

Potential for joined up marine monitoring and data collection between SNCBs and industry

## **1. Thames Estuary Wind Farm Site Gunfleet**

### **1.1. Overview**

#### **Area of sea in relation to coastline, 12nm and continental shelf, estuaries etc**

Gunfleet Sands Offshore Wind Farm (OWF) lies approximately 7 km off the Essex coastline, south-east of Clacton-on-Sea. The site is owned by DONG Energy Ltd and Marubeni Corporation.

#### **Industry this case study focuses on**

The waters of the UK support an increasing number of offshore wind farm developments. The outer Thames Estuary is an area that supports a particularly notable concentration of developments that are planned, licensed, under construction or operational. One such development is the Gunfleet Sands OWF.

#### **1.1.1. Generic Current Status of Industry Sector**

##### **Overview of sector development and status**

The UK Government has set a domestic goal of reducing carbon dioxide emissions by 20% below 1990 levels by 2010 and 60% by 2050. With specific reference to offshore wind, an ambitious target of 33GW of installed capacity has been proposed by the UK Government, with the announcement of a third round of offshore wind farm licensing providing the mechanism whereby up to an additional 25GW of capacity may be installed.

##### **History and forecast (where known) of requirements to conform to legislation in environmental monitoring**

Requirements to conform to legislation in environmental monitoring include:

- Environmental Impact Assessment (England and Wales) Regulations (1999);
- Marine licensing Habitats Regulations drive the monitoring undertaken by Natural England;
- Marine Works (EIA) (Amendment) Regulations 2011; and
- Water Environment (WFD) (England and Wales) Regulations 2003 (the Water Framework Regulations).

##### **Development of monitoring requirements through different stages of sector development, e.g. licensing rounds**

The UK's offshore wind industry has developed through a series of leasing Rounds managed by The Crown Estate (TCE):

- Round 1 - wind farms were located relatively close to shore and were generally small in scale.

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- Round 2 - wind farms released in 2003, were generally larger in scale and slightly further offshore.
- Round 3 - released at the end of 2009, adopted a different approach through the award of nine offshore wind development Zones, rather than the award of individual development sites.

Round 2 projects have taken longer to gain consent than Round 1 due to a number of factors including less experience of potential impacts from round 1 than was anticipated and greater requirements for Appropriate Assessments.

As a standard, monitoring includes a pre-construction survey to provide a baseline for subsequent monitoring, a second survey during construction and more annual surveys on consecutive years following construction. Licence conditions vary on a site-specific basis. Cefas undertook a desk-based review in 2010 of monitoring reports from UK wind farm. Inadequacies were highlighted within the report due to the learning curve associated with the relatively new technology of offshore wind development and issues applying to both the developer and licensing body

#### **Emphasis on particular biological (and biophysical) parameters and reason for this**

Particular biological (and biophysical) parameters include:

- benthos - specifically impacts from noise and vibration, temperature, electromagnetic fields, contaminants and disturbance
- fish and shellfish - including effects of electromagnetic fields on electro-sensitive fish, fish aggregation effects, interference/displacement of fishing activity, habitat changes and impacts on commercial fisheries, shellfisheries and aquaculture
- coastal Processes - Including changes in suspended sediment concentrations (during pile installation and cable laying), seabed morphology and scour
- underwater noise - Potentially causing behavioural disturbances and injury to species
- birds - Including collision risk and barrier effects
- marine mammals - Injury, behavioural disturbance
- water and sediments - Pollution potential.

#### **Approach to data standardisation (especially qualitative assessments) within sector**

Work undertaken by Cefas in 2010 was the first step in providing recommendations and a framework for future monitoring of offshore wind farms by strategically reviewing monitoring reports and formulating more general recommendations across the sector for future monitoring. Approaches to standardisation are being progressed including work undertaken by COWRIE on best-practice guidelines for boat-based

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and aerial platform bird and cetacean surveys, the collection of underwater noise data during piling; and the measurements of electromagnetic fields from power cables.

### **1.1.2. Overview of Case Study Industry Activities**

#### **Characteristics of main industry in case study including status of development and development round**

The licensing process for Gunfleet Sands OWF was undertaken within two separate phases; “GS1 in Round 1 (licensed in 2002) and GS2 in Round 2 (licensed in 2007)”. GS1 contained provisions for the construction of a total of 30 turbines across the area, and GS2 contained provisions for the construction of a further 22 turbines. The combined output of these two sites is 172MW.

