MONA OFFSHORE WIND PROJECT

Environmental Statement

Volume 2, Chapter 5: Offshore ornithology

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Image of an offshore wind farm

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Glossary

Term	Meaning
Avoidance	Probability that a bird takes successful evasive action to avoid collision with a wind turbine.
Air draught	Distance between sea level and lowest blade tip.
Bio-season	Bird behaviour and abundance is recognised to differ across a calendar year, with particular months recognised as being part of different seasons. The biologically defined minimum population scales (BDMPS) bio-seasons used in this report are based on those in Furness (2015), hereafter referred to as bio-seasons. Separate bio-seasons are recognised in this chapter in order to establish the level of importance any seabird species has within the study area during any particular period of time.
Biologically Defined Minimum Population Scales	Seasonal subdivision of bird population size. The rationale behind these subdivisions is that the likely origin of a bird in a particular location depends on the time of year.
Collision risk	Risk of a bird lethally colliding with a wind turbine within a wind farm.
Collision risk model (CRM)	A model that calculates collision risk for a species within a wind farm based on a set of wind farm and bird species specific parameters. Collision risk models can be run deterministically or stochastically.
Confidence Interval	A confidence interval displays the probability that a parameter will fall between a pair of values around the mean.
Design-based Abundance Estimates	An estimated total abundance of birds within a given area. The design-based method is based on the premise that the portion of the study area that is surveyed is representative of the remainder of the study area.
Disturbance sensitivity	Disturbance by wind farm structures, ship and helicopter traffic factor used scores from 1 (limited escape behaviour and a very short flight distance when approached), to 5 (strong escape behaviour, at a large response distance).
Habitat specialisation	The habitat specialisation factor represents the range of habitats species are able to use and whether they use these as specialists or generalists. Species habitat specialisation scores used in this Technical Report have been compiled by Bradbury *et al*. (2014). This score classifies species into categories from 1 (tend to forage over large marine areas with little known association with particular marine features) to 5 (tend to feed on very specific habitat features, such as shallow banks with bivalve communities, or kelp beds).
Light Detection and Ranging (LiDAR)	A remote sensing method using pulsed lasers to measure distances to the earth.
Lowest Astronomical Tide (LAT)	The lowest level of the sea surface with respect to the land.
Maximum Design Scenario (MDS)	The wind farm design scenario that is considered the worst case from the perspective of collision risk.
MRSea	Statistical package to model spatial count data and predict spatial abundances. Package has been developed by the Centre for Research into Ecological and Environmental Modelling (CREEM) specifically for dealing with data collected for offshore wind farm projects.
Ornithology	Ornithology is a branch of zoology that concerns the study of birds.

Term	Meaning
Parameter	Parameters are the input elements of a model that together affect the output of a model. In collision risk models, examples of parameters are the number of wind turbines and the length of the bird.
Section 42 of the Planning Act (2008)	Under Section 42 of the Planning Act, the applicant is required to undertake formal and statutory consultation with a prescribed list of bodies, local authorities and those people with an interest in the land, or whose properties may potentially be affected by the operation of the proposed Project.
Significant effect	The significance of an effect is determined by considering the overall importance of the receptor and the magnitude of the effect using a matrix-based approach and applying professional judgement as to whether the integrity of an SPA feature will be affected.
Stochastic model	Model where the input parameters that go into the model are allowed to vary, leading to a range of output.

Acronyms

Acronym	Description
BDMPS	Biologically Defined Minimum Population Scales
BoCC	Birds of Conservation Concern
BTO	British Trust for Ornithology
CEA	Cumulative Effects Assessment
CRM	Collision Risk Modelling
DAS	Digital Aerial Surveys
DCO	Development Consent Order
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
EWG	Expert Working Group
HPAI	Highly Pathogenic Avian Influenza
HRA	Habitat Regulations Assessment
IEF	Important ecological features
IEMA	The Institute of Environmental Management and Assessment
ISAA	Information to Support Appropriate Assessment
JNCC	Joint Nature Conservation Committee
LAT	Lowest Astronomical Tide
LiDAR	Light Detection and Ranging
LSE	Likely Significant Effects
MPCP	Marine Pollution Contingency Plan
MDS	Maximum Design Scenario

Acronym	Description
MLWS	Mean Low Water Springs
MNR	Marine Nature Reserves
MPA	Marine Protected Area
MRSea	Marine Renewables Strategic Environmental Assessment
NPS	National Policy Statements
NRW	Natural Resources Wales
OSP	Offshore Substation Platform
PEIR	Preliminary Environmental Information Report
PVA	Population Viability Analysis
RSPB	Royal Society for the Protection of Birds
SAC	Special Areas of Conservation
sCRM	Stochastic Collision Risk Model
SD	Standard Deviation
SMP	Seabird Monitoring Programme
SNCB	Statutory Nature Conservation Body
SOSSMAT	Strategic Ornithological Support Services Migration Assessment Tool
SPAs	Special Protection Areas
SSCs	Suspended Sediment Concentrations
SSSI	Site of Special Scientific Interest
TWT	The Wildlife Trusts
UK	United Kingdom
ZOI	Zone of Influence

Units

Unit	Description
%	Percentage
kJ	Kilojoules
km^2	Square kilometres
km	Kilometres
m	Metres
MW	Megawatts
nm	Nautical mile

5 Offshore ornithology

5.1 Introduction

5.1.1 Overview

5.1.1.1 This chapter of the Environmental Statement presents the assessment of the potential impact of the Mona Offshore Wind Project on offshore ornithology. Specifically, this chapter considers the potential impact of the Mona Offshore Wind Project seaward of Mean Low Water Springs (MLWS) during the construction, operations and maintenance, and decommissioning phases. Those impacts of the Mona Offshore Wind Project landward of MLWS are addressed in Volume 3, Chapter 4: Onshore and intertidal ornithology of the Environmental Statement.

5.1.1.2 The assessment presented is informed by the following technical reports:

- Volume 6, Annex 5.1: Offshore ornithology baseline characterisation of the Environmental Statement (Document reference F6.5.1)
- Volume 6; Annex 5.2: Offshore ornithology displacement technical report of the Environmental Statement (Document reference F6.5.2)
- Volume 6, Annex 5.3: Offshore ornithology collision risk modelling technical report of the Environmental Statement (Document reference F6.5.3)
- Volume 6 Annex 5.4: Offshore ornithology migratory bird collision risk modelling technical report of the Environmental Statement (Document reference F6.5.4)
- Volume 6, Annex 5.5: Offshore ornithology apportioning technical report of the Environmental Statement (Document Reference F6.5.5)
- Volume 6, Annex 5.6: Offshore ornithology population viability analysis technical report of the Environmental Statement (Document Reference F6.5.6)

5.1.1.3 The offshore ornithology chapter (Document reference F2.5) considers any seabirds that are present at some point in their life cycle in the study areas and non-seabird species using the study areas during migratory flights. The overarching term 'seabird' is used to refer to species that depend on the marine environment for survival at some point in their life cycle. Therefore, in addition to the true seabirds, seaducks, divers and grebes are also included because of their additional reliance on marine areas, especially in the non-breeding season. The study areas are defined in section 5.3.4.

5.1.2 Purpose of chapter

5.1.2.1 The primary purpose of the Environmental Statement is outlined in Volume 1, Chapter 1: Introduction of the Environmental Statement. (Document reference F1.1). In summary, the primary purpose of an Environmental Statement is to support the Development Consent Order (DCO) application for Mona Offshore Wind Project under the Planning Act 2008 (the 2008 Act). The Environmental Impact Assessment (EIA) has been finalised following completion of pre-application consultation and the Environmental Statement will accompany the application to the Secretary of State for Development Consent.

5.1.2.2 In particular, this Environmental Statement chapter:

1. Presents the existing environmental baseline established from desk studies, site-specific surveys and consultation
2. Identifies any assumptions and limitations encountered in compiling the environmental information
3. Presents the potential environmental effects on offshore ornithology arising from the Mona Offshore Wind Project, based on the information gathered and the analysis and assessments undertaken
4. Highlights any necessary monitoring and/or mitigation measures which could prevent, minimise, reduce or offset the possible environmental effects of the Mona Offshore Wind Project on offshore ornithology.

5.1.3 National Policy Statements

5.1.3.1 There are currently six energy National Policy Statements (NPSs), two of which contain policy relevant to offshore wind development and the Mona Offshore Wind Project, specifically:

- NPS for Energy (NPS EN-1) which sets out the United Kingdom (UK) Government's policy for the delivery of major energy infrastructure (Department for Energy Security & Net Zero, 2024a)
- NPS for Renewable Energy Infrastructure (NPS EN-3) (Department for Energy Security & Net Zero, 2024b).

5.1.3.2 NPS EN-1 and NPS EN-3 include guidance on what matters are to be considered in the assessment. These are summarised in Table 5.1. NPS EN-1 and NPS EN-3 also highlight a number of factors relating to the determination of an application and in relation to mitigation. These are summarised in Table 5.2.

Table 5.1: Summary of the NPS EN-1 and NPS EN-3 provisions relevant to offshore ornithology.

Summary of NPS EN-1 and EN-3 provision	How and where considered in the Environmental Statement
NPS-EN1	
All proposals for projects that are subject to the Infrastructure Planning (Environmental Impact Assessment) Regulations 2017 (the EIA Regulations) must be accompanied by an Environmental Statement (ES) describing the aspects of the environment likely to be significantly affected by the project. (NPS EN1 paragraph 4.3.1). The Regulations require an assessment of the Likely Significant Effects (LSE) of the proposed project on the environment, covering the direct effects and any indirect, secondary, cumulative, transboundary, short, medium, and long-term, permanent and temporary, positive and negative effects at all stages of the project, and also of the measures envisaged for avoiding or mitigating significant adverse effects. (NPS EN1 paragraph 4.3.3).	Assessment of the potential effects of the Mona Offshore Wind Project relevant to offshore ornithology is considered in section 5.7. The approach to mitigation is discussed in section 5.6.

Summary of NPS EN-1 and EN-3 provision	How and where considered in the Environmental Statement
For the purposes of this NPS and the technology specific NPSs the ES should cover the environmental, social and economic effects arising from pre-construction, construction, operation and decommissioning of the project. (NPS EN-1 paragraph 4.3.5)	Construction, operations and maintenance and decommissioning effects of the Mona Offshore Wind Project relevant to offshore ornithology are assessed in section 5.7.
Where some details are still to be finalised, the ES should, to the best of the applicant's knowledge, assess the likely worst-case environmental, social and economic effects of the proposed development to ensure that the impacts of the project as it may be constructed have been properly assessed. (NPS EN-1 paragraph 4.3.12)	The maximum design scenario (MDS) is shown in Table 5.21. The MDS has been selected as those scenarios having the potential to result in the greatest effect on an identified receptor or receptor group. The assessment of effects is contained in section 5.7.
The highest level of biodiversity protection is afforded to sites identified through international conventions. The Habitats Regulations set out sites for which a Habitat Regulations Assessment (HRA) will assess the implications of a plan or project, including Special Areas of Conservation (SAC) and Special Protection Areas (SPA). (NPS EN-1 paragraph 5.4.4)	Internationally designated sites are identified in Table 5.10 and Table 5.11, and are described in Volume 6, Annex 5.1: Offshore ornithology baseline characterisation of the Environmental Statement. (Document reference F6.5.1).
As a matter of policy, the following should be given the same protection as sites covered by the Habitats Regulations and an HRA will also be required: (a) potential SPA and possible SAC; (b) listed or proposed Ramsar sites; and (c) sites identified, or required, as compensatory measures for adverse effects on any of the other sites covered by this paragraph. (NPS EN-1, paragraph 5.4.5)	Internationally designated sites are identified in Table 5.10 described in Volume 6, Annex 5.1: Offshore ornithology baseline characterisation of the Environmental Statement. (Document reference F6.5.1). The findings of the HRA process are reported in an Information to Support Appropriate Assessment (ISAA) report (Document Reference E1.1 – E1.3), which assesses the impact specifically on all European sites and is submitted alongside the Environmental Statement.
Many Sites of Special Scientific Interest (SSSIs) are also designated as sites of international importance and will be protected accordingly. Those that are not, or those features of SSSIs not covered by an international designation, should be given a high degree of protection. Most National Nature Reserves are notified as SSSIs. (NPS EN-1 paragraph 5.4.7)	All relevant SSSIs are identified in Table 5.11 and described in Volume 6, Annex 5.1: Offshore ornithology baseline characterisation of the Environmental Statement. (Document reference F6.5.1). The assessment of impacts takes account all impacts on all designated sites (including SSSIs) within the Mona offshore ornithology study areas as defined in section 0.5.3.4.
Many individual species receive statutory protection under a range of legislative provisions. Other species and habitats have been identified as being of principal importance for the conservation of biodiversity in England and Wales, as well as for their continued benefit for climate mitigation and adaptation and thereby requiring conservation action. (NPS EN-1 paragraph 5.4.16)	Assessment of the potential effects of the Mona Offshore Wind Project relevant to offshore ornithology are considered in section 5.7. The approach to mitigation is discussed in section 5.6.

Summary of NPS EN-1 and EN-3 provision	How and where considered in the Environmental Statement
Where the development is subject to EIA, the applicant should ensure that the ES clearly sets out any effects on internationally, nationally, and locally designated sites of ecological or geological conservation importance (including those outside England), on protected species and on habitats and other species identified as being of principal importance for the conservation of biodiversity, including irreplaceable habitats. (NPS EN-1 paragraph, 5.4.17)	The baseline ornithological environment is described in section 5.4. As part of this chapter, the process of identifying designated sites has been undertaken and results are presented in Table 5.9 and Table 5.10. The specific bird species that may be impacted by the potential effects of the Mona Offshore Wind Project are identified in Table 5.11 and an assessment of the potential effects for these specific species are identified and considered in section 5.7.
Applicants should include appropriate avoidance, mitigation, compensation and enhancement measures as an integral part of the proposed development. In particular, the applicant should demonstrate that: • During construction, they will seek to ensure that activities will be confined to the minimum areas required for the works • The timing of construction has been planned to avoid or limit disturbance • During construction and operation best practice will be followed to ensure that risk of disturbance or damage to species or habitats is minimised, including as a consequence of transport access arrangements • Habitats will, where practicable, be restored after construction works have finished • Opportunities will be taken to enhance existing habitats rather than replace them, and where practicable, create new habitats of value within the site landscaping proposals. Where habitat creation is required as mitigation, compensation, or enhancement, the location and quality will be of key importance. In this regard habitat creation should be focused on areas where the most ecological and ecosystems benefits can be realised • Mitigations required as a result of legal protection of habitats or species will be complied with. (NPS EN-1 paragraph 5.4.35)	The approach taken to mitigation is described in section 5.6.

Summary of NPS EN-1 and EN-3 provision	How and where considered in the Environmental Statement
NPS-EN3	
As part of the Offshore Wind Environmental Improvement Package set out in the British Energy Security Strategy, government committed to establishing Offshore Wind Environmental Standards (OWES; previously referred to as Nature Based Design Standards) to accelerate deployment whilst offering greater protection of the marine environment. OWES aim to support developers to take a more consistent approach to avoiding, reducing, and mitigating the impacts of an offshore wind farm and/or offshore transmission infrastructure. The measures could apply to the design, construction, operation and decommissioning of offshore wind farms and offshore transmission (as defined in EN-5 at section 2.12). Defra will consult on a series of OWES before drafting clear OWES Guidance, which sets out where and how Defra expects each measure to be applied to a development. Once the OWES Guidance is issued, the Secretary of State will expect applicants to have applied the relevant measures to their applications. Applicants should explain how their proposals comply with the guidance or, alternatively, the grounds on which a departure from them is justified. Any reasons for departure from the OWES should be fully detailed within	The project is aware of the requirements in NPS EN3 to apply the guidance on Environmental Standards once the final guidance is issued. The project will review the guidance once available and determine how the project complies with the guidance, and where, if relevant, the project departs from them.

Summary of NPS EN-1 and EN-3 provision	How and where considered in the Environmental Statement
the application documents, with details of any agreements made with statutory consultees. (NPS EN-3 paragraphs 2.8.90 to 2.8.92)	
Applicants should consult at an early stage of pre-application with relevant statutory consultees and energy not-for profit organisations/non governmental organisations as appropriate, on the assessment methodologies, baseline data collection, and potential avoidance, mitigation and compensation options which should be undertaken. (NPS EN-3 paragraph 2.8.104)	Throughout the Mona Offshore Wind Project consultations with relevant statutory and non-statutory stakeholders have been carried out (e.g. via the Evidence Plan Process Expert Working Groups (EWG)) and are presented in section 0. A Scoping Report was submitted to the Planning Inspectorate and a Scoping Opinion was received, discussed in section Error! Reference source not found.. 5.2. Furthermore, Section S42 responses from the relevant statutory and non-statutory stakeholders were received following submission of the Preliminary Environmental Information Report (PEIR) technical annexes and chapter. All the responses provided, and changes suggested by the stakeholders are presented in the consultation report (Document reference E.3).
Offshore wind farms have the potential to impact on birds through: • Collisions with rotating blades • Direct habitat loss • Disturbance from construction activities such as the movement of construction/decommissioning/maintenance vessels and piling • Displacement during the operational phase, resulting in loss of foraging/roosting area • Impacts on bird flight lines (i.e. barrier effect) and associated increased energy use by birds for commuting flights between roosting and foraging areas • Impacts upon prey species and prey habitat; and • Impacts on protected sites. (NPS EN-3 paragraph 2.8.136)	Assessment of the potential effects of the Mona Offshore Wind Project relevant to offshore ornithology are discussed in section 5.7.
Applicants should discuss the scope, effort and methods required for ornithological surveys with the relevant statutory advisor, taking into consideration baseline and monitoring data from operational windfarms. (NPS EN-3 paragraph 2.8.143)	Baseline survey methods have been discussed with Natural Resources Wales (NRW), Natural England, the Joint Nature Conservation Committee (JNCC) and the Royal Society for the Protection of Birds (RSPB) through the Evidence Plan Process EWG. Relevant data from other operational offshore wind farms has been considered to inform the assessment of potential significant effects of the Mona Offshore Wind Project and the Cumulative Effects Assessment (CEA) in section 5.9.
Applicants must undertake collision risk modelling (CRM), as well as displacement and population viability assessments for certain species of birds. Applicants are expected to seek advice from Statutory Nature Conservation Bodies (SNCBs). (NPS EN-3 paragraph 2.8.144)	CRM, displacement assessment, population viability assessment has been undertaken for birds using parameters that have been agreed with SNCBs through the Evidence Plan process EWG. Potential effects from collision risk and displacement are presented and assessed in section 5.7.

