birds with offshore wind turbines*. Report prepared Bureau Waardenburg for Strategic Ornithological Support Services Project SOSS-03A.

[3] Collier, M.P., Dirksen, S., Krijgsveld, K.L. (2012). *A review of methods to monitor collisions or micro-avoidance of birds with offshore wind turbines. Part 2: Feasibility study of systems to monitor collisions*. Report prepared Bureau Waardenburg for Strategic Ornithological Support Services Project SOSS-03A.

Following on from the publications of the two SOSS-03 reports, SOSS members identified **an urgent requirement** to undertake a strategic field based project to collect data on actual avoidance behaviour and collision impacts at offshore wind farms. Upon consultation with SOSS, a list of criteria was identified for careful consideration prior to the finalisation of the scope of works (Annex A). The criteria for consideration require consultation with industry, to ensure the final scope delivers an appropriately designed and cost-effective monitoring project that meets industry's data requirements for future consenting.

Offshore Renewables Joint Industry Programme (ORJIP)

Following on from the recommendations made in the reports, an Interim Working Group comprising of Marine Scotland (MS), the Department of Energy and Climate Change (DECC) and The Crown Estate (TCE), are seeking proposals to design and implement a monitoring study that meets the criteria defined in this scope of works. It must use a range of appropriate detection systems that can be deployed at relevant offshore wind farms, to accurately determine bird avoidance behaviour and collision impacts with offshore wind turbines and obtain data suitable to assess potential impacts from collisions at offshore wind farms for future UK offshore wind consent applications. It is envisaged that the project will be a Joint Industry Project and will be commissioned as part of a UK-wide Offshore Renewables Joint Industry Programme, DECC, MS and TCE are in the process of establishing by Q4 2012/13. The programme will be joint funded between industry, DECC, MS and TCE and comprise a series of strategic research projects designed specifically to reduce consent risk to offshore renewables projects. Projects will be procured subject to the industry steer and refinement of scope of works, industry appetite for the research and funding securement.

Project 1 Contractor

It is envisaged that it is likely that no single company or institution will be able to provide all the technical expertise required to undertake this project successfully. Ideally, a consortium working together under a single tender will undertake the project. However, in reality this may not be achievable and there may be more than one successful tenderer each providing specific expertise to the project.

Scope of work

Task 1: Testing and validation of monitoring system

Goal: In order to achieve the objectives of this research, suitable monitoring system will need to be identified that can be effectively deployed at an offshore wind farm for a long enough period of time in order to obtain enough data to demonstrate that it is capable of accurately detecting birds' avoidance behaviours and their collision impacts in variable conditions.

If a current system exists, the contractor will be required to provide an evidence based report demonstrating the results of previous testing and validation of the system

Requirements: The monitoring system will probably comprise of multiple technologies that when combined are capable of measuring macro and micro bird avoidance and collision impacts. The spatial scales at which avoidance behaviour would be monitored should be described and justified in tender submissions. Ideally, the contractor should have a monitoring system that is at a stage of development that is ready to be deployed on existing wind turbines. Details of the system proposed to be deployed offshore must be presented, identifying both its

strengths and weaknesses. These should include statements on the predicted reliability of the system and the capability of the equipment to detect both avoidance behaviour and rates of collision in different conditions, e.g. periods of darkness, fog or adverse weather and the ability of the system to transmit data 'real time' to reduce risk of data loss. Close liaison with turbine manufacturers and operators must also be undertaken to ensure that any proposed technologies are compatible with turbine operation. The selected monitoring system should normally be able to identify the birds recorded to a species level.

The types of data required to describe avoidance behaviour may include the flux of birds approaching the wind farm, the flux of birds moving through either the wind farm or sweep area of the blade, individual collision events (i.e. strikes with blades), flight height, ground speed of flying birds and bird species (or species group).

Consideration should be given to the temporal and spatial scales of data that would provide the information on avoidance behaviour required. For example, it may be appropriate to sample macro avoidance behaviour (e.g. 3 hour blocks each day and night) over a large area rather than monitor it continuously. Micro avoidance may be feasible over only a restricted area of the wind farm and continuous monitoring may be required due to the potential rarity of micro avoidance events.