#### **Characteristics of other industries in area**

Gunfleet Sands OWF is situated within the outer Thames Estuary which is an area which supports a great deal of industrial activity. Not only does the area support a significant number of planned, developing and operational wind farms, such as the London Array, but it also supports a comparatively dense network of marine aggregates extraction areas such as the Long Sand Head Licence Area. In addition to these operations the area supports a number of busy shipping lanes, a number of large ports such as Felixstowe and a not inconsiderable fishing fleet.

#### **Specific local / national drivers for monitoring**

Drivers include surveys required under the:

- Environmental Impact Assessment (England and Wales) Regulations (1999)
- Habitats Regulations drive the monitoring undertaken by Natural England
- Marine Works (EIA) (Amendment) Regulations 2011
- Water Environment (WFD) (England and Wales) Regulations 2003 (the Water Framework Regulations)
- Marine licensing – specifically the Schedule of Conditions attached to Food and Environment Protection Act licence (now Marine Licences, post April 2011).

Specific local/national drivers for monitoring are required as the Gunfleet Sands OWF falls within the Outer Thames Special Protection Area (SPA), as discussed in further detail below.

### **1.1.3. Overview of Case Study MPA Designations**

Gunfleet Sands OWF is located within the Outer Thames SPA. The Outer Thames SPA was designated under the EU Birds Directive (1979) and covers an extraordinarily large area of 379,268.14 hectares. This area was selected for designation to provide protection for the significant population of Red-throated

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divers (*Gavia stellata*) which inhabit the area outside of their breeding season. This site supports approximately 40% of the total UK population of this species during winter.

Other designations in the Thames Estuary include:

- Recommended Marine Conservation Zones (rMCZ)
- Blackwater Estuary Site of Special Scientific Interest (SSSI), SPA and Ramsar site.
- Essex Estuaries Special Area of Conservation (SAC)
- Thanet Coast and Sandwich Bay SPA and Ramsar site
- Sandwich Bay to Hackling Marshes SSSI.

## **1.2. Industry Monitoring Programme**

### **1.2.1. Survey Characteristics**

#### **Development of monitoring through different stages of sector development**

Much of the deliberation during the consenting process concerns uncertainties over the environmental effects of offshore wind projects. With Round 2 being developed before some Round 1 developments were complete, there was little time available to gather and analyse monitoring data from early projects so that lessons learned could be applied to later projects.

Throughout the inception, planning, development and operation the site developers Gunfleet Sands OWF have commissioned a range of ecological and physical environmental studies in order to secure and maintain their relevant development licences. Ecological monitoring programmes by industry include baseline surveys to feed into Environmental Statements (ES) and EIAs, which are driven by license agreements. Ecological monitoring protocols and techniques take into consideration regulatory guidelines set out by government bodies.

#### **Biological (and biophysical) features monitored**

The FEPA licence for the Gunfleet Sands OWF requires that the licensee commissions monitoring of the following:

- sediment and hydrological processes
- benthic ecology
- electromagnetic fields
- noise and vibration
- fish monitoring

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- birds
- cetaceans
- pinnipeds
- basking sharks.

The Licence Holder was required to submit the reports of monitoring activities set out in the Supplementary Conditions to the Licensing Authority. This includes:

- monitoring of Sedimentary and Hydrological Processes, Benthic Ecology, Electromagnetic Fields and Noise and Vibration as scheduled
- proposals for adequate pre-construction baseline and post-construction surveys of fish populations in the area of the wind farm giving consideration to non-destructive methods
- ornithological monitoring subject to written agreement and consultation including post construction monitoring for 3 years
- a Marine Mammal Mitigation Programme, including a marine mammal observer to ensure piling activities do not commence until 30 minutes has elapsed during which marine mammals have not been detected
- a bathymetric survey to assess changes within the array and the need to apply additional scour protection within 3-6 and 9-12 months after construction.

To date, surveys have been carried out during the EIA phase of the project (2000/2), and the pre-construction phase of the project (2008). The licence holder is also required to commission relevant surveys throughout the operational phase of the development and following decommissioning.