Summary of NPS EN-1 and EN-3 provision	How and where considered in the Environmental Statement
The assessment should be undertaken for all stages of the lifespan of the proposed wind farm in accordance with the appropriate policy and guidance for offshore wind farm EIAs. (NPS EN-3 paragraph 2.8.198)	The construction, operations and maintenance and decommissioning phases of Mona Offshore Wind Project have been assessed in section 5.7.
The Secretary of State should consider the effects of a proposed development on marine ecology and biodiversity, considering all relevant information made available by the applicant. (NPS EN-3 paragraph 2.8.302)	Section 5.7 presents the assessment of effects of the Mona Offshore Wind Project on offshore ornithology receptors.

Table 5.2: Summary of NPS EN-1 and NPS EN-3 policy on decision making relevant to offshore ornithology.

Summary of NPS EN-1 and EN-3 provision	How and where considered in the Environmental Statement
NPS EN-1	
In the 25 Year Environment Plan, the government set out its vision for a quarter-of-a-century action to help the natural world regain and retain good health. A commitment to review the plan every 5 years was set into law in the Environment Act 2021. The Environmental Improvement Plan was published in 2023, which reinforces the intent of the 25 Year Environment Plan and sets out a plan to deliver on its framework and vision. The government's policy for biodiversity in England is set out in the Environmental Improvement Plan 2023, the National Pollinator Strategy and the UK Marine Strategy. The aim is to halt overall biodiversity loss in England by 2030 and then reverse loss by 2042, support healthy well-functioning ecosystems and establish coherent ecological networks, with more and better places for nature for the benefit of wildlife and people. This aim needs to be viewed in the context of the challenge presented by climate change. Healthy, naturally functioning ecosystems and coherent ecological networks will be more resilient and adaptable to climate change effects. Failure to address this challenge will result in significant adverse impact on biodiversity and the ecosystem services it provides. (NPS EN-1 paragraph 5.4.2).	Assessment of the potential effects of the Mona Offshore Wind Project and associated mitigation for specific species are identified and discussed in section 5.7 and 5.6 respectively.

5.1.4 The Welsh National Marine Plan and its relevance to offshore ornithology

5.1.4.1 The assessment of potential changes to offshore ornithology has also been made with consideration to the specific policies set out in the Welsh National Marine Plan (Welsh Government, 2019).

5.1.4.2 The Welsh National Marine Plan was published on 12 November 2019 and sets out the policy for the next 20 years for the sustainable use of Welsh seas. It includes sector objectives for renewable energy to support the decarbonisation of the Welsh economy and the use of marine renewable energy, including offshore wind farms.

5.1.4.3 Key provisions are set out in Table 5.3 along with details as to how these have been addressed within the assessment.

Table 5.3: Welsh National Marine Plan and its relevance to offshore ornithology.

Policy	Key provisions	How and where considered in the Environmental Statement
ENV_01: Resilient marine ecosystems	Proposals should demonstrate how potential impacts on marine ecosystems have been taken into consideration and should, in order of preference: • Avoid adverse impacts; and/or • Minimise impacts where they cannot be avoided; and/or • Mitigate impacts where they cannot be minimised. If significant adverse impacts cannot be avoided, minimised or mitigated, proposals must present a clear and convincing case for proceeding. Proposals that contribute to the protection, restoration and/or enhancement of marine ecosystems are encouraged.	The potential impacts on Important Ecological Features (IEFs) have been assessed in section 5.7 and measures adopted as part of the Mona Offshore Wind Project are summarised in section 5.6.
ENV_02: Marine Protected Areas (MPA)	Proposals should demonstrate how they: • Avoid adverse impacts on individual MPAs and the coherence of the network as a whole • Have regard to the measures to manage MPAs; and • Avoid adverse impacts on designated sites that are not part of the MPA network.	Designated sites supporting IEFs that have been identified as appropriate are outlined in section 5.3.8, and any potential impacts to features and the site network will be assessed in the Habitats Regulations Assessment Stage 2 Information to Support an Appropriate Assessment (ISAA) – Part Three: Special Protection Areas and Ramsar sites (Document Referencereference E1.3).
ENV_05: Underwater sound.	Proposals should demonstrate that they have considered man-made noise impacts on the marine environment and, in order of preference: • Avoid adverse impacts; and/or • Minimise impacts where they cannot be avoided; and/or • Mitigate impacts where they cannot be minimised. If significant adverse impacts cannot be avoided, minimised or mitigated, proposals must present a clear and convincing case for proceeding.	Section 5.7 assesses the impact of underwater and airborne sound on seabirds.

Policy	Key provisions	How and where considered in the Environmental Statement
ENV_07: Fish species and Habitats	Proposals potentially affecting important feeding, breeding (including spawning and nursery) and migration areas or habitats for key fish and shellfish species of commercial or ecological importance should demonstrate how they, in order of preference: • Avoid adverse impacts on those areas; and/or • Minimise adverse impacts where they cannot be avoided; and/or • Mitigate adverse impacts where they cannot be minimised. If significant adverse impacts cannot be avoided, minimised or mitigated, proposals must present a clear and convincing case for proceeding.	The potential effects on fish species and their habitats have been assessed in full in Volume 2, Chapter 3: Fish and shellfish ecology of the Environmental Statement. (Document reference F2.3). Section 5.7 of this chapter assesses the potential effects on seabirds in the context of how seabird prey species may be impacted.

5.1.5 North West Inshore and North West Offshore Coast Marine Plans

5.1.5.1 The assessment of potential changes to offshore ornithology has also been made with consideration to the specific policies set out in the North West Inshore and North West Offshore Coast Marine Plans (MMO, 2021). Key provisions are set out in Table 5.4 along with details as to how these have been addressed within the assessment.

Table 5.4: North West Inshore and North West Offshore Marine Plan policies of relevant to offshore ornithology.

Policy	Key provisions	How and where considered in the Environmental Statement
NW-SCP-1	Proposals within or relatively close to nationally designated areas should have regard to the specific statutory purposes of the designated area. Great weight should be given to conserving and enhancing landscape and scenic beauty in National Parks and Areas of Outstanding Natural Beauty.	As part of this chapter (as well as Volume 6, Annex 5.1: Offshore ornithology baseline characterisation of the Environmental Statement), (Document reference F6.5.1)), designated sites with mobile features connected to the Mona Offshore Wind Project have been identified. This is to ensure that all features and species of conservation importance were considered, where relevant, in this assessment. The HRA Stage 1 Screening Report (Document Referencereference E1.4) considers the direct or indirect effects on features of relevant SPA sites, and where relevant will be included in the ISAA (Document Referencereference E1.3).

Policy	Key provisions	How and where considered in the Environmental Statement
NW-MPA-1	Proposals that support the objectives of MPAs and the ecological coherence of the MPA network will be supported.	As part of this chapter (as well as Volume 6, Annex 5.1: Offshore ornithology baseline characterisation of the Environmental Statement), (Document reference F6.5.1)), designated sites with mobile features connected to the Mona Offshore Wind Project have been identified (section 5.3.8). This is to ensure that all features and species of conservation importance were considered, where relevant, in this assessment. The HRA Stage 1 Screening Report (Document Referencereference E1.4) considers the direct or indirect effects on features of relevant SPA sites, and where relevant will be included in the ISAA (Document Referencereference E1.3).
NW-BIO-1	NW-BIO-1 encourages and supports proposals that enhance the distribution of priority habitats and priority species.	The Mona Offshore Wind Project will aim to conserve habitats and species as far as reasonably practicable through a number of measures adopted to reduce the impact of the Mona Offshore Wind Project (section 5.6).
NW-BIO-2	NW-BIO-2 requires proposals to manage negative effects which may significantly adversely impact the functioning of healthy, resilient and adaptable marine ecosystems.	In addition to measures adopted as part of the Mona Offshore Wind Project and sensitive project design, secondary mitigation will be considered if an impact is considered to be significant in EIA terms in section 5.7.
NW-CE-1	Proposals which may have adverse cumulative effects with other existing, authorised, or reasonably foreseeable proposals must demonstrate that they will avoid, minimise and mitigate.	Cumulative effects have been quantified and their significance assessed in section 5.9.

5.2 Consultation

5.2.1 Overview

5.2.1.1 A summary of the key issues raised during consultation activities undertaken to date specific to offshore ornithology is presented in Table 5.5 below, together with how these issues have been considered in the production of this Environmental Statement chapter. Further detail is presented in the following Annexes:

- Volume 6, Annex 5.1: Offshore ornithology baseline characterisation of the Environmental Statement (Document reference F6.5.1)
- Volume 6; Annex 5.2: Offshore ornithology displacement technical report of the Environmental Statement (Document reference F6.5.2)
- Volume 6, Annex 5.3: Offshore ornithology collision risk modelling technical report of the Environmental Statement (Document reference F6.5.3)
- Volume 6, Annex 5.4: Offshore ornithology migratory bird collision risk modelling technical report of the Environmental Statement (Document reference F6.5.4)

- Volume 6, Annex 5.5: Offshore ornithology apportioning technical report of the Environmental Statement (Document reference F6.5.5)
- Volume 6, Annex 5.6: Offshore ornithology population viability analysis technical report of the Environmental Statement. (Document reference F6.5.6).

5.2.2 Evidence Plan process

5.2.2.1 The purpose of the Evidence Plan process is to agree the information the Mona Offshore Wind Project needs to supply to the Secretary of State, as part of a DCO application for the Mona Offshore Wind Project. The Evidence Plan seeks to ensure compliance with the HRA and EIA Regulations. The development and monitoring of the Evidence Plan and its subsequent progress is being undertaken by the Steering Group. The Steering Group is comprised of the Planning Inspectorate, the Applicant, NRW, Natural England, JNCC and the MMO as the key regulatory and SNCBs. To inform the EIA and HRA process during the pre-application stage of the Mona Offshore Wind Project, EWGs were also set up to discuss and agree topic specific issues with the relevant stakeholders. Consultation was undertaken via the Offshore Ornithology EWG, with meetings held in February 2022, July 2022, November 2022, February 2023, June 2023, October 2023 and December 2023 (Table 5.5).

5.2.2.2 The responses provided and changes suggested by the stakeholders through the EWG are summarised in Table 5.5 together with changes implemented in the chapter of the Environmental Statement.

Table 5.5: Summary of key topics and issues raised during consultation activities undertaken for the Mona Offshore Wind Project relevant to offshore ornithology.

Date	Consultee and type of response	Topics and issues raised	Response to issue raised and/or where considered in this chapter
February 2022	**Offshore Ornithology Expert Working Group 1** **Attended by:** Natural England, JNCC, The Wildlife Trusts (TWT), MMO, RSPB (apologies given by NRW)	The EWG agreed on broad approach to baseline characterisation (including digital aerial survey) and characterisation for the Mona Offshore Cable Corridor using desktop data sources only.	Methodology presenting the approach to baseline using site-specific surveys and desktop studies is summarised and presented in section 5.3 of this chapter.
	Scoping Opinion IOM Department of Infrastructure	The Isle of Man Department of Infrastructure noted that Manx shearwater *Puffinus puffinus*, common guillemot *Uria aalge*, razorbill *Alca torda* and black-legged kittiwake *Rissa tridactyla* were numerous in previous surveys of the generation assets study area. These are all within foraging range of their Isle of Man breeding colonies.	Abundance at breeding colonies on the Isle of Man (using the Seabird Monitoring Programme (SMP) database (JNCC (2023)) are considered in section 5.3 this chapter
		The Isle of Man government requested that the national bird statuses and conservation concerns of the Isle of Man are taken into account by reference to the recently published Manx Birds of Conservation Concern and had a current concern regarding severe declines in many seabird populations on the Isle of Man (See Hill *et al.,* 2019). Schedule 1 of the Wildlife Act 1990 lists the specially protected birds. Both of these are relevant to the status of these species in the vicinity of this development and in particular, the considerations of potential impacts on Manx populations.	The conservation value of Isle of Man birds has been included in section 5.3 of this chapter.

Date	Consultee and type of response	Topics and issues raised	Response to issue raised and/or where considered in this chapter
June 2022	**Scoping Opinion** The Planning Inspectorate	Where possible, the Applicant should seek to agree the magnitude of impact or sensitivity of receptors with relevant consultees through the PEIR and pre-application process. Where differences in opinion remain, these should be identified within the Environmental Statement with justification given for the Applicant's choice.	The description of the magnitude of each impact and sensitivity of each receptor, or each receptor group considered in the EIA (see sections 5.7 to 5.12 of this chapter). Comments note that where differences in opinion remain, these will be identified, and justification given for the Applicant's choice.
		The Environmental Statement should define what a 'reasonable timescale' or 'short time period' would be within which recovery could occur so that an impact would be reversible/not permanent.	For each impact where recovery is considered, the timescales for recovery has been stated in section5.4 of this chapter
		A number of mitigation plans have been referred to in aspect chapters. Where plans are relied upon to avoid significant environmental effects, outline or in-principle plans should be submitted as part of the DCO application.	Where a significant environmental effect has been identified, further mitigation has been proposed in section 5.6 of this chapter.
		The Applicant proposed to assess the effects of underwater sound on marine life due to jacket or monopile cutting and removal during decommissioning. The Scoping Report does not propose to assess this potential impact within the fish and shellfish ecology, marine mammals or offshore ornithology Environmental Statement chapters. The outcomes of this assessment should be presented within the relevant chapters.	The indirect impact of underwater sound on prey species relevant to ornithological receptors has been assessed for the construction, operations and maintenance, and decommissioning phases, as detailed in section 5.7.3 of this chapter.
		Direct disturbance and displacement impacts from underwater sound during the operations and maintenance and decommissioning phases.	Disturbance and displacement from airborne noise, underwater sound, and presence of vessels and infrastructure has been assessed in-combination across all phases, as detailed in section 5.7 of this chapter.

Date	Consultee and type of response	Topics and issues raised	Response to issue raised and/or where considered in this chapter
		The Inspectorate agreed that collision risk to birds from the offshore booster station structures is unlikely and is therefore content to scope this matter from the Environmental Statement.	The Offshore Booster Substation is no longer in the design for the Mona Offshore Wind Project and is therefore not included in the impact assessments presented in section 5.7 of this chapter.
		The Planning Inspectorate proposes a range (4 km to 10 km) within the study area proposed for the offshore ornithology aspect chapter. The Environmental Statement should clearly state and provide justification for the final study area adopted in the impact assessment. It should also be supported by a figure(s) clearly presenting the extent of the buffer and where these buffer distances differ. The study area should be based on the Zone of Influence (ZOI) for the Proposed Development. The Applicant's attention is directed to the recent issue of the 'Joint SNCB1 Interim Advice on the treatment of displacement for red-throated diver (2022)' with regards to revised guidance for red-throated diver displacement. The Inspectorate advises that the marine ornithology study area should include the array area and a minimum 10 km buffer. Where the buffer does not consistently reach 10 km, the Environmental Statement should clearly justify the approach.	There are three study areas adopted for the offshore ornithology assessment presented in section 5.3.4 of this chapter, with justifications.
		The Environmental Statement should consider those birds listed on Schedule 1 of the Wildlife Act 1990 (Isle of Man) and refer to the Manx Birds of Conservation Concern (2021) when considering conservation status of Manx birds (where relevant).	The conservation value of Isle of Man birds has been included in section 5.3 of this chapter.
		The Applicant's attention is directed to the response of the Isle of Man Government at Appendix 2 to this Opinion with regards to designated sites and in particular the Calf of Man National Bird Observatory.	The importance of the National Bird Observatory for monitoring, research and recreational activities is acknowledge (see Table 5.11 in section 5.3.8 of this chapter). However, the status of the Bird Observatory is of limited relevance to the assessment of ornithological receptors.