If the monitoring system is not at a stage where immediate deployment is a practicable option, then clear detailed information on the additional development required in order to meet the objectives of this research study should be provided. It should clearly set out which aspects of the system require further development, the estimated time it will take to complete and associated costs.

A period of development and testing may be required to validate the system. A suitable location to validate the system will need to be identified and consideration given on whether the test site should be at an onshore or offshore wind farm.

If required, as part of the validation process all elements of the monitoring system must be made available for review. Where there is potential for commercial sensitivities surrounding aspects of the system that may inhibit the ability to effectively review the system then these must be highlighted.

Product: A monitoring system that is tested and validated to confirm that it is capable of operating reliably offshore and provide the quality of data required in order to achieve the objectives of this project. The contractor shall prepare a report demonstrating that the data obtained from monitoring will be robust and reliable. If required, the report should clearly identify any weaknesses in the monitoring system or the data obtained and how these may affect the results presented from Task 3 and may be overcome in future monitoring programmes.

Task 2: Identify suitable field-study duration

Goal: Work with the To identify the suitable duration of the proposed research project and the number of sites to be monitored.

Requirements: The target duration of the research project including report preparation and publication is two to three years. Within this timescale, consideration must be given to the likely duration of the field work and number of study sites required in order to obtain a suitable data set from which robust conclusions on both avoidance behaviour and collision impacts can be obtained for a range of different species, seasons and weather conditions.

However, it is recognised that this may be constrained by both the requirement to present results from this study in a timely manner and the availability of resources.

Product: An evidence-based statement describing the likely duration of field studies required to ensure a suitable data set is obtained from the selected wind farms.

Task 3: Monitoring avoidance behaviour and collision impacts

Goal: Obtain robust data on avoidance behaviour and collision impacts of birds and if relevant to consenting of new projects, non-seabird species, at one or more offshore wind farms using a proven, practical and cost-effective monitoring system.

Requirements: The contractor shall undertake monitoring of avoidance behaviour and collision impacts at the offshore wind farm(s) identified by the Interim Working Group.

Following the testing and validation period identified in Task 1 the equipment will be deployed at one or more offshore wind farms and the contractor shall undertake monitoring over a suitable period of time identified in Task 2. It is recognised that a period of trials may be required in order to demonstrate the reliability and effectiveness of the monitoring equipment deployed. Ideally, this period of time will be kept to a minimum. The contractor will need to determine a suitable duration for the field trials but the duration of the trials should be such that the system is suitably tested for both durability and accuracy in a range of conditions. Monitoring should be undertaken, as far as practicable, for the whole duration of deployment including during periods of darkness or adverse weather conditions, to provide evidence of possible variability in avoidance or collision rates.

It is important that results obtained from the monitoring system should be put into a wider context in order to validate the avoidance or collision impacts recorded and to improve our understanding of the potential variation in collision impacts across the offshore wind farms. To achieve this there will be a requirement to undertake observations across the wider study area i.e. beyond the windfarm boundary simultaneously as avoidance behaviour and collision impacts are being monitored. This may be undertaken using visual observations or radar studies or, most likely, a combination of both.

The influence of prevailing environmental conditions (e.g. visibility, wind speed, time of day, season) as well as bird flight height, speed, flock size and species on avoidance behaviour and collision risk should be assessed using robust statistical analysis[4]. Where this is not possible due to limited data, this must be justified within the summary report. The outputs from the collision monitoring must be compatible with the application of the 'Band model' (Band, 2012) as well as other methods of predicting collision rates.

Product: The programme of trials should lead to robust validation of the suitability of the instrumentation for offshore use, and its performance in a range of weather etc. conditions. Enough data should be obtained from the research to provide good evidence on avoidance and collision impacts on a variety of seabirds suitable to inform Environmental Impact Assessment (EIA) and Habitats Regulations Assessment (HRA)/ Appropriate Assessment (AA) for current and future offshore wind farm developments. The results from the research will be published in one or more peer reviewed, publically available reports and presented at suitable fora. The successful bidder should identify the likely journals within which the outputs will be published and the international academic experts whom will be appropriate to undertake the peer review.

[4] This would best be done by experienced ecological modellers as this is fundamental to the successful delivery of the product as described above.