Monitoring Advice in the FEPA licence for Gunfleet Sands OWF include:

- **Aerial Surveys**-Four surveys to be carried out during the winter months, of which 2 must be undertaken in the mid-winter period (at a comparable time to those undertaken in the EIA), to enable comparison with the baseline flights shown in 2002 and 2003. These are to be undertaken over a period of three-winters post construction.
- **Boat Surveys**- Two surveys per month during the period November to beginning of March covering the winter period for 3 years post construction.
- **Automatic Monitoring**- Prior to construction, the Licence Holder will undertake a study into the applicability and value of 'state of the art' techniques for monitoring collision impacts, including radar, infrared technology, camera and impact noise monitoring. Post-construction the Licence Holder to support a project to further assess the equipment or install or maintain the equipment on site for a period of three years and report on the findings.

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**Spatial scale, including distribution or coverage / extent of survey effort and density of focused survey points / lines; also important to account for area of impact as dictated by tidal excursion**

The requirement that monitoring programmes should include temporal and spatial considerations (including interaction with other wind farm sites and activities) has been recognised. However, detecting change considering the relatively short time scale that wind farms have been monitored and the large natural variability that can be experienced, has been difficult (Cefas, 2010). Offshore wind development is a relatively new and emerging area and new technologies relating to the construction of wind farms will mean monitoring techniques need to develop to accommodate this.

### **1.2.2. Monitoring methods**

#### **Monitoring protocols and survey methods**

Monitoring protocols and survey methods are outlined within conditions in the FEPA licence 31919/08/0 for Gunfleet Sands OFW. The monitoring protocols and survey methods are outlined below:

#### **1. Benthic ecology**

Licence conditions required:

- Locations for ongoing monitoring to be determined by factors such as precise monopile locations, location of cables etc. taking into account factors such as sensitive areas, coastal processes modelling outputs (for sediment transport/deposition information) and geophysical surveys (to ensure adequate coverage of seabed habitats).
- Samples should be taken to adequately cover the extent and direction of the full tidal excursion and have adequate controls.
- The number and location of the sample points to be submitted to the Licensing Authority along with a plan and rationale and agreed with CEFAS and English Nature (Natural England) at least one month prior to the survey works commencing.
- The survey should be designed in line with the approach described in the DTLR publication 'Guidelines for the conduct of benthic studies at aggregate dredging sites, May 2002'.
- If directional drilling is not used, intertidal invertebrate sampling must be undertaken at lower, mid and upper shore sampling stations along three transects running perpendicular to the shore in the area of the cable landfall.
- The Licence Holder must therefore provide the details of the methodology used for cable laying at least two months prior to works commencing so that recommendations on the benthos monitoring specifications can be made.

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To date, the survey specifications have been agreed with the regulators, are largely compliant with the methods outlined and have been approved by the relevant industry regulator and regulatory advisors. Laboratories undertaking taxonomic analysis are often members of the National Marine Biological Analytical Quality Control (NMBAQC) scheme.

It is a condition of the licence that the monitoring surveys shall be comparable with the methodologies used during the pre-dredge baseline monitoring surveys carried out in 2008. The data generated by industrial monitoring are thus produced to a pre-specified standard.

For wind farms in general, Cefas have noted that while survey guidelines are available (Boyd, 2002) for benthos, survey techniques have varied across sites, sometimes in relation to these site-specific issues.

## **2. Electromagnetic fields**

The Licence Holder must:

- provide the Licensing Authority with information on attenuation of field strengths associated with the cables, shielding and burial. As described in the Method Statement, and related to data from the Rødsand wind farm studies in Denmark, and any outputs from the COWRIE tendered studies in the UK (where appropriate) to provide electromagnetic field generated is negligible
- Should this study show that the field strengths associated with the cables are sufficient to have potential significant adverse effects on electro-sensitive species; further biological monitoring may be required to investigate the effect.

## **3. Noise and vibration**

Detailed post construction data must be collected on the frequency and magnitude of underwater noise produced by the Gunfleet Sands OWF.

The choice of sites for installing monitoring equipment should reflect the different conditions such as sediment type, water depth and pile type.

## **4. Fish monitoring**

The EIA observed electro-sensitive species (such as the thornback ray) in the vicinity of the Gunfleet Sands OWF site. In the absence of any evidence that electromagnetic fields do not pose a risk to such organisms, monitoring work is required to determine the numbers and distribution of such species in the vicinity of the Gunfleet Sands OWF. The results should be presented and discussed in combination with the EMF studies.