Date	Consultee and type of response	Topics and issues raised	Response to issue raised and/or where considered in this chapter
		The Scoping Report proposes to determine connectivity between breeding seabird colonies at designated sites and the Proposed Development through the application of the metric 'mean maximum (plus one standard deviation)'. Until the site-specific surveys are complete, and the data analysis finalised, it may be prudent to scope in all SPAs, Ramsar sites, and SSSIs with marine or estuarine bird qualifying features to the impact assessment. The Applicant should seek to agree the appropriate metric with relevant consultation bodies, including NRW and Natural England.	Best practice (i.e. using the mean-max + 1 standard deviation (SD) foraging range from Woodward *et al.*, (2019)) guidelines were followed to determine connectivity between sites and the ZOI of the Mona Offshore Wind Project. Designated sites connected to the Mona Offshore Wind Project are presented in 5.3.8 of this chapter.
		The Scoping Report states that the displacement matrix approach for the transmission assets may be modified (in terms of the appropriate displacement and mortality rates) to assess the potential temporary impact of disturbance during installation of the offshore export cables. If fundamental disagreements remain regarding the assessment methods and modelling for assessing effects from displacement and collision-related mortality, the Environmental Statement should include assessments based on the Applicant's preferred method and those advocated by NRW and Natural England. The Applicant is advised to agree the detailed assessment methodologies with relevant stakeholders represented on the ornithology EWG.	The Mona Offshore Cable Corridor assessment has been agreed with the Offshore Ornithology EWG and the findings are presented in section 5.7 of this chapter.
	Scoping Opinion **JNCC**	Clarity is required as to how impacts from operational developments will be included within a cumulative assessment. If built and operational projects are classed as part of the baseline conditions, then the project alone assessment needs to consider whether it brings 'baseline mortality' (including the mortality contributed from baseline projects) above a level that is unacceptable. Mortality that can be attributed to projects that were built and operational at the time that survey data were collected do need to be considered alongside predicted mortality from the Mona proposal. We would suggest that, given the difficulties in assessing 'actual' mortality or population consequences for mobile species such as marine birds, from existing built and operational infrastructure (such as windfarms), then in practice this means that the assessment is based on a combined 'predicted' mortality across built, operational, under construction, consented and otherwise identified infrastructure projects. The Scoping Report appears to suggest that operational project/plans will be included within a cumulative assessment, which contracts with the list of developments in stated elsewhere in the document. Please clarify whether and how the impact operational developments will be incorporated in a cumulative assessment.	The impact of operational developments has been included in the cumulative assessment (section 5.9 of this chapter). The approach to assessing cumulative impact is based on obtaining collision risk estimates where available. If unavailable for historic projects, a qualitative assessment of collision will be undertaken. For displacement, the approach follows standard methodology obtaining, where possible, abundance data from each project (or using Marine Ecosystem Research Programme (MERP)

Date	Consultee and type of response	Topics and issues raised	Response to issue raised and/or where considered in this chapter
			data if unavailable) and scaling this to relevant areas/seasons.
	Scoping Opinion Natural England	Identification of receptors and the sensitivity of receptors to impact scale definitions should be discussed and agreed as part of the Evidence Plan process with the relevant EWG. These definitions should be set out within the Environmental Statement.	The definition of sensitivity for receptors and receptor groups is included in section 5.3.11 of this chapter.
		A matrix for assessment of significance is provided as an example, demonstrating how the sensitivity of receptor against magnitude of impact can determine the significance of effect. As with above comments, sensitivity of receptor, magnitude of impact and the matrix of significance of effect should be discussed and agreed through the Evidence Planning process. Discuss and agree with the relevant EWGs and definitions should be provided in the Environmental Statement.	The matrix for assessment of significance has been included in section 5.3.11 of this chapter.
		We understand that at the current stage this is a high-level definition, however, all definitions will require refining. Discussion and agreement should be sought through the Evidence Plan process with the relevant EWG.	The definition if significance levels will be included in section 5.3.11 of this chapter.
		Consideration of climate change impacts over the operational period of Mona offshore wind farm should be considered. These impacts will become important if they cause an alteration in the baseline conditions and become detectable above natural inter-annual variations.	An assessment of the future baseline scenario including the impact of climate change is presented in section 5.1.1 of this chapter.

Date	Consultee and type of response	Topics and issues raised	Response to issue raised and/or where considered in this chapter
February 2022	**Offshore Ornithology Expert Working Group 1** – **Attended by:** Natural England, JNCC, NRW, TWT,	Agreed on ways of working document, including timescales. Agreed on broad approach to digital aerial surveys (DAS). Agreed on broad approach to characterisation for the Mona Offshore Cable Corridor using desktop data sources only.	The Mona digital aerial area includes a buffer of 7-16 km from the Mona Array Area. The Mona digital aerial survey area does not extend fully to 10 km in all directions around the Mona Array Area, as this area was refined following commencement of the DAS. The uneven buffer around the Mona Array Area is a result of the surveys being designed on the basis of an array area that differed to the final boundary. The use of Light Detection and Ranging (LiDAR) as a method for collecting flight height data to parameterise collision risk models was not endorsed by Natural England; as such it has not been progressed and flight heights are based on existing literature. The approach to characterisation of the Mona Offshore Cable Corridor is to rely on available desktop data for the Mona Offshore Cable Corridor. This approach is standard for offshore wind farm transmission assets

Date	Consultee and type of response	Topics and issues raised	Response to issue raised and/or where considered in this chapter
13 July 2022	**Offshore Ornithology Expert Working Group 2** **Attended by:** Natural England, JNCC, NRW, RSPB, TWT, MMO	The second EWG meeting provided an update on the approach used to characterise the baseline conditions and assess the effects on ornithological receptors. • JNCC advised that the assessment of displacement during construction and decommissioning should include for 50% of the displacement during operation.	The EWG agreed on the approach to baseline characterisation as summarised and presented in section 5 of this chapter. A summary of the methodology presenting the approach to baseline using site-specific surveys and desktop studies is presented in section 5.3.1. Assessment during construction and decommissioning is presented in section 5.7 of the Environmental Statement chapter
November 2022	**Offshore Ornithology Expert Working Group 3** **Attended by:** Natural England, JNCC, NRW, RSPB TWT, MMO, Isle of Man Government	The third EWG meeting provided an update on the results of the baseline characterisation, displacement assessment, migratory and non-migratory collision assessment, apportioning and approach to LSE screening under for the Preliminary Environmental Information Report (PEIR). • NRW and JNCC advised on displacements rates and mortality rates to be used for Manx shearwater • Request for sabbaticals to be included as adult birds.	As recommended, auk species displacement and mortality rates have been used in the assessment of effect presented in section of the 5.7 of the Environmental Statement chapter. Sabbaticals are included in adult impacts in the assessment of effect presented in section of the 5.7 of this chapter.
February 2023	**Offshore Ornithology Expert Working Group 4** **Attended by:** Natural England, JNCC, NRW, RSPB TWT, MMO	The fourth EWG meeting provided an update on the Highly Pathogenic Avian Influenza (HPAI) and discuss the result of the assessment for the Mona Offshore Cable Corridor on seaducks and divers, overview of the new conservation advice package for Liverpool Bay SPA, and approach to LSE screening. • NRW/JNCC/Natural England suggested timing restrictions during cable laying across the Liverpool Bay SPA to avoid disturbance and displacement impacts on red-throated divers and common scoter.	Timing restrictions of work will be followed and implemented during cable laying across the Liverpool Bay SPA. Mitigation measures adopted are presented in section 5.6 of this chapter.

Date	Consultee and type of response	Topics and issues raised	Response to issue raised and/or where considered in this chapter
June 2023	**Offshore Ornithology Expert Working Group 5** **Attended by:** Natural England, JNCC, NRW, RSPB TWT, Isle of Man Government, MMO, Niras	Presentation of Power Analysis results and discussion of Section 42 comments. The fifth EWG meeting (June 2023) discussed Section 42 responses and provided an update on the power analysis carried out to demonstrate the adequacy of the survey design and sampling regime.	A summary of the key Section 42 responses with changes implemented in the Environmental Statement chapter are presented in this table below.
June 2023	**S42 Consultation** NRW, JNCC, Natural England	Consultees do not agree with the use of stable age structures for age-class apportioning or the removal of sabbaticals from impacts in the PEIR.	Sabbaticals are included in adult impacts in the assessment of effect presented in section of the 5.7 of Volume 2, Chapter 5: Offshore ornithology of the Environmental Statement. (Document reference F2.5).
	S42 Consultation NRW, JNCC, Natural England	Consultees do not consider it appropriate to base the cumulative (and hence also in-combination) assessments on so many unknowns for impacts from many of the relevant other projects. Whilst these historic projects may not have undertaken quantitative assessments, or assessments using current approaches, estimates will need to be generated for these unknown projects in order to undertake meaningful assessments.	The impact of historic projects for which collision and assessment were unknown have been included in the cumulative assessment (section 5.9 of this chapter). In the absence of quantitative assessment for historical projects, qualitative assessment has been presented where the information was available.
	S42 Consultation NRW and Natural England	Consultees query why Manx shearwater has not been assessed for cumulative displacement impacts both during construction and operation/maintenance, as we consider this should be assessed.	Cumulative and in-combination assessments have been undertaken for Manx shearwater and the results are presented in this chapter.
	S42 Consultation NRW and Natural England	Consultees suggest that cumulative collision assessments of migrant species are also undertaken.	Cumulative collision assessment of migrant species is included in the CEA presented in this chapter.

Date	Consultee and type of response	Topics and issues raised	Response to issue raised and/or where considered in this chapter
	S42 Consultation NRW, JNCC, Natural England	The combined impact of displacement plus collision risk for the Mona project alone should be undertaken for black-legged kittiwake and northern gannet.	The combined cumulative displacement and collision for northern gannet and black-legged kittiwake for the Mona project alone is included in the CEA presented in this chapter.
	S42 Consultation Orsted	To assess the impacts of project alone and cumulative projects on Whooper swan.	Project alone and cumulative collision assessment of Whopper swan is included in the CEA presented in this chapter.
October 2023	**Offshore Ornithology Expert Working Group 6** Attended by: Natural England, JNCC, NRW, RSPB TWT, Isle of Man Government, MMO, Niras	Project updates that affect the assessment were presented to the EWG (e.g., a reduction in the array area and no. of turbines). The EWG were asked to agree whether or not up to 8 vessel movements at the landfall would not be subject to seasonal restrictions. The EWG were notified that due to a number of project changes the baseline characterisation presented in the ES will differ slightly from that of the PEIR and that the regional population estimates used had been revised. It was also noted that precautionary regional breeding estimates as explored with the EWG would be used for assessment. It was noted that the impacts assessed in the ES will be the same as those assessed in the PEIR.	The SNCBs disagreed with the approach taken surrounding the revision of population estimates and the inclusion of immatures within the breeding population and suggested that the discussion would need more clarification. Following the EWG meeting, a technical note detailing the approach to calculating the reference breeding population for project alone and cumulative effect assessment has been circulated to the SNCBs. Agreement on approach detailed under the December EWG meeting below,

Date	Consultee and type of response	Topics and issues raised	Response to issue raised and/or where considered in this chapter
December 2023	**Offshore Ornithology Expert Working Group 7** Attended by: Natural England, JNCC, NRW, RSPB, TWT, Isle of Man Government, MMO, Niras	Methodology updates that affect the assessment were presented to the EWG (e.g., project alone and CEA breeding regional population approach and avoidance rates for gull species). Following presentation of the Applicant's approach to calculating regional breeding population against NRW approach (as agreed with JNCC and NE), NRW/JNCC/NE requested that the impacts in the context of the smallest regional breeding population for project alone should also be presented. Following discussion on data sources on avoidance rates, NRW/JNCC/NE requested that the Natural England avoidance rates should be used when assessing collision risk to gull species. The applicant presented an update to the Mona HRA outlining method of screening SPAs for LSE and concluded that there are likely no adverse effects on integrity of any SPAs and a derogation case would likely not be required.	Following discussion with SNCBs, the applicant has presented for project alone the impacts in the context of the smallest regional breeding population. The NRW approach (as agreed with JNCC and Natural England) shows a smaller regional population for northern gannet and Manx shearwater and the Applicant has u presented these values alongside the foraging range populations. The impacts are presented in section 5.7.

5.3 Baseline methodology

5.3.1 Relevant guidance

5.3.1.1 The baseline characterisation has followed methodologies and approaches set out in the following guidance documents:

- Offshore Wind Marine Environmental Assessments: Best Practice Advice for Evidence and Data Standards. Phase I: Expectations for pre-application baseline data for designated nature conservation and landscape receptors to support offshore wind applications (Natural England, 2022a)
- Offshore Wind Marine Environmental Assessments: Best Practice Advice for Evidence and Data Standards. Phase II: Expectations for pre-application engagement and best practice guidance for the evidence plan process (Natural England, 2022b)
- Offshore Wind Marine Environmental Assessments: Best Practice Advice for Evidence and Data Standards. Phase III: Expectations for data analysis and presentation at examination for offshore wind applications (Natural England, 2022c).

5.3.2 Scope of the assessment

5.3.2.1 The scope of this Environmental Statement has been developed in consultation with relevant statutory and non-statutory consultees as detailed in Table 5.5

5.3.2.2 Taking into account the scoping and consultation process, Table 5.6 summarises the issues considered as part of this assessment.

Table 5.6: Issues considered within this assessment.

Activity	Potential effects scoped into the assessment
Construction phase	
	• Disturbance and displacement from airborne noise, underwater sound, and presence of vessels and infrastructure • Indirect impacts from underwater sound affecting prey species • Temporary habitat loss/disturbance and increased suspended sediment concentrations (SSCs).
Operation and maintenance	
	• Disturbance and displacement from airborne noise, underwater sound, and presence of vessels and infrastructure • Temporary habitat loss/disturbance and increased SSCs • Presence of operational wind turbines may lead to collision risk. Additional mortality may cause a decrease in seabird populations • Presence of operational wind turbines may result in additional energy expenditure as migrating or commuting birds fly longer distances around the offshore wind farm.

Activity	Potential effects scoped into the assessment
Decommissioning	
	• Disturbance and displacement from airborne noise, underwater sound, and presence of vessels and infrastructure • Indirect impacts from underwater sound affecting prey species • Temporary habitat loss/disturbance and increased SSCs.

5.3.2.3 On the basis of the baseline environment and the description of development outlined in Volume 1, Chapter 3: Project description of the Environmental Statement, a number of impacts have been scoped out of the assessment at the scoping stage for offshore ornithology. These impacts are outlined, together with a justification for scoping them out, in Table 5.7.

Table 5.7: Impacts scoped out of the assessment for offshore ornithology.

Potential impact	Justification
Direct disturbance and displacement impacts from underwater sound during the operations and maintenance phase.	Underwater sound as a result of operation of the wind turbines is extremely unlikely to result in sound levels that would harm birds. In the unlikely event that such low levels of sound emission result in displacement of birds away from wind turbines, this impact would already be accounted for by the above-water operational displacement assessment.
Accidental pollution during all phases of the Mona Offshore Wind Project.	Pollution impacts (accidental oil/fuel spills) during all phases of the Mona Offshore Wind Project relating to the generation assets are scoped out on the basis that the implementation of a Marine Pollution Contingency Plan (MPCP) will avoid the risk of significant pollution events. Consequently, seabirds and shorebirds are extremely unlikely to be significantly affected by any such pollution impacts.
Indirect impact from underwater sound from wind turbine operation on prey fish species during the operations and maintenance phase.	Sound generated by operational wind turbines is of a very low frequency and low sound pressure level (Andersson, 2011). Studies have found that sound levels are only high enough to possibly cause a behavioural reaction within metres from a wind turbine (Sigray and Andersson, 2011) and therefore such levels are not considered to have potentially significant effects on fish. The Marine Management Organisation (MMO, 2014) review of post-consent monitoring at offshore wind farms found that available data on the operational wind turbine sound, from the UK and abroad, in general showed that sound levels from operational wind turbines are low and the spatial extent of the potential impact of the operational sound is low. This is supported by project specific modelling which indicated that effects on fish (e.g., injury or behavioural effects) are unlikely to occur for the modelled operations wind turbines. See Volume 5, Annex 3.1: Underwater sound technical report of the Environmental Statement (Document reference F5.3.1) for further details.

5.3.3 Methodology to inform baseline

5.3.3.1 In order to inform the Environmental Statement, 24 months of DAS were undertaken between March 2020 and February 2022. The DAS aim to characterise the distribution and abundance of seabirds within the Mona Offshore Ornithology Array Area study area (Figure 5.1).

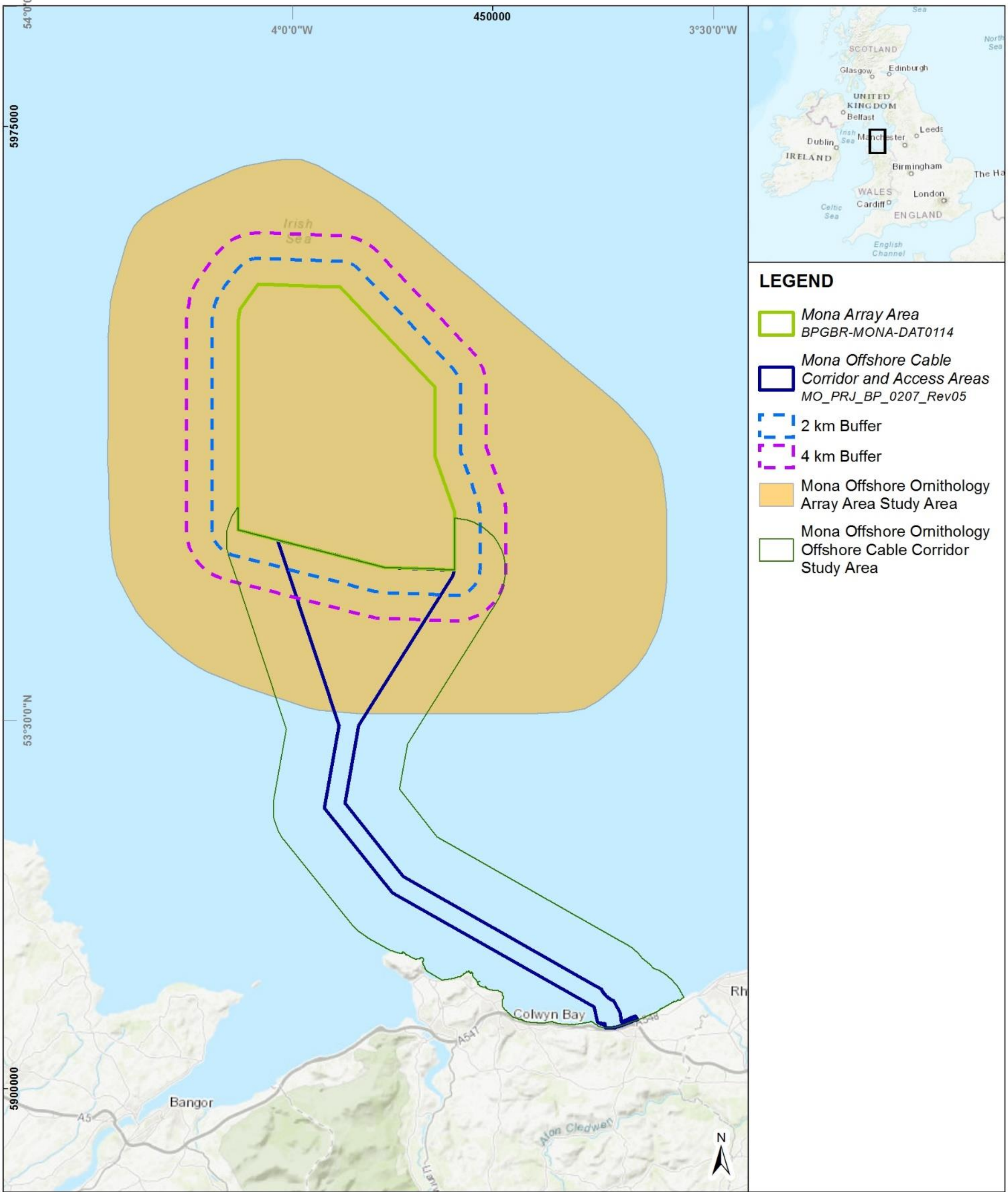
5.3.3.2 Furthermore, information on offshore ornithology within the Mona Offshore Ornithology Array Area study area and the Mona Offshore Ornithology Offshore Cable Corridor study area was collected through a detailed desktop review of existing studies and datasets.