Project Outputs

A number of project outputs will be required:

- An evidence-based statement describing the likely duration of field studies required ensuring a suitable data set is obtained from the selected wind farms. This must include the compatibility of the proposed methodologies with existing wind turbines and opportunities for the incorporation of the technology during turbine manufacture.
- A report providing technical details of the instrumentation to be deployed, demonstrating that the data obtained from monitoring will be robust and reliable and be applicable for future consent applications.
- An interim report following the first six months of project kick off and every 6 months of monitoring thereafter presenting initial findings and identifying any issues arising.
- On completion of the monitoring, a final technical report presenting all the results on avoidance behaviour and collision impacts for the species agreed in the scope of works.
- Publication of the findings of the research in a peer reviewed journal.
- Presentation of the results at appropriate meetings.

Priority Species and Site selection

The Interim Working Group has recognised the importance of identifying the key species of concern and consequently the most appropriate sites to undertake the proposed work. Following discussions with company representatives and stakeholders at a project workshop held on 6 November 2012 a number of key species of concern were identified:

- Kittiwake,
- Great black-backed gull,
- Lesser black-backed gull,
- Gannet.
- Herring gull
- Little gull

Whilst not deemed as important as the Gulls above the following two species were also recommended for inclusion in the study if applicable:

- Great skua
- Common tern

It is also recognised that any sites that are eventually selected will also have other species at potential collision risk including for example passage species, e.g. Swans and Geese.

The presence of sufficient numbers of the priority bird species is critical to the success of the project and is therefore the overriding justification for the choice of operational windfarms for the study. Based on the results of the identification of the priority bird species, a high level review of available data from the currently constructed offshore wind farms was undertaken to identify which sites held the highest densities of the key species across the year. Further discussions between the developers of the above sites and the Interim Working Group are currently

underway to confirm the suitability of the identified sites to undertake the proposed work.

Project Duration

We expect that the Contract will be awarded in Q1 2013 with the project commencing immediately. The project will run for a period of three years with final reports published in Q1 2016.

Budget

The budget for the project has still to be determined but it is envisaged that in order to achieve all the aims and objectives of the project a budget of between £1 - 5 million will be required. Please note, that costs will vary depending on the number of species being monitored and the different types of technology that are deployed.

An estimated breakdown of costs is presented below but these are very much considered indicative at this stage until the results from the tendering exercise are known.

Activity	Cost (£)
Testing and validating system - based on testing one system at a single site.	£150,000
Micro avoidance and collision monitoring system costs - based on the installation of five systems at a single offshore wind farm at £200,000 per system, for a period of up to two years.	£1,000,000
Macro survey costs – these will vary significantly depending on the method used i.e. aerial or boat based.	£1,100,000
Statistical analysis and report writing. Includes interim and final reports. Preparation of publications, Presentations at suitable fora.	£250,000
Total for each wind farm	£2,500,000

Currently it is envisaged that two wind farm sites will be selected indicating total costs at £5,000,000.

Although there will be some funding from MS, DECC and TCE to manage the programme and projects procured, the primary source of funding will be required from industry. Consequently, the level of funding available for the project is dependent on the level of financial support and project appetite from industry. It is therefore possible that enough funding may not be made available to achieve all the aims and objectives set out in this Scope of Work. Should this occur, then decisions will be made as to which aims/options, if any, will be taken forward and the scope revised accordingly.

Annex A

Key Criteria for Future Research Programme identified by SOSS members

- Testing and validation of monitoring systems,
- The length of study required,
- The number of study sites required to provide an understanding of mean avoidance rates, and the variation around these, that can be used to provide recommendations as to the avoidance rates to be used in collision risk modelling,
- Key species of concern (see SOSS-03 outputs) and thus the study sites considered,
- The need for associated monitoring to put the relative frequency of collision events in context and so be able to validate avoidance rates. Thus, in addition to the development of technologies to monitor collisions, the study should also include radar and visual monitoring,
- The technologies used to monitor collisions should also be able to record collisions during both day and night, and in all weather conditions, so as to be able to provide an understanding the factors causing variation in collision rates,
- The need for species identification,
- The need to understand variation in collision rates across the wind farm area,
- Validation of existing collision risk models using actual collision rates.