Fish surveys were undertaken seasonally to acquire accurate representation of the populations., these included:

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- otter trawls conducted in summer (June- September), winter (November – February) and spring (March – May), and beam trawl surveys in the summer months to target smaller species and juveniles that might otherwise be underrepresented by otter trawl alone
- ten otter trawls and ten beam trawls completed in a total of eight sites on and around Gunfleet Sands OWF, and a further two at far-field sites within a reference zone established to the east northeast of Gunfleet Sands OWF
- a suite of three seasonal surveys completed prior to construction to provide representative baseline data. It was proposed that post-construction, three seasonal surveys be conducted each year; repeated initially for two consecutive years post construction
- a twin rig otter trawl with 80 mm mesh was used, consistent with techniques employed by the local commercial fisheries. The headline height was 1.2m in the centre and 1m on the wings. Trawls were towed for 30 minutes at 1.8 knots. The average distance of seabed covered by each trawl was approximately 1667 m.
- beam trawl surveys were conducted with a 2 m beam fitted with a 20 mm stretched mesh (10 mm “knot” to “knot”) and a cod-end liner of 3 mm “knot” to “knot”. The beam trawl was towed at each site for 10 minutes at an average speed of 3.1 knots, and therefore on average each tow covered approximately 956 m.

A herring spawning ground survey was undertaken in spring 2009. This included:

- Sampling beginning in February, and consisting of weekly sampling until the end of the spawning season, with the possibility of twice weekly sampling during the peak of the season. Surveying was to be undertaken with a semi pelagic net with a 32 mm cod end and headline height of no less than 6.5 m.
- The samples were to be analysed for spawning condition using the 9 stage maturity key and be analysed for sex ratios. Once the net had been fully hauled, the sea temperature will be recorded at 1-metre increments from the seabed to the surface using a Conductivity Temperature and Depth (CTD) Meter and calibrated probe.

Cefas noted that for fish monitoring generally, while the conditions imposed are similar in nature, different target species at different sites has meant that methods and equipment have differed between wind farms. For example, some developments have used existing data (e.g. beam trawl survey data from Cefas), whereas most have commissioned new surveys. Surveys have used scientific and/or commercial gears, some have utilised anecdotal information from fishermen or other surveys whereas others have not. Some have undertaken broad scale surveys whereas others have been more targeted.

## **5. Bird monitoring**

Licensing requirements:



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- Monitoring is to commence with at least a year of baseline, pre-construction data gathering and monitoring during the year of construction.
- Post-construction monitoring annually for three years.
- The level of subsequent monitoring, during the lifetime of the wind farm's operation, to be determined, in agreement with English Nature (Natural England) by the magnitude of change in bird populations observed in the initial monitoring period.
- Monitoring should be linked, where appropriate, with the benthic monitoring.
- Monitoring reports will be provided to English Nature (Natural England) annually, or more frequently where the results of the data may trigger further monitoring work.
- Monitoring of an agreed reference site will also be carried out in parallel to the wind farm site.
- Monitoring will need to confirm the predictions made in the EIA are correct, assess collision risk prior to construction of the wind farm and any actual collisions during and post construction, and provide generic information on bird/wind farm interactions.

The accumulated total number of individuals of Red-throated Diver recorded over 23 vessel surveys (Oct '01- Jul '02) was reported within the Environmental Statement (ES) and the predicted impact on the local wintering population of Red-throated Diver classified as minor/moderate. However, monitoring of the impact on birds was ongoing and it was recommended that for the first years of the operational phase, monitoring of specific species and aspects should be undertaken.

In general, Cefas noted there were similarities between wind farms sites and bird monitoring as basic ornithological monitoring methodologies are standardised and set out by COWRIE guidance. However, for other techniques, such as migration monitoring and radar surveys, standardised techniques do not exist and therefore the developers devised their own methods and analysis techniques. In some cases, these data were then not used, which should be discouraged as these techniques are often required for meeting licence conditions, such as those for barrier effects, which cannot be met by the basic standardised monitoring methods alone.

## **6. Cetaceans, pinnipeds and basking sharks**

Cefas noted that with regards to marine mammals, initially very little was requested of the developer, and whilst there was a licence condition requiring a minimisation of disturbance, the condition was vague and allowed multiple interpretations, resulting in a lack of similarity in methods and data produced. However, primarily as a result of the introduction of MMMPs, the more recent wind farms have similar monitoring conditions.