5.3.3.3 The full details of both the site-specific surveys and desktop review methodology are presented in Volume 6, Annex 5.1: Offshore ornithology baseline characterisation technical report of the Environmental Statement. (Document reference F6.5.1).

5.3.4 Study areas

5.3.4.1 There are three study areas for the Mona Offshore Ornithology EIA. These are:

- The Mona Offshore Ornithology Array Area study area: this includes the Mona Array Area plus a buffer extending between 7 km and 16.5 km (Figure 5.1). This area was defined by the extent of the digital aerial bird surveys. Due to the changes in the proposed Mona Array Area since the design of the digital aerial survey in spring 2020, the Mona Offshore Ornithology Array Area study area does not extend equally in all directions around the Mona Array Area assessed in this Environmental Statement
- The Mona Offshore Ornithology Offshore Cable Corridor study area: this encompasses the Mona Offshore Cable Corridor and Access Areas running between the landfall area on the Welsh Coast and the Mona Array Area, plus a 4 km buffer (Figure 5.1). Part of the Mona Offshore Ornithology Offshore Cable Corridor study area has been covered by the digital aerial bird surveys. The areas outside the digital bird surveys are covered by the regional studies of Liverpool Bay (Bradbury *et al*., 2014, Lawson *et al.*, 2016 and HiDef Aerial Surveying Limited., 2023)
- The Cumulative Mona Offshore Ornithology study area: this was identified by consideration of the foraging ranges of seabird species recorded within the Mona Offshore Ornithology Array Area study area and the relevant Biologically Defined Minimum Population Scales (BDMPS) region (Furness, 2015). The Cumulative Mona Offshore Ornithology study correlates to the relevant BDMPS (e.g. 'UK Western Waters'). The Cumulative Mona Offshore Ornithology study area varies dependent upon different species foraging ranges (See Volume 6, Annex 5.1: Offshore ornithology baseline characterisation technical report of the Environmental Statement (Document reference F6.5.1) for a list of mean maximum foraging ranges plus one standard definition as reported by Woodward, *et al*. (2019)).



Service Layer Credits: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community

Data Sources: Client

Project Name:
MONA OFFSHORE WIND PROJECT

0 2.5 5 nm
0 5 10 km

Drawing Number:
RPSE-MN-ES-ORN-001-03

Drawing Title:
OFFSHORE ORNITHOLOGY STUDY AREA

Geodetic Information:
Datum: ETRS 1989
Projection: ETRS 1989 UTM Zone 30N
Scale@160mmx220mm: 1:500,000

VER	DATE	DETAILS	BY	CHECK
00	24/07/23	First Issue	MJ	AN
03	03/10/23	Revision	MJ	AM

Figure 5.1: The Mona Offshore Ornithology Array Area study area and the Mona Offshore Ornithology Offshore Cable Corridor study area.

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5.3.5 Desktop study

5.3.5.1 Information on offshore ornithology within the Mona Offshore Ornithology Array Area study area and the Mona Offshore Ornithology Offshore Cable Corridor study area was collected through a detailed desktop review of existing studies and datasets. These are summarised in Table 5.8 with full details presented in Volume 6, Annex 5.1: Offshore ornithology baseline characterisation technical report of the Environmental Statement. (Document reference F6.5.1).

Table 5.8: Summary of key desktop reports reviewed to inform baseline.

Title	Reference
Identifying important at-sea areas for seabirds using species distribution models and hotspot mapping.	Cleasby *et al*., 2020
Distribution maps of cetacean and seabird populations in the northeast Atlantic.	Waggitt *et al*., 2020
Mapping seabird sensitivity to offshore wind farms.	Bradbury et al., 2014
Non-breeding season populations of seabirds in UK waters: Population sizes for Biologically Defined Minimum Population Scales (BDMPS).	Furness, 2015
All Wales Common Scoter survey: report on 2002/03 work programme.	Cranswick *et al*., 2004
An assessment of the numbers and distributions of inshore aggregations of waterbirds using Liverpool Bay during the non-breeding season in support of possible SPA identification.	Webb *et al*., 2006
An assessment of the numbers and distribution of wintering waterbirds and seabirds in Liverpool Bay/Bae Lerpwl area of search.	Lawson *et al*., 2016
SEA678 Data Report for Offshore Seabird Populations.	Mackey and Giménez, 2006
Seabird Tracking Database.	BirdLife International, 2022
Morgan Offshore Wind Project Preliminary Environmental Information Report (Volume 2, Chapter 10: Offshore Ornithology)	Morgan Offshore Wind Ltd, 2023
Morecambe Offshore Wind Project Preliminary Environmental Information Report (Volume 1, Chapter 12: Offshore Ornithology)	Morecambe Offshore Wind Ltd, 2023
Densities of qualifying species within Liverpool Bay Bae Lerpwl SPA: 2015 to 2020	HiDef Aerial Surveying Limited, 2023

5.3.6 Identification of designated sites

5.3.6.1 All designated sites within the three study areas with qualifying interest features that could be affected by the construction, operations and maintenance and decommissioning phases of the Mona Offshore Wind Project were identified.

5.3.6.2 All designated sites of international (e.g. SPAs or Ramsar sites) and national (e.g. SSSIs or Marine Nature Reserves (MNR) within the Isle of Man) importance which directly overlap one of the three study areas or have features which connect to the

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study areas were identified. The main sources for identifying these sites were the JNCC's online resource on the SPAs network (JNCC, 2022), the Ramsar Sites Information Service (RSIS, n.d.) and the Isle of Man's website (The Official Isle of Man Government Website, 2023).

5.3.6.3 Connectivity was established during the breeding season if a site (for which a species is a qualifying feature) is within foraging range of one of the study areas (using mean maximum + 1 SD (Woodward *et al*., 2019).

5.3.6.4 Additional designated sites are included within the HRA for the non-breeding period (migration and winter) but are not specifically mentioned within the chapter. Impacts to populations are felt more profoundly during the breeding season due to its significance in life cycles and therefore to reduce the length of baseline description within this Environmental Statement chapter, only sites connected to the Mona Offshore Wind Project during the breeding season are described in section 5.3.8. During the non-breeding season, species are no longer spatially restricted and undertake much larger movements than during the breeding season (Furness, 2015).

Site-specific surveys

5.3.6.5 In order to inform the Environmental Statement, site-specific surveys were undertaken as agreed with the statutory bodies. A summary of the surveys undertaken to inform the offshore ornithology impact assessment is outlined in Table 5.9.

Table 5.9: Summary of site-specific survey data.

Title	Extent of survey	Overview of survey	Survey contractor	Date	Reference to further information
DAS	Mona Array Area with buffer extending 7 km to 16.5 km	DAS to characterise the distribution and abundance of seabirds within the Mona Offshore Ornithology Array Area study area.	APEM	March 2020 to February 2022 (24 months)	Volume 6, Annex 5.1: Offshore ornithology baseline characterisation technical report of the Environmental Statement. (Document reference F6.5.1).

5.3.7 Baseline environment

Desktop study findings

5.3.7.1 The Mona Array Area is situated in the central part of the Irish Sea. The Irish Sea separates the islands of Ireland and Great Britain and is linked to the Celtic Sea in the south by St George's Channel, and to the Inner Seas off the West Coast of Scotland in the north by the North Channel (also known as the Straits of Moyle).

5.3.7.2 21 species of seabird have been reported as regularly nesting on beaches or cliffs around the Irish Sea (Mitchell *et al.,* 2004).

5.3.7.3 A large proportion of the Manx shearwater biogeographic population is found breeding on offshore islands around the Irish Sea. Most of the world's Manx shearwater population is found in the UK and over 90% of the UK population is found on the Islands of Rum, Eigg (Scotland), Skomer and Skokholm (Wales) (Mitchell *et al*., 2004; JNCC, 2020).

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5.3.7.4 During the non-breeding season, large populations of common scoter *Melanitta nigra* and red-throated diver use the shallow waters of Liverpool Bay (Lawson *et al*., 2016).

5.3.7.5 For the most widespread and abundant seabirds of the central Irish Sea, namely northern gannet, common guillemot, European herring gull *Larus argentatus*, black-legged kittiwake, lesser black-backed gull *Larus fuscus*, Manx shearwater and razorbill, there are a number of breeding colonies within the species-specific foraging ranges (mean-maximum foraging ranges compiled by Woodward *et al.* (2019)) from the Mona Array Area.

5.3.7.6 During the desktop study a review of boat-based and aerial survey data analysed by Waggitt *et al*. (2020) and Bradbury *et al*. (2014) revealed key patterns of temporal and spatial use in the Mona Offshore Ornithology Array Area study area. These are summarised below with full details presented in Volume 6, Annex 5.1: Offshore ornithology baseline characterisation of the Environmental Statement. (Document reference F6.5.1).

5.3.7.7 Both studies showed that black-legged kittiwake have a patchy seasonal distribution, an overall lower abundance during the breeding season (March to August) and relative low densities in the Mona Offshore Ornithology Array Area study area. It is also apparent from both studies that the Mona Array Area did not overlap with hotspots of abundance of common guillemot and razorbill, which were located further inshore or offshore during the non-breeding and breeding seasons respectively. It is also evident from Waggitt *et al*. (2020) and Bradbury *et al*. (2014) that lesser black-backed gull and European herring gull have a very restricted coastal distribution during the breeding season (April to August) owing to their small foraging range (Woodward *et al*., 2019).

5.3.7.8 Both Bradbury *et al*. (2014) and Waggitt *et al*. (2020) showed densities of Manx shearwater to be relatively low during the breeding season (April to August) with less than one bird per km^2 in the Mona Offshore Ornithology Array Area study area. The work by Waggitt *et al*. (2020), based on aerial and boat-based survey data collected between 1980 to 2018, also indicated that northern gannet were found in the highest densities to the west of the Mona Offshore Ornithology Array Area study area during the breeding season (March to September) whilst Bradbury *et al*. (2014) found the highest densities to be southeast of the Mona Offshore Ornithology Array Area study area during the breeding season.

Site-specific survey findings

5.3.7.9 Design-based abundance estimates of all species are presented in Volume 6, Annex 5.1: Offshore ornithology baseline characterisation technical report of the Environmental Statement, (Document reference F6.5.1), alongside model-based abundance (using the Marine Renewables Strategic Environmental Assessment (MRSea) package) for the most abundant seabird species. MRSea modelling is unable to calculate estimated abundance for species with low counts.

5.3.7.10 Common guillemot was the most abundant seabird species recorded during the DAS, with most birds found on the sea. Common guillemot distribution was heterogeneous depending on year and month. Within the Mona Array Area study area plus 2 km, the highest MRSea modelled estimates were recorded in March 2020 and February 2021, with 5,739 and 4,415 individuals, respectively.

5.3.7.11 Black-legged kittiwake were most abundant in March at the start of the breeding season. Thereafter, the predicted abundance varied greatly for the rest of the breeding season (April to August) and the predicted distribution within the Mona Array Area appeared to be variable, with high inter-month variability recorded. Black-legged kittiwake were also present in moderate numbers throughout the non-breeding season. MRSea modelled estimates for monthly black-legged kittiwake numbers in the Mona Array Area plus 2 km peaked at 540 individuals in March 2021.

5.3.7.12 Within the Mona Array Area plus 2 km, the highest MRSea estimate of Manx shearwater was recorded in June 2021, with an estimated 1,209 individuals. The presence of Manx shearwater in July suggested that these birds might be associated with the Welsh colonies and thus forage within the Mona Offshore Ornithology Array Area study area.

5.3.7.13 Razorbill was recorded in the highest MRsea estimates in February 2021 with 2,305 individuals in the Mona Array Area plus 2 km. At this time of the year, the species starts gathering at sea in the vicinity of breeding colonies. Outside the pre-breeding period (February to March), population estimates were very low.

5.3.7.14 The distribution of northern gannet during the breeding months was patchy, and the highest densities were found outside the Mona Array Area. In Year 1, the highest MRSea estimate in the Mona Array Area plus 2 km was recorded in July and August, with 209 and 144 individuals respectively. In contrast the highest MRSea estimate was recorded at the end of the breeding season in Year 2 with 293 individuals (in September 2022. The low abundances and high inter-annual variability during the breeding season suggests that the Mona Array Area is not favoured by foraging northern gannet.

5.3.8 Designated sites

International sites (European sites and Ramsar sites)

5.3.8.1 Internationally designated sites identified for the offshore ornithology assessment are described in Table 5.10. Sites are ordered according to distance from the Mona Array Area within two broad categories of site; marine SPAs and breeding seabird colony SPAs.

Table 5.10: Designated sites and relevant qualifying interests for the offshore ornithology assessment.

Designated site	Closest distance to the Mona Array Area (km)	Closest distance to the Mona Offshore Cable Corridor and Access Areas (km)	Relevant qualifying interest (i.e. the site is within connectivity distance (mean max foraging range + 1 SD) to the Mona Array Area or Cable Corridor and Access Areas)
Marine SPAs (designated for aggregations of seabirds within the marine environment)			
Liverpool Bay SPA	10.0	0.0	Red-throated diver
			Little gull
			Common scoter
			Little tern *Sternula albifrons*
			Common tern
			Waterbird assemblage

Designated site	Closest distance to the Mona Array Area (km)	Closest distance to the Mona Offshore Cable Corridor and Access Areas (km)	Relevant qualifying interest (i.e. the site is within connectivity distance (mean max foraging range + 1 SD) to the Mona Array Area or Cable Corridor and Access Areas)
Mersey Narrows and North Wirral Foreshore SPA/Ramsar	44.9	26.2	Little gull
Irish Seafront SPA	57.2	61.4	Manx shearwater
Breeding seabird colony SPAs (designated for breeding seabirds)			
Dee Estuary SPA/Ramsar	39.2	13.1	Common tern
			Sandwich tern
			Cormorant
Ribble and Alt Estuaries SPA/Ramsar	37.2	39.3	Lesser black-backed gull
Morecambe Bay and Duddon Estuary SPA/Ramsar	47.0	58.7	Lesser black-backed gull
			European herring gull
			Sandwich tern
Bowland Fells SPA	76.2	80.1	Lesser-black backed gull
Aberdaron Coast and Bardsey Island SPA	98.9	83.0	Manx shearwater
Lambay Island SPA	128.9	132.5	Lesser black-backed gull
			European herring gull
			Black-legged kittiwake
			Razorbill
			Northern fulmar
			Atlantic puffin
Howth Head Coast SPA	134.4	137.7	Black-legged kittiwake
Ireland's Eye SPA	134.7	138.0	Black-legged kittiwake
Copeland Islands SPA	136.1	152.1	Manx shearwater
Wicklow Head SPA	148.8	146.2	Black-legged kittiwake
Ailsa Craig SPA	166.9	193.0	Northern gannet
			Black-legged kittiwake
			Lesser black-backed gull
Rathlin Island SPA	207.7	230.3	Black-legged kittiwake
			Seabird assemblage (breeding) including the components: Atlantic puffin Lesser black-backed gull
Skomer, Skokholm and the Seas off Pembrokeshire SPA	220.6	201.1	European storm-petrel *Hydrobates pelagicus*
			Manx shearwater
			Lesser black-backed gull

Designated site	Closest distance to the Mona Array Area (km)	Closest distance to the Mona Offshore Cable Corridor and Access Areas (km)	Relevant qualifying interest (i.e. the site is within connectivity distance (mean max foraging range + 1 SD) to the Mona Array Area or Cable Corridor and Access Areas)
			Atlantic puffin
			Seabird assemblage (breeding) including the components:
			Black-legged kittiwake
			• Manx shearwater
			Common guillemot
			• RazorbillAtlantic puffin
			Lesser black-backed gull.
Grassholm SPA	229.4	211.4	Northern gannet
			Northern fulmar
Saltee Islands SPA	236.8	228.2	Northern gannet
			Lesser black-backed gull
			Black-legged kittiwake
			Northern fulmar
			Atlantic puffin
North Colonsay and Western Cliffs SPA	281.7	307.0	Black-legged kittiwake
Helvick Head to Ballyquin SPA	292.4	286.6	Black-legged kittiwake
Rum SPA	365.5	391.8	Black-legged kittiwake
Old Head of Kinsale SPA	377.7	371.9	Black-legged kittiwake
Canna and Sanday SPA	384.5	410.7	Black-legged kittiwake
Cruagh Island SPA	407.31	410.7	Manx shearwater
Isles of Scilly SPA/Ramsar	433.3	411.1	Great-black backed gull
			Lesser black-backed gull
Blasket Islands SPA	465.5	465.9	Manx shearwater
Deenish Island and Scariff Island SPA	466.5	464.6	Northern fulmar
			Manx shearwater
Shiant Isles SPA	467.5	494.3	Seabird assemblage including the components: Northern fulmar
Puffin Island SPA	472.6	471.5	Northern fulmar
Skelligs SPA	481.9	480.5	Northern gannet
Handa SPA	505.1	532.5	Seabird assemblage including the components: Northern fulmar
St Kilda SPA	514.2	538.9	Northern gannet
			Northern fulmar

Designated site	Closest distance to the Mona Array Area (km)	Closest distance to the Mona Offshore Cable Corridor and Access Areas (km)	Relevant qualifying interest (i.e. the site is within connectivity distance (mean max foraging range + 1 SD) to the Mona Array Area or Cable Corridor and Access Areas)
Cape Wrath SPA	527.1	554.6	Northern fulmar
Flannan Isles SPA	535.5	561.6	Northern fulmar

National sites (SSSI and MNRs)

5.3.8.2 Nationally designated sites (seabird colonies within SSSI and MNR sites) identified for the offshore ornithology assessment are described in Table 5.11. Sites are ordered according to distance from the Mona Array Area within each category of site.