Annex B

List of Species to be refined in consultation with Industry and Stakeholders[5]

Species	Flight height % at blade height	Flight agility	% of time flying	Night flight	Summary score Percent flying at blade height x 1/3(manoeuverability score + % time flying score + nocturnal flight score)
Great black-backed gull	35	2	2	3	82
Herring gull	31	2	2	3	72
Lesser black-backed gull	27	1	2	3	54
White-tailed eagle	24	3	5	1	72
Northern gannet	16	3	3	2	43
Common gull	23	1	2	3	46
Black-legged kittiwake	16	1	3	3	37
Arctic skua	10	1	5	1	23
Great skua	10	1	4	1	20
Black-headed gull	18	1	1	2	24
Sandwich tern	7	1	5	1	16
Black-throated diver	5	5	3	1	15
Great northern diver	5	5	2	1	13
Northern fulmar	5	3	2	4	15
Common tern	7	1	5	1	16
Red-throated diver	5	5	2	1	13
Little tern	7	1	5	1	16
Arctic tern	5	1	5	1	12
Roseate tern	5	1	5	1	12
Razorbill	5	4	1	1	10
Shag	5	3	2	1	10
Common guillemot	4	4	1	2	9
Slavonian grebe	4	4	2	2	11
Greater scaup	3	4	2	5	11
Common eider	3	4	2	3	9
Black guillemot	4	4	1	1	8
Great cormorant	4	4	2	1	9
Common goldeneye	3	3	2	3	8
Common scoter	3	3	2	3	8
European storm-petrel	2	1	3	4	5
Velvet scoter	3	3	2	3	8
Leach's storm-petrel	2	1	3	4	5
Great-crested grebe	4	4	3	2	12

[5] Furness, B. & Wade, H. (2012) Vulnerability of Scottish seabirds to offshore wind turbines. Report commissioned by Marine Scotland.

Long-tailed duck	3	3	2	3	8
Little auk	4	3	1	1	7
Atlantic puffin	1	3	1	1	2
Manx shearwater	0	3	3	3	0
Sooty shearwater	0	3	3	3	0

NB. It is also recognised that there are potential impacts with waterfowl such as Swans and Geese at specific sites.

Appendix C

List of Potential Project Locations

	Site	Developer	Anticipated date of completion
Operational			
R0	Blyth	EON	Complete
R1	Barrow	Centrica & DONG	Complete
R1	Burbo Bank	DONG	Complete
R1	Gunfleet Sands I	DONG and Marubeni Corporation	Complete
R1	Inner Dowsing	Centrica (Owned by Centrica 50% and TCW 50%)	Complete
R1	Kentish Flats	Vattenfall	Complete
R1	Lynn	Centrica (Owned by Centrica 50% and TCW 50%)	Complete
R1	North Hoyle	RWE Npower (Owned by Zephyr Investments Ltd = RWE, Prudential M&G and JP Morgan IIF)	Complete
R1	Ormonde	Vattenfall	Complete
R1	Robin Rigg E	EON	Complete
R1	Robin Rigg W	EON	Complete
R1	Rhyl Flats	RWE NPower	Complete
R1	Scroby Sands	EON	Complete
R2-04	Gunfleet Sands II	DONG and Marubeni Corporation	Complete
R2-03	Greater Gabbard	SSE 50% and RWE Npower 50%	Complete
R2-11	Thanet	Vattenfall	Complete
R2-13	Walney 1	DONG (Owned by DONG 50.1%, SSE 25.1% and OPW (24.8%))	Complete
R2-13	Walney 2	DONG (Owned by DONG 50.1%, SSE 25.1% and OPW (24.8%))	Complete
In construction			
R2	Sheringham Shoal	Statoil and Statkraft	Q4 2012
R2	London Array	Eon Dong Masdar	Q4 2012 [Q1 2013]
R1	Teeside	EDF	Q4 2012 [Q1 2013]
R1	Lincs	Centrica	Q2 2013 [Q4 2012]
R2	Gwynt-y-Mor	RWE	Q2 2013 [Not fully constructed unto Q2 2014]

Danish and Dutch windfarm sites will also be reviewed by the working group to identify the most appropriate locations for the research.