### **1.2.3. Post Survey Data Processing**

**Type of processing and data products derived, including level of detail provided. Provide detail for different parameters as relevant.**

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Based on the Preconstruction benthic ecology report by RPS Ltd (Tessa McGarry, 2008), multivariate analysis of the sediment data was carried out using PRIMER. Additionally, cluster analysis was carried out to determine whether the sites fell into any distinct groupings and Univariate indices were calculated for each site.

**Quality assurance carried out whether internal / external and if required by regulations or completed anyhow (and confidence of data). Provide detail for different parameters as relevant.**

Quality control included using a laboratory which was a member of the NMBAQC scheme.

#### **1.2.4. Dissemination of Data Products**

**Ultimate owner of data and any restrictions in place**

Liaison with CMACS Ltd has confirmed that monitoring reports are made public through The Crown Estate.

**Sensitivity of data, obstructing data sharing**

No real sensitivity issues have been identified

#### **1.2.5. Internal Survey Management**

**Internal system adopted / used, protocols**

Subcontractors e.g. CMACS Ltd, follow the protocols and internal systems required by the client (DONG) and general recommendations are.

**Health and safety and risk management policies / approach**

The Health and safety and risk management policies / approach are also specified by the client (DONG). This includes standard risk management based practices and relates to marine coordinator audits and training.

**Timescales working to with planning, contracts, survey, data processing etc**

The survey plan and methodology were agreed at the outset with regulators and CMACS Ltd was not involved in this process.

**Funds available for programme, source and flow of money**

Monitoring was paid for by the client.

#### **1.2.6. "Upwards" Contractual Obligations**

**Contractual limitations in liability of equipment**

CMACS Ltd follow DONGS Standard terms of equipment liability.

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### **1.2.7. “Downwards” Contractual Set Up**

#### **Number of tiers sub-contracted survey operation, organisations involved and management / level of interaction or involvement by client**

CMACS Ltd contracted by DONG to undertake benthic work only. Vessel charter also required to undertake works.

### **1.3. MPA Monitoring Characteristics**

#### **1.3.1. Survey Characteristics**

##### **Biological (and biophysical) features monitored**

Natural England are required to undertake an assessment of the condition of the Outer Thames SPA once every six years. Parameters measured include Red-throated Diver population size, habitat extent of sublittoral, shallow sandbank habitat and also prey items for Red-throated Diver. A range of other biological parameters are measured by the Environment Agency and Cefas which overlap with the Outer Thames SPA. Further details of these are included in the table below. Miriam Knollys at Natural England confirmed that at the time of writing Natural England/JNCC had only undertaken an assessment of the area’s potential for qualification as a marine SPA (May 2009). However, budget was currently in place for further work on the SPA potentially involving condition monitoring.

##### **Temporal characteristics, including period of survey (e.g. seasonal control), inter-annual requirements, also frequency of measurements for data logging (e.g. every minute, hour or day).**

The boundary for Red-throated Diver within the Outer Thames SPA is based on the identification of a density threshold using data from 37 days of survey of the Greater Thames from between January 1989 and March 2005 and analysed by Webb *et al.* (2005). Additional aerial surveys were carried out during the winters of 2005/06 and 2006/07, covering previously surveyed areas and new areas beyond the possible SPA seaward boundary.

Temporal characteristics of the parameters surveyed by the Environment Agency and CEFAS are included in the following table.

##### **Spatial scale, including distribution or coverage / extent of survey effort and density of focused survey points / lines; also account for area of impact as dictated by tidal excursion.**