Table 5.11: Nationally designated sites and relevant qualifying interests for the offshore ornithology assessment.

Designated Site	Closest Distance to the Mona Array Area (km)	Closest Distance to the Mona Offshore Cable Corridor and Access Areas (km)	Relevant Qualifying Interest
SSSI (seabird colonies)			
Creigiau Rhiwledyn/Little Orme's Head SSSI	31.3	2.3	Common guillemot
			Razorbill
			Black-legged kittiwake
			Great cormorant
Pen y Gogarth/Great Orme's Head SSSI	29.8	3.3	Common guillemot
			Razorbill
			Black-legged kittiwake
			Great cormorant
Arfordir Gogleddol Penmon SSSI	34.7	13.8	Northern fulmar
Penrhynoedd Llangadwaladr SSSI	57.3	43.5	Lesser black-backed gull
			Herring gull
Ribble Estuary SSSI	58.7	48.3	Black-headed gull
			Common tern
St. Bees Head SSSI	77.8	97.3	Common guillemot
			Northern fulmar
			Black-legged kittiwake
			Razorbill
			Herring gull
	108.0	127.9	Northern fulmar

Designated Site	Closest Distance to the Mona Array Area (km)	Closest Distance to the Mona Offshore Cable Corridor and Access Areas (km)	Relevant Qualifying Interest
Abbey Burn Foot to Balcary Point SSSI			Black-legged kittiwake
			Razorbill
Sanda Islands SSSI	191.2	209.5	Northern fulmar
			Black-legged kittiwake
St. Margaret's Island SSSI	226.0	197.6	Black-legged kittiwake
			Atlantic puffin
			Lesser black-backed gull
Grassholm / Ynys Gwales SSSI	232.6	213.6	Northern gannet
MNRs			
Langness MNR	40.9	56.6	Northern fulmar
			Herring gull
			Lesser black-backed gull
Little Ness MNR	44.6	62.2	Northern fulmar
			Lesser black-backed gull
Laxey Bay MNR	48.8	67.8	Herring gull
			Lesser black-backed gull
			Northern fulmar
Baie ny Carrickey MNR	49.9	64.7	Razorbill
			Common guillemot
			Northern fulmar
			Black-legged kittiwake
			Atlantic puffin
Calf of Man and Wart Bank MNR	53.2	66.6	Lesser black-backed gull
			Herring gull
			Manx shearwater
			Atlantic puffin
			Black-legged kittiwake
Port Erin Bay MNR	56.5	70.8	Northern fulmar
			Northern gannet
			Herring gull
Ramsey Bay MNR	57.0	76.7	Northern fulmar

Designated Site	Closest Distance to the Mona Array Area (km)	Closest Distance to the Mona Offshore Cable Corridor and Access Areas (km)	Relevant Qualifying Interest
			Northern gannet
			Atlantic puffin
			Black-legged kittiwake
			Herring gull
Niarbyl Bay MNR	57.5	72.2	Northern fulmar
			Lesser black-backed gull
West Coast MNR	60.7	76.4	Black-legged kittiwake
			Northern fulmar
			Common guillemot
			Atlantic puffin
			Razorbill
			Manx shearwater
			Lesser black-backed gull
			Herring gull

5.3.9 Important Ecological Features (IEFs)

5.3.9.1 The IEFs included within the assessment are those species recorded during the site-specific surveys and identified in the desktop study that could be potentially affected by the Mona Offshore Wind Project during the construction, operations and maintenance or decommissioning phases. In addition, statutory consultees requested additional species also be included within the assessment (highlighted within Table 5.12).

5.3.9.2 The offshore ornithology IEFs have been selected (Table 5.12) based on the conservation status of the ornithological receptor, their sensitivity to impact (for each impact which has been scoped in for the assessment) and known abundance from site specific surveys and desktop studies (Volume 6, Annex 5.1: Offshore ornithology baseline characterisation of the Environmental Statement). (Document reference F6.5.1)).

5.3.9.3 For each IEF identified, it has been stated in Table 5.12 whether the identified species are listed on Annex I of the European Commission ('EC') Directive 2009/147/EC (codified version of 79/409/EC) on the Conservation of Wild Birds (the 'Birds Directive'). Within the UK, the Conservation of Habitats and Species (Amendment) (EU Exit) Regulations 2019 (known as the 'Habitats Regulations') provide amendments to the 2017 Habitats Regulations. The 2017 Habitats Regulations transpose aspects of the Birds Directive into national law, covering all environments out to 12 nm.

5.3.9.4 The level of conservation concern is presented from the Birds of Conservation Concern 5 (BoCC) (Stanbury *et al*., 2021), which uses quantitative assessments against standardised criteria to allocate species to red, amber, or green lists depending on their level of conservation concern.

5.3.9.5 Furthermore, species of principal importance for the conservation of biodiversity in England (priority species) were included in the assessment as listed under Section 41 of the Natural Environment and Rural Communities Act 2006. A number of species of conservation importance, i.e., BoCC (Stanbury *et al*., 2021) and Section 41 (Natural England, 2022d), are also interest features of UK SSSI sites and MNR on the Isle of Man.

5.3.9.6 Following the evaluation, the IEFs identified in Table 5.12 were taken forward for consideration in the impact assessment. Species that were recorded in very low numbers or very infrequently during the site-specific surveys and the desktop study are excluded because a population-level effect would be undetectable and thus negligible.

Table 5.12: Evaluation of IEFs showing species assessed for significance of effect from the Mona Offshore Wind Project.

Important ecological features	Conservation status	Observed within the Mona Array Area plus 2 km buffer (or 4 km buffer if appropriate for the species)	Vulnerable to disturbance and displacement	Vulnerable to collision risk	Assessed for significance of effects for the Mona Offshore Wind Project
Arctic skua	Red list	Yes – peak abundance of 11 birds during one survey.	Very low	High	Yes for collision, the species risk of collision was considered during the migration periods using the WWT Consulting and MacArthur Green (2014) approach for migratory species. However, as Arctic skua are assumed to migrate within a band of no more than 20 km from shore, there was no risk of collision during the migration period using the WWT Consulting and MacArthur Green (2014) approach.
Arctic tern	Annex 1, Amber list	No	Low	Moderate	No, no birds were present within array area
Atlantic puffin	**Red list**	**Yes – peak abundance of 44 birds during one survey.**	**Moderate**	**Very low**	**Yes, for disturbance and displacement**
Black-headed gull	**Amber list**	**Yes – peak abundance of 7 birds during one survey.**	**Low**	**Moderate**	**Yes, for migratory collision risk**
Black-legged kittiwake	**Red list**	**Yes – peak abundance of 907 birds during one survey.**	**Low**	**High**	**Yes, for disturbance and displacement, and collision risk**
Common guillemot	**Red list**	**Yes – peak abundance of 5,739 birds during one survey.**	**Moderate**	**Very low**	**Yes, for disturbance and displacement**
Common gull	Amber list	Yes – peak abundance of 20 birds during one survey.	Low	High	Yes for collision during migration periods, the species risk of collision was considered using the WWT Consulting and MacArthur Green (2014) approach for migratory species. However, as common gull are assumed to migrate within a band of no more than 20 km from shore, there was no risk of collision during the migration period using the WWT Consulting and MacArthur Green (2014) approach.

Important ecological features	Conservation status	Observed within the Mona Array Area plus 2 km buffer (or 4 km buffer if appropriate for the species)	Vulnerable to disturbance and displacement	Vulnerable to collision risk	Assessed for significance of effects for the Mona Offshore Wind Project
Common scoter	**Red list, Section 41 species**	**No**	**High**	Very low	**Yes, for disturbance and displacement due to higher abundances within the Cable Corridor and Access Areas.**
Common tern	Annex 1, Amber list	Yes – peak abundance of 7 birds during one survey.	Low	Moderate	No, for collision during breeding season, the species was not considered as the Mona Array Area is beyond the mean maximum plus one standard deviation for foraging common tern at breeding colonies. Yes, for collision during migration periods, the species risk of collision was considered using the WWT Consulting and MacArthur Green (2014) approach for migratory species. However, as common tern are assumed to migrate within a band of no more than 20 km from shore, there was no risk of collision during the migration period using the WWT Consulting and MacArthur Green (2014) approach.
European shag	Red list	No	Moderate	Moderate	No, no birds were present within the Mona Array Area
Great black-backed gull	**Amber list**	**Yes – peak abundance of 174 birds during one survey.**	Low	**Very high**	**Yes, for collision risk**
Great cormorant	Green list	Yes – peak abundance of 6 birds during one survey.	High	Low	No, the species is of low conservation status and low numbers of birds were present and therefore, the risk of collision and displacement was not considered.
Great skua	**Amber list**	**Yes – peak abundance of 7 birds during one survey.**	**Very Low**	**Moderate**	**Yes, for migratory collision risk**
Herring gull	**Red list, Section 41 species**	**Yes – peak abundance of 68 birds during one survey.**	Low	**Very high**	**Yes, for collision risk**
Lesser black-backed gull	**Amber list**	**Yes – peak abundance of 27 birds during one survey.**	Low	**Very high**	**Yes, for collision risk**

Important ecological features	Conservation status	Observed within the Mona Array Area plus 2 km buffer (or 4 km buffer if appropriate for the species)	Vulnerable to disturbance and displacement	Vulnerable to collision risk	Assessed for significance of effects for the Mona Offshore Wind Project
Little gull	Annex 1, Green list	Yes – peak abundance of 14 birds during one survey.	Low	Low	No, species is of low risk to displacement and/or collision risk. In addition, low numbers of birds were present compared to regional populations and therefore, the species was not assessed.
Manx shearwater	**Amber list**	**Yes – peak abundance of 2,173 birds during one survey.**	**Very Low**	**Very low**	**Yes, for disturbance and displacement and collision risk. Requested by the EWG even though the species is very low vulnerability.**
Northern fulmar	**Amber list**	**Yes – peak abundance of 149 birds during one survey.**	Very Low	**Very low**	**Yes, for collision risk. Requested by the EWG even though the species is very low vulnerability.**
Northern gannet	**Amber list**	**Yes – peak abundance of 293 birds during one survey.**	**Low**	**High**	**Yes, for disturbance and displacement, and collision risk.**
Razorbill	**Amber list**	**Yes – peak abundance of 2,305 birds during one survey.**	**Moderate**	Very low	**Yes, for disturbance and displacement.**
Red-throated diver	**Annex 1, Green list**	**No**	**High**	Moderate	**Yes, for disturbance and displacement. Requested by the EWG even though the species was not recorded during the Array Area surveys.**

Important ecological features	Conservation status	Observed within the Mona Array Area plus 2 km buffer (or 4 km buffer if appropriate for the species)	Vulnerable to disturbance and displacement	Vulnerable to collision risk	Assessed for significance of effects for the Mona Offshore Wind Project
Sandwich tern	Annex 1, Amber list	Yes – peak abundance of 15 birds during one survey.	Moderate	Moderate	No, for disturbance and displacement during breeding season, the species was not considered as the Mona Array Area is beyond the mean maximum plus one standard deviation for foraging common tern at breeding colonies. Yes for collision, the species risk of collision was considered during the migration periods using the WWT Consulting and MacArthur Green (2014) approach for migratory species. However, sandwich tern are assumed to migrate within a band of no more than 20 km from shore, there was no risk of collision during the migration period using the WWT Consulting and MacArthur Green (2014) approach.

Seasonality

5.3.9.7 The behaviour and abundance of bird populations vary throughout the calendar year, contingent on the biological seasons relevant to different seabird species. The IEFs included in the assessment showed seasonality in their distribution and abundance during the site-specific surveys, which reflected the timing of the breeding and non-breeding seasons and migratory periods (i.e. pre- and post-breeding). These distinct biological seasons (bio-seasons) are acknowledged in order to assess the significance of each bird species within the Mona Offshore Wind Project during each specific time period. The BDMPS seasons used within the assessment are based on those in Furness (2015).

5.3.9.8 The seasonal definitions in Furness (2015) include overlapping months in some instances due to variation in the timing of migration for birds which breed at different latitudes (i.e. individuals from breeding sites in the north of the species' range may still be on spring migration when individuals farther south have already commenced breeding).

5.3.9.9 Bio-seasons used within the assessment were defined according to the breeding, non-breeding and migratory periods (autumn and spring migration) from Furness (2015) are shown in Table 5.13. Common Scoter was not included within Furness (2015) and so was based on Cramp and Simmons (1983). The Migration-free breeding season was not used in the assessment as advised by JNCC in the second EWG (held on 13/07/2022).

Table 5.13: Seasonal definitions as the basis for assessment, from Furness (2015).

Species	Pre-breeding season/spring migration	Migration-free breeding season	~~Breeding~~Full breeding Season	Post breeding Season/autumn migration	Migration-free non-breeding/ winter season
Red-throated diver	February to April	May to August	March to August	September to November	December to January
Common Scoter	N/A	N/A	May to August	N/A	September to April
Common guillemot	December to February	March to June	March to July	July to October	November
Razorbill	January to March	April to June	April to July	August to October	November to December
Atlantic puffin	March to April	May to June	April to early August	Late July to August	September to February
Northern fulmar	December to March	April to August	January to August	September to October	November
Northern gannet	December to March	April to August	March to September	September to November	N/A
Manx shearwater	Late March to May	June to July	April to August	August to early October	November to February
Black-legged kittiwake	January to April	May to July	March to August	August to December	N/A
European herring gull	January to April	May to July	March to August	August to November	December

Species	Pre-breeding season/spring migration	Migration-free breeding season	~~Breeding~~Full breeding Season	Post breeding Season/autumn migration	Migration-free non-breeding/ winter season
Lesser black-backed gull	March to April	May to July	April to August	August to October	November to February
Great black-backed gull	January to April	May to July	Late March to August	August to November	December

Reference populations

5.3.9.10 Regional population estimates for the non-breeding, wintering and autumn and spring migration periods have been defined and calculated using the BDMPS relevant for each species (Furness, 2015). Population estimates for the breeding population were based on SPA and non-SPA sites (including SSSIs and MNR sites) located within the species' mean-maximum plus one standard deviation foraging range (using Woodward *et al.,* 2019) of the Mona Offshore Wind Project. Regional breeding colony counts were extracted from the SMP online database (JNCC, 2023), with the most recent colony count for each colony utilised (up to the year 2023)

5.3.9.11 In addition to breeding adult birds associated with the breeding colonies, there will be immature and juvenile seabirds present within the region. Population counts therefore must be adjusted to account for these seabirds.

5.3.9.12 As outlined in Volume 6, Annex 5.1 Offshore ornithology baseline characterisation technical report of the Environmental Statement~~,~~ (Document reference F6.5.1), calculation of the total regional breeding population was explored collaboratively with the Offshore Ornithology EWG due to their being little evidence to support the calculation of the number of juveniles, immatures and non-breeding birds that remain in their wintering areas into the breeding season. During the seventh EWG meeting (held 08 December 2023), it was agreed that for the project alone assessment, foraging range populations could be used, however if the foraging range population is greater than the regional seas populations (BDMPS from Furness, 2015) then impacts would also be assessed against this population. This specifically occurs for northern gannet and Manx shearwater. For precaution, the lowest breeding season population is presented in assessment.

5.3.9.13 In the non-breeding season, seabirds are not constrained by colony location and can, depending on individual species, range widely within UK seas and beyond. The ZOI for seabird species where an assessment in the non-breeding season and migratory periods is deemed to be required is based on either the 'UK Western Waters', 'UK Western Waters and Channel' or 'UK south-west and Channel waters' depending on the species (Furness, 2015). The total regional breeding population (adult plus juveniles and immatures) are presented in Table 5.14 alongside the non-breeding and migration periods BDMPS. Non-breeding populations for common scoter and red-throated diver were derived from HiDef Aerial Surveying Limited (2023).

5.3.9.14 As shown in Table 5.14, only certain seasons have been taken forward to the assessment. Furness (2015) provides under each species account the appropriate seasons to be used within assessments and hence why not all seasons in Table 5.13 have been utilised. These seasons were agreed with the EWG during the second meeting.

Table 5.14: Bio-seasonseasons, monthly breakdown and population sizes used within the assessment.

Bio-season population sizes of species taken from Furness, 2015.
[1]HiDef. (2023) – Latest population for the Liverpool Bay/Lerpwl Bae Area of Search.

Species	Pre-Breeding Season/Spring Migration	Foraging Range Breeding Season	Regional Seas Breeding Season	Post Breeding Season/Autumn Migration	Non-breeding/Winter Season
Red-throated diver	February to April (4,373)	N/A	N/A	September to November (4,373)	December to January (2,073)[1]
Common scoter	N/A	N/A	N/A	N/A	September to April (95,931)[1]
Common guillemot	N/A	March to July (136,680)	March to July (1,145,528)	N/A	August to February (1,139,220)
Razorbill	January to March (606,914)	April to July (18,345)	April to July (198,969)	August to October (606,914)	November to December (341,422)
Atlantic puffin	N/A	April to early August (203,302)	April to early August (1,482,791)	N/A	Mid-AugustSeptember to March (304,557)
Northern fulmar	December to March (828,194)	January to August (54,403)	January to August (629,594)	September to October (828,194)	November (556,367)
Northern gannet	December to February (661,888)	March to September (682,989)	March to September (522,888)	October to November (545,954)	N/A
Manx shearwater	March (1,580,895)	April to August (2,372,485)	April to August (1,821,544)	September to early October (1,580,895)	N/A
Black-legged kittiwake	January to MarchFebruary (691,526)	AprilMarch to August (156,679)	AprilMarch to August (245,234)	September to December (911,586)	N/A
European herring gull	N/A	March to August (31,214)	March to August (217,167)	N/A	September to February (173,299)
Lesser black-backed gull	March to April (163,304)	April to August (109,785)	April to August (240,750)	AugustSeptember to October (163,304)	November to February (41,159)
Great black-backed gull	N/A	Late March to August (1,496)	Late March to August (44,753)	N/A	September to MarchFebruary (17,742)

Baseline mortality rates

5.3.9.15 The impact of additional mortality due to offshore wind farm effects is assessed in terms of the change in the baseline mortality rate which could result. It has been assumed that all age classes are equally at risk of effects, with each age class affected in proportion to its presence in the population. Therefore, a weighted average baseline mortality rate has been calculated which is appropriate for all age classes for use in assessments, calculated for those species screened in for assessment.

5.3.9.16 Age specific survival rates for each species from Horswill and Robinson (2015) were entered into a matrix population model. Updated productivity values were provided by JNCC/British Trust for Ornithology (BTO) (SMP, 2023), with the UK average over the course of 2010 to 2019 calculated and used. Not all species and colonies had updated counts after 2014, and so the national average from Horswill and Robinson (2015) was used if no updated rates from JNCC/BTO were made available. Productivity values were used to calculate the expected proportions in each age class. Each age class survival rate was multiplied by its proportion and the total for all ages summed to give the average survival rate for all ages. The average mortality rate was subsequently calculated by subtracting the survival rate from 1. The demographic rates, age class proportions and average mortality rates calculated are presented in Table 5.15.

Table 5.15: Demographic rates from JNCC/BTO (SMP, 2023) and Horswill and Robinson (2015) and population age ratios calculated from population models used to estimate average mortality for use in impact assessment.

Species	Parameter	Age Class						Adult	Productivity	Average mortality
		0 to 1	1 to 2	2 to 3	3 to 4	4 to 5	5 to 6			
Red-throated diver	Survival	0.600	0.620	N/A	N/A	N/A	N/A	0.840	0.571	0.233
	Proportion in population	0.196	0.118	N/A	N/A	N/A	N/A	0.686	N/A	N/A
Common scoter	Survival	0.749	0.749	N/A	N/A	N/A	N/A	0.783	1.838	0.238
	Proportion in population	0.352	0.264	N/A	N/A	N/A	N/A	0.384	N/A	N/A
Common guillemot	Survival	0.560	0.792	0.917	0.939	0.939	N/A	0.939	0.583	0.133
	Proportion in population	0.153	0.084	0.065	0.058	0.053	N/A	0.587	N/A	N/A
Razorbill	Survival	0.630	0.630	0.895	0.895	N/A	N/A	0.895	0.532	0.172
	Proportion in population	0.155	0.099	0.064	0.059	N/A	N/A	0.623	N/A	N/A
Atlantic puffin	Survival	0.709	0.709	0.709	0.760	0.805	N/A	0.906	0.555	0.176
	Proportion in population	0.155	0.113	0.082	0.060	0.046	N/A	0.544	N/A	N/A
Northern fulmar	Survival	0.260	N/A	N/A	N/A	N/A	N/A	0.936	0.410	0.221
	Proportion in population	0.233	N/A	N/A	N/A	N/A	N/A	0.767	N/A	N/A
Manx shearwater	Survival	0.870	0.870	0.870	0.870	0.870	N/A	0.870	0.600	0.130
	Proportion in population	0.140	0.120	0.103	0.089	0.077	N/A	0.471	N/A	N/A
Northern gannet	Survival	0.424	0.829	0.891	0.895	0.895	N/A	0.919	0.766	0.193
	Proportion in population	0.201	0.084	0.069	0.061	0.054	N/A	0.531	N/A	N/A
Black-legged kittiwake	Survival	0.790	0.854	0.854	0.854	N/A	N/A	0.854	0.619	0.156
	Proportion in population	0.160	0.126	0.107	0.090	N/A	N/A	0.517	N/A	N/A

Species	Parameter	Age Class						Adult	Productivity	Average mortality
		0 to 1	1 to 2	2 to 3	3 to 4	4 to 5	5 to 6			
European herring gull	Survival	0.798	0.834	0.834	0.834	0.834	N/A	0.834	0.498	0.171
	Proportion in population	0.132	0.110	0.096	0.084	0.073	N/A	0.505	N/A	N/A
Lesser black-backed gull	Survival	0.820	0.885	0.885	0.885	0.885	N/A	0.885	0.438	0.121
	Proportion in population	0.120	0.099	0.088	0.079	0.069	N/A	0.547	N/A	N/A
Great black-backed gull	Survival	0.798	0.930	0.930	0.930	0.930	N/A	0.930	1.061	0.095
	Proportion in population	0.188	0.134	0.112	0.094	0.078	N/A	0.394	N/A	N/A

5.3.10 Future baseline scenario

5.3.10.1 The Infrastructure Planning (Environmental Impact Assessment) Regulations 2017 requires that *"an outline of the likely evolution thereof without implementation of the development as far as natural changes from the baseline scenario can be assessed with reasonable effort on the basis of the availability of environmental information and scientific knowledge"* is included within the Environmental Statement. In the event that the Mona Offshore Wind Project does not come forward, an assessment of the future baseline conditions has been carried out and is described within this section.

5.3.10.2 The UK holds internationally important populations of seabirds (Mitchell *et al*., 2004). UK seabird populations have shown a marked decline over the last two decades (JNCC, 2020; Mitchell *et al*., 2020) with over a third of species experiencing declines in breeding abundance of up to 30% or more since the early 1990s (Mitchell *et al.,* 2020).

5.3.10.3 A recent study suggests that, in terms of number of species affected and the average impact, the key three threats to seabird populations globally are invasive species (165 species across all the most threatened groups), bycatch in fisheries (100 species but with the greatest average impact) and climate change (96 species affected) (Dias *et al*., 2019; Mitchell *et al*., 2020).

5.3.10.4 Most seabird species in the UK are at the southern limit of their range in the northeast Atlantic and therefore an increase in global temperatures could result in a shift in species' range with the potential for overall declines in population size (Frederiksen *et al*., 2007, 2013 and Mitchell *et al*., 2020). In the UK and Ireland, climate change is considered to be the likely primary cause of decline in seabird populations in the future, with anticipated depletion of breeding conditions for most species either indirectly, through changes in prey abundance, or directly during extreme weather events (Mitchell *et al.*, 2020). On current predictions it is anticipated that sea surface temperatures will continue to rise (see Volume 4, Chapter 2: Climate Change of the Environmental Statement). (Document reference F4.2)).

5.3.10.5 Fisheries management will also likely impact on future seabird populations in the UK and Ireland. For many years, seabird species have benefitted from bycatch and fisheries discards; for scavenging species such as European herring gull, black-legged kittiwake, great skua and fulmar, population levels may already be above those that naturally occurring food sources would sustain (Votier *et al.,* 2004 and Frederiksen *et al.,* 2013), however the introduction between 2015 and 2019 of the Common Fisheries Policy Landings Obligation ('discard ban') will likely reduce the discard available and ultimately put more pressure on scavenging species.

5.3.11 Data limitations

5.3.11.1 Baseline characterisation of the Mona Offshore Ornithology Array Area study area and resulting assessments of significance use site-specific data (DAS) conducted over a period of 24 months (March 2020 to February 2022). As sampling is undertaken once a month for a period of 24 months, it may be considered to represent a snapshot of each month. Indeed, seabird numbers may fluctuate both spatially and temporally in response to environmental conditions. However, the sampling regime adopted at the Mona Offshore Wind Project is identical to other baseline characterisation surveys at offshore wind farms projects which have been previously agreed by SNCBs as suitable for baseline characterisation.

5.3.11.2 The level of precision of the abundance estimates is crucial as reliable abundance underpins the robustness of the predictions and the assessment of the effects on the IEFs. To characterise the baseline conditions, model-based estimates using the MRSea) package were produced in order to predict numbers across the survey area alongside 95% confidence intervals to provide a level of uncertainty. Design based estimates for bird numbers and densities in each month were also generated and compared to the MRSea estimates to provide additional validation of the MRSea outputs and provide estimates for months where low raw abundances prevented the use of the MRSea model. Flight heights for the Stochastic Collision Risk Model (sCRM) were derived from the published literature rather than site-specific data. Generic flight height distributions published by Johnston *et al*. (2014a, 2014b) were therefore used in sCRM for this assessment. The application of site-specific flight height data collected by LiDAR survey was considered during the survey programme but was not undertaken following consultation with the EWG in 2021. At the time of consultation, the EWG did not endorse the use of LiDAR as a method for collecting flight height data to parameterise CRMs due to the lack of an established body of scientific evidence. Other methods to collect site-specific flight height data (e.g. derived from aerial imagery) were not currently considered to be sufficiently robust or precise in their estimates and have associated issues with the application of appropriate avoidance rates. The use of generic flight heights conforms to current best practice and has been agreed through the Evidence Plan Process EWG as presented in section 0.

5.3.11.3 The impact of the short, medium and long-term effects of the 2022 HPAI outbreak on seabird colony abundance and vital rates (productivity and survival) on UK breeding colonies is unclear. It is also unclear yet how the distribution and abundance of seabirds at sea was affected during the 2022 summer outbreak. The disease has affected 61 bird species, including species such as northern gannet, razorbill, common guillemot, Atlantic puffin, Manx shearwater, northern fulmar and small and large gull species (Pearce-Higgens *et al*., 2022). The impact has affected northern gannet and great skua colonies profoundly, with both species now facing increased risk of global extinction (Pearce-Higgens *et al*., 2022) (the UK supports 55.6% of the global northern gannet population and 60% of the global great skua population; JNCC, 2021). However, as determined by recent Natural England guidance on HPAI in relation to baseline characterisation of offshore renewable projects (Natural England, 2022d), as the baseline data for the Mona Offshore Ornithology Array Area study area were all collected prior to summer 2022 (surveys commenced in March 2020 and were completed in February 2022), the assessments within this report remain a valid representation of typical seabird distribution and density.

5.4 Impact assessment methodology

5.4.1 Overview

5.4.1.1 The offshore ornithology impact assessment has followed the methodology set out in Volume 1, Chapter 5: EIA methodology of the Environmental Statement. (Document reference F1.5). Specific to the offshore ornithology impact assessment, the following guidance documents have been considered:

- Offshore Wind Marine Environmental Assessments: Best Practice Advice for Evidence and Data Standards. Phase I: Expectations for pre-application baseline data for designated nature conservation and landscape receptors to support offshore wind applications (Natural England, 2022a)

- Offshore Wind Marine Environmental Assessments: Best Practice Advice for Evidence and Data Standards. Phase II: Expectations for pre-application engagement and best practice guidance for the evidence plan process (Natural England, 2022b)
- Offshore Wind Marine Environmental Assessments: Best Practice Advice for Evidence and Data Standards. Phase III: Expectations for data analysis and presentation at examination for offshore wind applications (Natural England, 2022c)
- Chartered Institute of Ecology and Environmental Management (CIEEM) (2018) Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater, Coastal and Marine
- EIA for Offshore Renewable Energy projects (British Standards Institute (BSI) (2015); and
- UK Planning Inspectorate Advice Note Twelve: Transboundary Impacts (PINS, 2015); and Advice Note Seventeen: Cumulative Effects Assessment (PINS, 2019).

5.4.1.2 In addition, the offshore ornithology impact assessment has considered the legislative framework as defined by:

- The Conservation of Habitats and Species (Amendment) (EU Exit) Regulations 2019 and the 2017 Habitats Regulations
- European Commission ('EC') Directive 2009/147/EC (codified version of 79/409/EC) on the Conservation of Wild Birds (the 'Birds Directive')
- Ramsar Convention on Wetlands of International Importance 1971
- Wildlife and Countryside Act 1981 (as amended).

5.4.2 Impact assessment criteria

5.4.2.1 Determination of significance of effects is a two-stage process that involves defining the magnitude of the impacts and the sensitivity of the receptors. This section describes the criteria applied in this chapter to assign values to the magnitude of potential impacts and the sensitivity of the receptors. The terms used to define magnitude and sensitivity are based on those which are described in further detail in Volume 1, Chapter 5: EIA methodology of the Environmental Statement. (Document reference F1.5).

5.4.2.2 The criteria for defining magnitude in this chapter are outlined in Table 5.16 below. This set of definitions has been determined on the basis of changes to bird populations.

Table 5.16: Definition of terms relating to the magnitude of an impact.

Magnitude of impact	Definition
High	A change in the size or extent of distribution of the relevant biogeographic population or the population that is the interest feature of a specific protected site that is predicted to irreversibly alter the population in the short to long term and to alter the long-term viability of the population and/or the integrity of the protected site. Impacts felt long-term. Impacts predicted to be reversed in the long-term (i.e. more than five years) following cessation of the project activity.

Magnitude of impact	Definition
Medium	A change in the size or extent of distribution of the relevant biogeographic population or the population that is the interest feature of a specific protected site that occurs in the short and long-term, but which is not predicted to alter the long-term viability of the population and/or the integrity of the protected site. Impacts felt medium to long-term. Impacts predicted to be reversed in the medium-term (i.e. no more than five years) following cessation of the project activity.
Low	A change in the size or extent of distribution of the relevant biogeographic population or the population that is the interest feature of a specific protected site that is sufficiently small-scale or of short duration to cause no long-term harm to the feature/population. Impacts present for a short to medium duration. Impacts predicted to be reversed in the short-term (i.e. no more than one year) following cessation of the project activity.
Negligible	Very slight or no change from the size or extent of distribution of the relevant biogeographic population or the population that is the interest feature of a specific protected site. Impacts present for a short duration. Impacts predicted to be reversed rapidly (i.e. no more than circa six months) following cessation of the project related activity.

5.4.2.3 The criteria for defining recoverability and sensitivity in this chapter are outlined in Table 5.17 below.

Table 5.17: Definition of recoverability of the receptor.

Recoverability	Definition
High	A species with a low to medium reproductive success and a stable or increasing UK trend in breeding abundance and productivity.
Medium	A species with a low reproductive success and a stable or increasing UK long-term trend in breeding abundance and productivity.
Low	A species with a low reproductive success and a declining UK long-term trend in breeding abundance and productivity or uncertainty regarding the long-term trend (due to data availability).

5.4.2.4 The conservation value of ornithological receptors is based on the population from which individuals are predicted to be drawn. This reflects current understanding of the movements of species, with site-based protection (e.g. SPAs) generally limited to specific periods of the year (e.g. the breeding season). Therefore, conservation value can vary through the year depending on the relative sizes of the number of individuals predicted to be at risk of impact and the population from which they are estimated to be drawn. Conservation value therefore corresponds to the degree of connectivity which is predicted between the offshore wind farm site and protected populations. Using this approach, the conservation importance of a species seen at different times of year may fall into any of the defined categories (Table 5.18).

Table 5.18: Definition of conservation importance of the receptor.

Conservation Importance	Definition
High	A species for which individuals at risk can be clearly connected to a particular SPA and is listed as a qualifying feature of a designated site

Conservation Importance	Definition
Medium	A species for which individuals at risk are probably drawn from particular SPA populations, although other colonies (both SPA and non-SPA) may also contribute to individuals observed on the Mona Offshore Wind Project. The species is listed as a feature of a national designated site (e.g SSSI)
Low	A species for which it is not possible to identify the SPAs from which individuals on the Mona Offshore Wind Project have been drawn, or for which no SPAs are designated (includes SPAS, Ramsar sites and SSSIs).

5.4.2.5 The definition of sensitivity considers the vulnerability and recoverability of a receptor as well as taking into account the conservation importance of each receptor (outlined in Table 5.18).

5.4.2.6 It should be noted that high vulnerability and/or low recoverability are not necessarily linked with high conservation value within a particular impact. A receptor could be categorised as being of high conservation value (e.g. an interest feature of a SPA) but have a low or negligible physical/ecological vulnerability to an effect and vice versa. Determination of sensitivity takes these differing aspects into consideration.

Table 5.19: Definition of sensitivity of the receptor.

Sensitivity	Definition
Very High	Bird species has high conservation value, very high vulnerability to impact and has no ability to recover
High	Bird species has high conservation value, medium vulnerability to impact and has low recoverability
	Bird species has medium conservation value, high vulnerability to impact and has low recoverability
Medium	Bird species has high conservation value, low vulnerability to impact and has medium recoverability
	Bird species has high conservation value, low vulnerability to impact and has low recoverability
	Bird species has medium conservation value, high vulnerability to impact and has medium recoverability
	Bird species has medium conservation value, medium vulnerability to impact and has medium recoverability
	Bird species has medium conservation value, low vulnerability to impact and has medium recoverability
Low	Bird species has medium conservation value, medium vulnerability to impact and high recoverability
	Bird species has low conservation value, medium to high vulnerability to impact and medium to high recoverability
Negligible	Bird species has low conservation value, low vulnerability to impact and medium to high recoverability
	Bird species is not vulnerable to impacts.

5.4.2.7 The significance of the effect upon offshore ornithology is determined by correlating the magnitude of the impact and the sensitivity of the receptor. The method employed for this assessment is presented in Table 5.20. Where a range of significance of effect is presented in section 5.7, the final assessment for each effect is based upon expert judgement and a precautionary approach.

5.4.2.8 For the purposes of this assessment, any effects with a significance level of 'moderate' or 'major' have been concluded to be significant in terms of The Infrastructure Planning (Environmental Impact Assessment) Regulations 2017.

Table 5.20: Matrix used for the assessment of the significance of the effect.

Sensitivity of Receptor	Magnitude of Impact			
	Negligible	**Low**	**Medium**	**High**
Negligible	Negligible	Negligible or Minor	Negligible or Minor	Minor
Low	Negligible or Minor	Negligible or Minor	Minor	Minor or Moderate
Medium	Negligible or Minor	Minor	Moderate	Moderate or Major
High	Minor	Minor or Moderate	Moderate or Major	Major
Very High	Minor	Moderate or Major	Major	Major

5.4.3 Designated sites

5.4.3.1 Where National Site Network sites (i.e. internationally designated sites) are considered, this chapter summarises the assessments made on the interest features of internationally designated sites as described within section 5.3.8 of this chapter (with the assessment on the site itself deferred to the ISAA (Document ~~Reference~~reference E.1.1 – E1.3)). With respect to nationally and locally designated sites, where these sites fall within the boundaries of an internationally designated site (e.g. SSSIs which have not been assessed within the ISAA (Document ~~Reference~~reference E.1.1 – E1.3)), only the international site has been taken forward for assessment. This is because potential effects on the integrity and conservation status of the nationally designated site are assumed to be inherent within the assessment of the internationally designated site (i.e. a separate assessment for the national site is not undertaken).