**Table 1, showing current monitoring schemes in the Thames Estuary**

<b>Data Type</b>	<b>Source</b>	<b>Stage</b>	<b>Date</b>	<b>Comments</b>
Thames Herring Survey	UKDMOS	Driven by EU Common Fisheries Policy	Earliest start 1989	By Cefas to provides population estimates.
Dangerous Substances Monitoring Programme	UKDMOS	Driven by EC Dangerous Substances Directive	1990	By EA to monitor List I and/or List II substances in water and sediments.
Wetland bird Survey in Thames Estuary	UKDMOS	The Wetland Bird Survey scheme	Since 1953	Bird taxonomy related counts on beach/intertidal zone structure.
Shellfish waters monitoring programme	UKDMOS	Driven by the EC Shellfish Waters Directive	Since 1991	The water quality in areas where shellfish live is monitored each year by EA.
Transitional and Coastal WFD Water column Monitoring	UKDMOS	Driven by EC Water Framework Directive	Since 2007	Surface Water Column monthly sampling for the WFD Surveillance programme by EA.
Benthic Invertebrate WFD Monitoring Programme	UKDMOS	Driven by the EC Water Framework Directive	Since 2006	Not an annual programme. Defined as a rolling programme over 3 years by EA.
WFD Transitional Fish Population Monitoring	UKDMOS	Driven by the EC Water Framework Directive	Since 2006	Programme is limited to estuaries by EA.
Opportunistic Macroalgae Monitoring	UKDMOS	Driven by the EC Water Framework Directive	Since 2007	By EA.
Thames Bass Survey	UKDMOS		Since 2007	By Cefas to determine the distribution and relative abundance of pre-recruit bass.
Shellfish Biotxin Monitoring Programme	UKDMOS	Driven by the EC Food Hygiene Regulations and EC Shellfish Hygiene Directive	Since 2001	To ensure that the products are safe to go onto open market as per the Shellfish Hygiene Directive by Cefas.
Toxic Phytoplankton Monitoring	UKDMOS	To provide information for Shellfish Hygiene Directive	Since 1992	By Cefas.
Shellfish Classification Monitoring	UKDMOS	Driven by the EC Food Hygiene Regulations	Since 1992	By Cefas to measure Bacteria in biota.
Thames Estuary SPA	UKDMOS	Driven by the EC Birds Directive.	Monitoring began in 2001	Minimum sampling frequency of 18 years and a maximum of 4 years.

				Parameters monitored are bird-taxonomy related abundance per unit area of surface.
Furoid Extent Macroalgae	UKDMOS	Driven by the EC Water Framework Directive	Since 2007	Macroalgae and seagrass taxonomy-related counts by EA.
WFD Saltmarsh monitoring	UKDMOS	Driven by the EC Water Framework Directive	Since 2007	Not an annual programme. Defined as a rolling programme by EA.
WFD Seagrass Monitoring	UKDMOS	Driven by the EC Water Framework Directive	Since 2007	Not an annual programme. Defined as a rolling programme by EA.

#### 1.4. Conclusions from desk study

Offshore wind farms are a relatively new industry and the monitoring and approaches to standardising methodologies for environmental assessment are still evolving. Gunfleet Sands OWF appears to provide typical examples of the monitoring undertaken by wind farms, which is significantly related to requirements within the EIA Process and licensing conditions. The industry have already recognised the need to identify collaborative ways of working together to achieve more timely and effective consents and practicable monitoring programmes for Round 3 wind farm projects, which could potentially be enhanced by joint monitoring. Recommendations already identified to achieve effective monitoring programmes include:

- re-evaluation of data already collected from monitoring programmes for evidence of gross effect. Where no evidence is found this should contribute to the regulators’ assessment of significance of effects
- discussion of what is and what isn’t practical in terms of data collection in the marine environment, and development of a definition of an acceptable evidence base
- design of monitoring programmes that clearly link pre and post - construction monitoring and are suitable for validating the predictions made in the ES
- development of a programme between the developer and the regulator to review monitoring outputs, with an adaptive management plan to reduce the monitoring effort and reduce requirements if certain stage gates/requirements are met
- investigation of ways that data from monitoring programmes could be combined with other data gathering programmes to enhance value of outputs.

Joined-up monitoring should also consider the constraints already identified in collecting data in the marine environment, including limitations in monitoring the large areas covered by wind farms, distances from shore, weather, health and safety, costs and supply chain.

The potential for joint monitoring of Gunfleet Sands OWF is potentially less directly relevant than other offshore wind farm case studies. The greatest potential relates to joint monitoring within the Outer Thames Special Protected Area (SPA), which overlaps partially with the site and was selected for

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designation in order to provide protection for the significant population of Red-throated Divers (*Gavia stellata*).

Monitoring of birds therefore, provides some overlap with this SPA. In addition some monitoring of the Gunfleet Sands OWF is indirectly related such as information on coastal processes, and potential impacts on the availability of prey.