5.4.3.2 The ISAA (Document ~~Reference~~reference E.1.1 – E1.3) has been prepared in accordance with Advice Note Ten: Habitats Regulations Assessment Relevant to Nationally Significant Infrastructure Projects (Planning Inspectorate, 2022) and has been submitted alongside the Environmental Statement.

5.5 Key parameters for assessment

5.5.1 Maximum design scenario

5.5.1.1 The MDS identified in Table 5.21 have been selected as those having the potential to result in the greatest effect on an identified receptor or receptor group. These scenarios have been selected from the Project Design Envelope provided in Volume 1, Chapter 3: Project description of the Environmental Statement~~.~~ (Document reference F1.3). Effects of greater adverse significance are not predicted to arise should any other development scenario, based on details within the Project Design Envelope (e.g. different infrastructure layout), to that assessed here be taken forward in the final design scheme.

Table 5.21: Maximum design scenario considered for the assessment of potential impacts on offshore ornithology.

[a] C=construction, O=operations and maintenance, D=decommissioning

Potential impact	Phase[a] C	O	D	Maximum Design Scenario	Justification
Disturbance and displacement from airborne noise, underwater sound, and presence of vessels and infrastructure	✓	✓	✓	**Construction phase** Installation of wind turbines, offshore substation platforms (OSPs), inter-array and interconnector cables in the Mona Array Area of up to 300 km^2, and offshore export cables within the Mona Offshore Cable Corridor and Access Areas. - Wind turbines: installation of up to 96 wind turbines - Up to 64 with four-legged jacket foundations. This will require one pile per leg with a maximum diameter of each pile of 3.8 m) installed by impact piling - Up to 32 with gravity base foundations, with up to 10 requiring piling, leading to up to 150 piles, with 15 piles per foundation (maximum diameter of 4 m per pile) - OSPs: installation of up to four OSPs - OSP foundations consisting of up to four-legged jacket foundations, with three piles per leg (48 piles, maximum diameter of 5 m per pile) installed by impact piling - Maximum hammer energy of up to 4,400 kJ - Up to two vessels piling wind turbines concurrently with a maximum hammer energy of 3,000 kJ each (minimum distance 1.4 km, maximum distance 15 km, between piling vessels) - Maximum of up to 4.5 hours of piling for a wind turbine foundation with a cumulative total of up to 1,152 hours, with a maximum of one foundation (four piles) per day. - Consecutive piling to take place over a maximum of 24 hoursper foundation. - Up to four piles installed per 24 hours per vessel = up to 159 days (up to 64 four legged jacket foundations for wind turbines, up to 37.5 days for the 10 gravity base foundations that require piling, 12 days for OSP foundation piles) for a single vessel (maximum temporal) or 57 days for two vessels (maximum spatial) - Total piling phase (foundation installation) of up to two years within a four-year construction programme	Represents the maximum density of wind turbines and structures across the maximum Mona Array Area and the Mona Offshore Cable Corridor and Access Areas that would cause greatest extent of disturbance and displacement to birds or the greatest duration of impact. Represents the maximum underwater sound impacts from impact piling for each of the relevant infrastructure foundation options. Represents the maximum number of vessel and helicopter movements that would cause greatest visual and noise disturbance and displacement to birds from the Mona Array Area and the Mona Offshore Cable Corridor and Access Areas.

Potential impact	Phase[a] C	O	D	Maximum Design Scenario	Justification
				- Burial of up to 325 km of inter-array cables, 50 km of interconnector cables and 360 km of export cable via ploughing, trenching and jetting; cable burial and rock dumping • Mona Array Area - Up to 1,929 installation vessel movements (return trips) during construction (521 main installation and support vessels, 74 tug/anchor handlers, 56 cable lay installation and support vessels, 50 guard vessel, 31 survey vessels, 19 seabed preparation vessels, 1,135 CTVs, 41 scour protection installation vessels and 2 cable protection installation vessels) - Up to a total of 69 construction vessels on site at any one time - Up to 1,095 helicopter movements with up to 7 helicopters on site at any one time • Mona Offshore Cable Corridor and Access Areas - Up to a total of 17 construction vessels on site at any one time including; o 2 cable lay installation and support vessels o 2 trench supporting vessels for export cable route o 2 installation support vessels for export cable route o 1 guard vessel for export cable route o 2 survey vessels for pre or post survey works for export cable route o 1 Out of Service cable removal vessel for export cable route o 1 boulder clearance vessel for export cable route o 1 dredging vessel for export cable route o 2 crew transport / installation support vessels o 1 rock dumping vessel for export cable route o 1 construction support vessel for concrete mattress installation for export cable route - Up to 126 installation vessel movements (return trips) during construction (10 cable lay installation cycles, 10 TSV rotations and 20 ISV rotations (support vessels), 18 guard vessel, 4 survey vessels, 24 seabed preparation vessels, 20 CTVs, and 20 cable protection installation vessels)	

Potential impact	Phase[a]			Maximum Design Scenario	Justification
	C	O	D		

				Operations and maintenance phase
				Disturbance and displacement from presence of operational wind turbines and associated operations and maintenance activity, including increased vessel, helicopter and inspection drone activity:
				- Presence of up to 96 operating turbines and up to four OSPs occupying the Mona Array Area of up to 300 km^2
				- Minimum spacing of 1400 m between wind turbines
				- Up to a total of 21 operations and maintenance vessels on site at any one time
				  ○ Up to 6 crew transfer vessels
				  ○ Up to 3 Jack-up vessels
				  ○ Up to 4 cable repair vessels
				  ○ Up to 4 other vessels
				  ○ Up to 4 excavator or backhoe dredger
				  ○ Up to 8 helicopters
				  ○ Up to 5 inspection drones (operated from vessel). Up to five inspections per wind turbine per year as a maximum.
				- Up to 849 operations and maintenance vessel movements (return trips) each year
				  ○ Up to 730 crew transfer vessels return trips
				  ○ Up to 25 Jack-up vessel trips return trips
				  ○ Up to 8 cable repair vessel return trips
				  ○ Up to 78 other vessel return trips
				  ○ Up to 8 excavator or backhoe dredger return trips
				  ○ Up to 730 helicopter return trips
				  ○ Up to 214 inspection drone return trips (operated from vessel).
				- Routine inspectons once per year
				  ○ max 2 repairs every 5 years per export cable with max 4 km per repair = 6.4 km per year
				  ○ estimated 1 reburial event every 5 years with approx 15 km cable length per reburial event	

Potential impact	Phase[a] C	O	D	Maximum Design Scenario	Justification
				- Operational lifetime of up to 35 years. **Decommissioning phase** - Vessels used for a range of decommissioning activities such as removal of foundations - Noise from vessels assumed to be as per vessel activity described for the construction phase above.	
Indirect impacts from underwater sound affecting prey species	✓	×	✓	**Construction phase** • As described in Volume 2, Chapter 3: Fish and shellfish ecology of the Environmental Statement (Document reference F2.3) for: – Underwater sound during the construction phase impacting fish and shellfish receptors. **Decommissioning phase** • As described in Volume 2, Chapter 3: Fish and shellfish ecology of the Environmental Statement (Document reference F2.3) for: – Underwater sound during the construction phase impacting fish and shellfish receptors.	As described in Volume 2, Chapter 3: Fish and shellfish ecology of the Environmental Statement. (Document reference F2.3).
Temporary habitat loss/disturbance and increased SSCs	✓	✓	✓	**Construction phase** • As described in Volume 2, Chapter 3: Fish and shellfish ecology of the Environmental Statement (Document reference F2.3) for: – Increased SSCs and associated sediment deposition. **Operations and maintenance phase** • As described in Volume 2, Chapter 3: Fish and shellfish ecology of the Environmental Statement (Document reference F2.3) for: – Increased SSCs and associated sediment deposition. **Decommissioning phase** • As described in Volume 2, Chapter 3: Fish and shellfish ecology of the Environmental Statement (Document reference F2.3) for: – Increased SSCs and associated sediment deposition.	As described in Volume 2, Chapter 3: Fish and shellfish ecology of the Environmental Statement. (Document reference F2.3).

Potential impact	Phase[a] C	O	D	Maximum Design Scenario	Justification
Collision risk	×	✓	×	**Operations and maintenance phase** • Presence of up to 96 wind turbines within the Mona Array Area • Minimum lower blade tip height of 34 m above Lowest Atronomical Tide (LAT) • Maximum hub height of 168 m above LAT • Maximum blade tip height of 293 m above LAT • Maximum rotor diameter of 250 m • Average blade pitch (in degrees) of 10 • Maximum chord width of 6.8 m • Maximum rotor speed of 8.4 rpm (with maximum average speed of 6.2 rpm) • Proportion of time operational of 94% • Operational lifetime of up to 35 years.	The potential for collision risk is derived from wind turbine parameters including rotor diameter, chord width, rotor speed and minimum lower blade tip height. The parameters associated with the most numerous wind turbines (96) represents the MDS because it will result in the greatest potential for collision risk. The parameters associated with the most numerous turbine option have been used, these values are based on the MDS parameter values for the worst-case collision risk.
Barrier to movement	×	✓	×	**Operations and maintenance phase** • Presence of up to up to 96 wind turbines, up to four OSPs within the Mona Array Area of 300 km^2 with a minimum spacing of 1,400 m between rowsand within rows.	Maximum density of wind turbines and structures across the Mona Array Area, which maximises the potential barrier to foraging grounds and migration routes for bird species.

5.6 Measures adopted as part of the Mona Offshore Wind Project

5.6.1.1 For the purposes of the EIA process, the term 'measures adopted as part of the project' is used to include the following measures (adapted from The Institute of Environmental Management and Assessment (IEMA), 2016):

- Measures included as part of the project design. These include modifications to the location or design envelope of the Mona Offshore Wind Project which are integrated into the application for consent. These measures are secured through the consent itself through the description of the development and the parameters secured in the DCO and/or marine licences (referred to as primary mitigation in IEMA (2016))
- Measures required to meet legislative requirements, or actions that are standard practice used to manage commonly occurring environmental effects and are secured through the DCO requirements and/or the conditions of the marine licences (referred to as tertiary mitigation in IEMA (2016)).

5.6.1.2 A number of measures (primary and tertiary) have been adopted as part of the Mona Offshore Wind Project to reduce the potential for impacts on offshore ornithology. These are outlined in Table 5.22. As there is a secured commitment to implementing these measures for the Mona Offshore Wind Project, they have been considered in the assessment presented in section 5.7 (i.e. the determination of magnitude and therefore significance assumes implementation of these measures).

5.6.1.3 It should be noted that the Applicant has committed to increase the air draught to 34 m above LAT during the project design phase to reduce the impacts from collision. Air draught is a known factor in calculating collision risk and it is assumed that increasing the air draught will decrease the proportion of birds flying at risk height (Band, 2012), and ultimately reduce the number of predicted collisions.

Table 5.22: Measures adopted as part of the Mona Offshore Wind Project.

Measures adopted as part of the Mona Offshore Wind Project	Justification	How the measure will be secured
Primary measures: Measures included as part of the project design		
The Applicant has committed to a minimum lower blade tip height (air draught) of 34 m above LAT.	Air draught is known to be an important factor for collision risk, with typically fewer collisions predicted with increasing air draught.	To be secured as a requirement of the DCO and within the deemed marine licence in Schedule 14 of the draft DCO.
Tertiary measures: Measures required to meet legislative requirements, or adopted standard industry practice		
Offshore Environmental Management Plan (EMP) that will include measures to minimise disturbance to rafting birds from transiting vessels	The development of and adherence to an Offshore EMP which will include measures to minimise disturbance to rafting birds from transiting vessels.	To be secured within the deemed marine licence in Schedule 14 of the draft DCO and expected to be secured within the standalone NRW marine licence.

Measures adopted as part of the Mona Offshore Wind Project	Justification	How the measure will be secured
The Offshore EMP will include a timing restriction of no offshore export cable installation during the period 1st November to 31st March within the Liverpool Bay SPA.	The timing restriction will ensure no installation of offshore export cables during the period of 1st November to 31st March within the Mona Offshore Cable Corridor and Access Areas located within the Liverpool Bay SPA in order to minimise disturbance to IEFs within the Mona Offshore Cable Corridor and Access Areas, in particular diver and seaduck species.	To be secured within the deemed marine licence in Schedule 14 of the draft DCO and expected to be secured within the standalone NRW marine licence.
The Offshore EMP will include a MPCP.	Implementation of an EMP including a MPCP which will include planning for accidental spills, address all potential contaminant releases and include key emergency details.	To be secured within the deemed marine licence in Schedule 14 of the draft DCO and expected to be secured within the standalone NRW marine licence.

5.7 Assessment of significant effects

5.7.1 Overview

5.7.1.1 The impacts of the construction, operations and maintenance, and decommissioning phases of the Mona Offshore Wind Project on offshore ornithology have been assessed. These potential impacts are listed in Table 5.21, along with the MDS against which each impact has been assessed.

5.7.1.2 A description of the potential effect on offshore ornithology receptors caused by each identified impact is given below.

5.7.2 Disturbance and displacement from airborne noise, underwater sound, and presence of vessels and infrastructure

5.7.2.1 The construction, operations and maintenance, and decommissioning of the Mona Offshore Wind Project may lead to disturbance and displacement of birds. The MDS is represented by the maximum density of wind turbines and structures across the Mona Array Area and the Mona Offshore Cable Corridor and Access Areas that would cause the greatest extent of disturbance and displacement to birds or the greatest duration of impact. The MDS also represents the maximum underwater sound output from impact piling for each of the relevant infrastructure foundation options and the maximum number of vessel and helicopter movements that would cause greatest visual and sound disturbance and displacement to birds from the Mona Array Area and Mona Offshore Cable Corridor and Access Areas. The MDS is summarised in Table 5.21.

5.7.2.2 Disturbance as the result of activities during the construction, operations and maintenance, and decommissioning phases of an offshore wind farm has the potential to displace seabirds from an area of sea in which the activity is occurring. In relation to offshore wind farm development, displacement is defined as a reduction in the number of seabirds occurring within or immediately adjacent to an offshore wind farm (Furness *et al*., 2013).

5.7.2.3 As the result of disturbance, displaced birds may move to areas already occupied by other birds and thus face higher intra- or inter-specific competition due to a higher density of individuals competing for the same resource. Alternatively, displaced birds may be forced to move into areas of lower quality (e.g. areas of lower prey availability). Such disturbance and resulting displacement could ultimately affect their demographic fitness (i.e. survival rates and breeding productivity) as well as potentially impacting on other birds in areas that displaced birds move to.

5.7.2.4 Disturbance as a result of activities during the construction of an offshore wind farm (such as installing foundations, wind turbines, inter-array cabling and associated vessel movements) and the offshore export cable has the potential to displace birds. Cable laying vessels will be active for six months within the construction period. Construction activities then result in a point source of disturbance, for example when construction vessels are at a location to undertake piling and install foundations or the wind turbines. The level of disturbance associated with each location would vary depending on the activity undertaken. With regards to vessels in the Mona Array Area, there is no method to quantify the displacement impact of the activities due to their highly local and temporary nature. An EMP that includes measures to minimise disturbance to rafting birds from transiting vessels is anticipated to be secured within the draft DCO and agreed pre-construction. It is expected that impacts of vessels on seabirds are negligible and this has not been taken forward to further assessment.

5.7.2.5 During the operations and maintenance phase, the presence of operational wind turbines has the potential to directly disturb seabirds leading to displacement from the offshore wind farm array area including an area of variable size or buffer around it (Dierschke *et al*., 2016). Therefore, the presence of wind turbines at the Mona Array Area has the potential to directly disturb and displace seabirds that would normally reside within and around the area of sea. Additionally, activities associated with the operations and maintenance of wind turbines (e.g. vessel, helicopter and inspection drone activity) may disturb and displace species within the Mona Array Area and potentially within surrounding buffers to a lower extent.

5.7.2.6 The displacement assessment for the Mona Offshore Wind Project is based on the use of the SNCB Matrix Table approach, which was agreed during consultation with the Offshore Ornithology EWG on 13 July 2022 as part of the Evidence Plan process. As sensitivity to displacement differs considerably between seabird species, species were screened and progressed for the Matrix Table approach using ‘Disturbance Sensitivity’ and ‘Habitat Specialization’ scores from Bradbury *et al*. (2014) and Wade *et al*. (2016) as recommended by the Joint SNCB Interim Displacement Advice Note (JNCC *et al*, 2022). In addition to the species’ sensitivity rating, the abundance of birds in the Mona Array Area was considered as to whether species were progressed to the matrix stage.

5.7.2.7 For each of the species considered (common guillemot, razorbill, Atlantic puffin, black-legged kittiwake, northern gannet, red-throated diver and Manx shearwater, Table 5.12), displacement impacts were quantified for the population derived within the Mona Array Area plus 2 km buffer (or 4 km buffer if appropriate for the species).

5.7.2.8 SNCBs recommend for most species a standard displacement buffer of 2 km with the exception of the species groups of divers and seaducks as they can be affected at distances over 4 km (JNCC, 2022).

5.7.2.9 Red-throated diver and common scoter were rarely recorded in the Mona Offshore Ornithology Array Area study area during the baseline surveys and have therefore been excluded from the assessment of displacement from the Mona Array Area but included in the Mona Offshore Cable Corridor and Access Areas assessment. There is the potential for disturbance and displacement from airborne noise, underwater sound, and presence of vessels within the Mona Offshore Cable Corridor and Access Areas as the result of site preparation activities in advance of installation activities, cable installation activities, pre-cabling seabed clearance (including Unexploded Ordnance (UXO) detonation), anchor placements and decommissioning activities such as export cable removal.

5.7.2.10 The evidence-based for the displacement rates and associated mortality rates for each species is noted below, and the full approach of the displacement assessment is detailed in Volume 6, Annex 5.2: Offshore ornithology displacement technical report of the Environmental Statement. (Document reference F6.5.2).

Evidence-based displacement and mortality rates

5.7.2.11 Since displacement sensitivity vary between species, the displacement rates and associated mortality rates used to assess the effects of the operations and maintenance phase of the Mona Offshore Wind Project have been derived from previous studies, guidance documents and advice received by SNCBs during the Evidence Plan Process. Given that construction is limited both spatially and temporally and that any potential effects are unlikely to reach the same level as during the operations and maintenance phase, the level to be used for the construction phase of the Mona Offshore Wind Project is a 50% reduction in the displacement rate used for operational phase assessments as recommended by Natural Resource Wales (NRW) during the second EWG (held on 13 July 2022).

5.7.2.12 There is limited empirical evidence in which mortality rate to use when assessing the impacts of displacement of offshore wind farms, however, the current SNCBs guidance, based on expert opinion (Natural England 2014), is to consider a mortality rate of up to 10% (SNCBs, 2017). Van Kooten *et al.* (2019) studied the effects of displacement of seabirds using energy-budget models for two scenarios using habitat utilization maps and a fixed 10% mortality rate. The evidence from this study suggests that a 1% mortality rate for displaced birds is more appropriate than the potentially over-precautionary 10% mortality rate. Similarly, Searle *et al.* (2014; 2018) used time and energy budget models to investigate the effects of displacement and barrier effects on breeding populations of seabirds, including auks during the chick rearing period. The study reported changes in time and energy budgets which could impact future survival of auks, however the simulations concluded that the displacement effects were unlikely to result in a mortality rate increase of over 0.5%. Therefore, in line with the advice from the SNCBs (2017), a 1 to 10% mortality of displaced individuals has been used for all species in this assessment, although the Applicant considers that 1% mortality rate to be the more likely impact based on expert judgement. To ensure that the assessments are suitably precautionary for all species, the mortality rates considered for the construction phase remain the same as those used for operational phase impacts.

5.7.2.13 Decommissioning activities within the Mona Array Area are equal to or less than those carried out during the construction phase. Therefore, for the purpose of this assessment it is assumed that the impacts are likely to be similar.

Atlantic puffin, common guillemot, razorbill, Manx shearwater

5.7.2.14 Evidence shows that auk species exhibit a medium level of sensitivity to vessel and helicopter traffic (Garthe and Hüppop, 2004; Furness and Wade, 2012; Langston, 2010; Bradbury *et al.*, 2014). Furthermore, displacement impacts from post-consent monitoring studies (from 13 different European offshore windfarm sites) have been collated and reviewed by Dierschke *et al.,* (2016), which found auk species to show 'weak displacement' overall, but results were highly variable. Similarly, a recent review submitted by Hornsea Four Offshore Wind Farm (Orsted, 2021; APEM 2022) summarises all current post consent-monitoring studies undertaken to date within the North Sea and UK Western Waters and provides an extensive study and analysis of the empirical data from offshore wind farms. This review found that auk displacement varies considerably across different sites, with displacement rates ranging from +112% to -75%.

5.7.2.15 Based on the review of the relevant literature, a displacement rate of 50% during the operations and maintenance phase of the Mona Offshore Wind Project has been deemed appropriate for the auk species (i.e. common guillemot, razorbill and Atlantic puffin) considered in this assessment. This rate is considered to be highly precautionary as a study of offshore wind farms in the German North Sea found reduced displacement rates (~20%) of guillemots during the breeding season compared to the non-breeding season (Peschko *et al.,* 2020). This is of important consideration as the mean displacement rates derived from the Dierschke *et al*. (2016) review was primarily from data collected in the non-breeding season. Therefore, by applying a single displacement rate of 50% across all bio-seasons within the Mona Array Area, this ensures a precautionary rate is used for the assessment.

5.7.2.16 Furthermore, evidence suggests that although auk species are somewhat sensitive to displacement, the effects are short-term, and studies indicate auk habituation to offshore windfarms. For example, a study at Thanet Offshore Windfarm found auk species became habituated and the displacement rate of 75% to 85% in the first year of operations fell to 31% to 41% within years two and three of operations (Royal Haskoning, 2013). Further evidence is emerging through additional post-construction monitoring of offshore windfarms, for instance, there are reports of auk numbers increasing and observations of foraging behaviour within the offshore wind farm itself (Leopold and Verdaat, 2018). This suggests the displacement rates of auk species within the Mona Array Area will reduce over time, and, given that the site is close to other offshore wind farms (such as Burbo Bank and West of Duddon Sands), some habituation may have already occurred within local populations that would result in reduced avoidance of the Mona Array Area compared to a new offshore wind farm in a previously unimpacted region.

5.7.2.17 The conclusion from the literature review suggests that a displacement rate of 50% (range 30% to 70%) during the operations and maintenance phase of the Mona Array Area and 2 km buffer is the most applicable for auk species, whilst still being suitably precautionary for assessment. As there is limited evidence regarding displacement rates in Manx shearwater, it was advised by the SNCBs at the Offshore Ornithology EWG meeting (held 13 July 2023, see S42 Consultation, see Annex 5, Chapter 2: Offshore ornithology displacement technical report~~)~~ (Document reference F6.5.2)) that these are to be treated similarly to the auk species, using a 50% (range 30% to 70%) displacement rate. The use of a 50% displacement rate in Manx shearwater is also likely to be highly precautionary since this species shows weak avoidance to offshore wind farms and the population vulnerability to displacement is very low (Dierschke *et al.,* 2016; Bradbury *et al.,* 2014).

5.7.2.18 Few studies have provided empirical displacement rates for the construction phase of offshore windfarms. However, studies suggest the displacement rates of auks is either comparable to or significantly lower than that of the operational phase (Royal

Haskoning, 2013; Vallejo *et al.,* 2017). Although potential disturbance from construction activities within a development can be high during the construction phase, it is likely to be both temporally and spatially restricted compared to the operations and maintenance phase, and thus the resultant displacement rate of the entire site is lower in comparison.

5.7.2.19 Given that the displacement rate used for the construction phase is a 50% reduction from the operational phase displacement rate, the rate used for auks, kittiwake and Manx shearwater during the construction phase is 25% (range 15% to 35%) as agreed with the SNCBs in the second EWG (held on 13/07/2022).

Northern gannet

5.7.2.20 To assess the effects of the operations and maintenance phase of the Mona Offshore Wind Project on the northern gannet population in the area, a displacement rate of 70% (range 60% to 80%) and a mortality rate of 1% (range 1% to 10%) was used.

5.7.2.21 Evidence suggests that northern gannet show a low level of sensitivity to ship and helicopter traffic (Garthe and Hüppop, 2004; Furness and Wade, 2012), however, their avoidance rates to offshore wind farms can be high. Natural England recently reviewed nine studies that reported on northern gannet avoidance rates using a variation of survey methods (Pavat *et al.,* 2023). The avoidance rates reported range from 61.7% to 100%. Another review by APEM (2022) looked at studies across 25 offshore wind farms, over different seasons, and reported displacement rates of 40% to 60% during the breeding season, and 60% to 80% during the non-breeding season. In light of literature, and following guidance from Natural England (pers. comm., 7 July 2022), using a displacement rate of 70% has been deemed appropriate for this assessment.

5.7.2.22 Given that the displacement rate used for the construction phase is a 50% reduction from the operational phase displacement rate, the rate used for northern gannet during the construction phase is 35% (range 30% to 40%) as agreed with the SNCBs.

5.7.2.23 Based on expert judgement a mortality rate of 1% (range 1% to 10%) was selected for this assessment. This decision is supported by additional evidence that suggests that northern gannet have a large mean-maximum (315 km) and maximum (709 km) foraging range (Woodward *et al.*, 2019) and feed on a diverse range of prey items and thus displaced birds will have access to suitable alternative foraging opportunities despite the potential reduced foraging activities within the Mona Array Area.

Black-legged kittiwake

5.7.2.24 Black-legged kittiwake are considered to have a low habitat specialisation score and low sensitivity to displacement (Bradbury *et al.,* 2014; Furness and Wade, 2012; Nature Scot, 2023). However, the population near the Mona Array Area is of high importance and so, following an agreement through the Evidence Plan Process and at the recommendation of JNCC, the species has been considered for the displacement assessment.

5.7.2.25 Studies regarding the displacement at Egmond aan Zee OWF (Leopold *et al.,* 2011), Bligh Bank OWF and Thorntonbank OWF (Vanermen, 2013). Horns Rev OWF, Princess Amalia Windpark (Furness, 2013) reported no significant displacement of black-legged kittiwake.

5.7.2.26 A study by Peschko (2020) used a long-term dataset covering 14 years before and 3 years after the construction of OWFs in the southern North Sea to assess the

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displacement of black-legged kittiwake. They found a 45% decrease in density during the breeding season.

5.7.2.27 Nature Scot advise a 30% displacement rate and 1% to 3% mortality rate for black-legged kittiwake in both the breeding and non-breeding season (Nature Scot, 2023). In light of this guidance and additional evidence stated, for the purpose of this assessment, precautionary rates of 50% (range 30% to 70%) for displacement and 1% (range 1% to 10%) for mortality have been used for the operations and maintenance phase of the Mona Offshore Wind Project. Given that the displacement rate used for the construction phase is a 50% reduction from the operational phase displacement rate, the rate used for black-legged kittiwake during the construction phase is 25% (range 15% to 35%) as agreed with the SNCBs in the second EWG (held on 13/07/2022)

Construction phase

Magnitude of impact

Mona Offshore Ornithology Offshore Cable Corridor

Red-throated diver

5.7.2.28 Red-throated diver was absent from the Mona Array Area + 4 km buffer and therefore was excluded from assessment of impact within this area. However red-throated diver occur within the nearshore environment where the Mona Offshore Cable Corridor intersects with areas of usage by this species. Therefore, red-throated diver has been included for assessment of impact within Mona Offshore Cable Corridor.

5.7.2.29 NRW requested that a 2 km buffer for this species be applied around the cable laying vessel. Within the MDS up to two cable laying vessels will be present with up to four support vessels at any one time. Any support vessels will be in the immediate vicinity of the cable laying vessels and so any displacement effect from those vessels will be included within the 2 km buffer. Therefore 25.14 km^2 of area would be disturbed around the construction vessels at any given time. However, during construction, vessel activity will be clustered around the area of cable laying and the areas of potential disturbance from each vessel will overlap. Therefore, the overall area of disturbance will likely be smaller than 25.14 km^2.

5.7.2.30 During the winter months (October to March) the densities of birds present within the Mona Offshore Cable Corridor and Access Areas are close to the coast at Colwyn Bay, where up to 1.22 birds per km^2 were present (HiDef, 2023) and therefore up to 30.67 birds could be temporarily displaced.

5.7.2.31 During summer months (April to September) the highest densities of birds present within the Mona Offshore Cable Corridor and Access Areas are close to the coast at Colwyn Bay, where up to 0.099 birds per km^2 were present (Bradbury *et al*., 2014) and therefore up to 2.49 birds could be temporarily displaced.

5.7.2.32 All red-throated diver are assumed to be displaced by vessel activity (displacement rate of 100%). The evidence for the impacts of mortality currently do not support that displacement causes increased mortality among red-throated diver (Dierschke *et al*., 2017; MacArthur Green, 2019). Between 0.5% and 1% mortality was assumed, which was requested by NRW as part of their S42 response. Therefore, in the non-breeding period between 0.15 and 0.31 birds may experience morality, whereas in the migration periods between 0.01 to 0.02 birds may experience mortality.

5.7.2.33 Using an average adult and immature mortality estimate of 0.233, and a non-breeding population of 2,073 this would lead to a baseline mortality rate of 483.01 individuals. The increase in baseline mortality using the estimates presented then equates to an increase mortality rate of between 0.03% to 0.06% for the Mona Offshore Cable Corridor and Access Areas alone in the non-breeding season.

5.7.2.34 During the migration periods, using an average adult and immature mortality estimate of 0.233, and a population of 4,373 this would lead to a baseline mortality rate of 1,019 individuals. The increase in baseline mortality using the estimates presented then equates to an increase mortality rate of <0.01% for the Mona Offshore Cable Corridor and Access Areas alone.

5.7.2.35 As part of the measures adopted for the Mona Offshore Wind Project, no offshore export cable installation activities will occur during the period of 1st November to 31st March within the Liverpool Bay SPA. This therefore means that red-throated diver will not be displaced during the non-breeding period and an increase in baseline mortality of <0.01% is predicted during installation.

5.7.2.36 If the unlikely scenario that all 17 cable laying vessels were to be present at the one time during cable laying activities, this would mean that a total area of 213.69 km^2 would be disturbed, which would equate to an increase in baseline mortality of 0.02% to 0.04% during the summer months for red-throated diver.

5.7.2.37 In either case, all scenarios considered are well below a 1% increase in baseline mortality and the magnitude is therefore, considered to be **negligible**.

Common scoter

5.7.2.38 Common scoter was absent from the Mona Array Area + 4 km buffer and therefore was excluded from assessment of impact within this area. However, common scoter occur within the nearshore environment where the Mona Offshore Cable Corridor and Access Areas intersects.

5.7.2.39 JNCC requested that a 2.5 km buffer for this species, as part of the Section 42 Consultation, be applied around the cable laying vessel (Fliessbach *et al.*, 2019). Within the MDS up to two cable laying vessels will be present with up to four support vessels at any one time. Any support vessels will be in the immediate vicinity of the cable laying vessels and so any displacement effect from those vessels will be included within the 2.5 km buffer. Therefore 39.27 km^2 of area would be disturbed round the vessels at any given time. However, during construction vessel activity will be clustered around the area of cable laying and the areas of potential disturbance from each vessel will overlap. Therefore, the overall area of disturbance will likely be smaller then 39.27 km^2.

5.7.2.40 During the winter months (October to March) The highest densities of birds present within the Mona Offshore Cable Corridor and Access Areas are close to the coast, where up to 56.51 birds per km^2 were present (Bradbury *et al*., 2014) and therefore up to 2,210 birds could be temporary displaced.

5.7.2.41 During summer months (April to September) no birds were present within the Mona Offshore Cable Corridor and Access Areas (Bradbury *et al*., 2014) and therefore no birds would be temporarily displaced and increase in baseline mortality would be 0.00%.

5.7.2.42 All common scoter are assumed to be displaced by vessel activity (displacement rate of 100%). Between 0.5% and 1% mortality was assumed and therefore between 11.05 and 22.10 birds may experience morality.

5.7.2.43 Using an average adult and immature mortality estimate of 0.238, and a non-breeding population of 95,931 (HiDef, 2023) this would lead to a baseline mortality rate of 22,831.58 individuals. The increase in baseline mortality using the estimates presented then equates to an increase between 0.05% to 0.10% for the Mona Offshore Cable Corridor and Access Areas alone.

5.7.2.44 As part of the measures adopted for the Mona Offshore Wind Project, no offshore export cable installation activities will occur during the period of 1st November to 31st March within the Liverpool Bay SPA. This therefore means that common scoter will not be displaced during the non-breeding period and an increase in baseline mortality of 0.00% is predicted during installation.

5.7.2.45 In either case, all scenarios considered are well below a 1% increase in baseline mortality and the magnitude is therefore, considered to be **negligible**.

Other species

5.7.2.46 Within Volume 6, Annex 5.1: Offshore ornithology baseline characterisation technical report, (Document reference F6.5.1), the density of birds for all other seabird and raftering birds was no greater than 1 bird per km^2. As the works being undertaken within the Mona Offshore Cable Corridor and Access Areas are temporary and minor in nature with work likely to be spatially and temporally restricted, no assessment was done for any other species within the Mona Offshore Cable Corridor during construction. The effect has been therefore assessed to be **negligible**.

Mona Offshore Ornithology Array Area

Common guillemot

5.7.2.47 The estimated mortality (when considering a displacement rate of 15% to 35% and a mortality rate of 1% to 10% as requested per guidance of the EWG) resulting from displacement during construction was assessed for each bio-season and for the combined bio-seasons (Table 5.23) as detailed in Volume 6, Annex 5.2: Offshore ornithology displacement technical report of the Environmental Statement. (Document reference F6.5.2).

5.7.2.48 In both bio-seasons and annually, the predicted increase in the baseline mortality rate does not surpass the 1% threshold (Table 5.23).

5.7.2.49 The impact is predicted to be of local spatial extent, short term duration, intermittent and high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **negligible**.

Table 5.23: Common guillemot bio-season and annual displacement estimates for Mona during construction.

Bio-season	Seasonal abundance (Mona Array Area + 2 km buffer)	Regional baseline population		Number of common guillemot subject to mortality (no. of indiv.)	Increase in baseline mortality (%)
		Population	Baseline mortality		
Breeding (March to July)	4,220	136,680	18,178	6 to 148	0.033 to 0.814
Non-breeding (August to February)	3,756	1,139,220	151,516	6 to 131	0.004 to 0.086
Annual	7,976	1,139,220	151,516	12 to 279	0.008 to 0.184

Razorbill

5.7.2.50 The estimated mortality (when considering a displacement rate of 15% to 35% and a mortality rate of 1% to 10%) resulting from displacement during construction was assessed for each bio-season and for the combined bio-seasons (Table 5.24) as detailed in Volume 6, Annex 5.2: Offshore ornithology displacement technical report of the Environmental Statement~~.~~ (Document reference F6.5.2).

5.7.2.51 In all four bio-seasons (breeding, non-breeding, autumn, and spring migration) and for the combined bio-seasons, the predicted increase in the baseline mortality rate does not surpass the 1% threshold.

5.7.2.52 The impact is predicted to be of local spatial extent, short term duration, intermittent and high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **negligible**.

Table 5.24: Razorbill bio-season and annual displacement estimates for the Mona Array Area plus 2 km buffer during construction.

Bio-season	Seasonal Abundance (Mona Array Area + 2 km buffer)	Regional Baseline Population		Number of razorbill subject to mortality (indiv.)	Increase in baseline mortality (%)
		Population	Baseline mortality		
Spring migration (January to March)	1,924	606,914	104,389	3 to 67	0.003 to 0.064
Breeding (April to July)	~~92~~83	18,345	3,155	0 to 3	0.000 to 0.095
Autumn migration (August to October)	~~86~~91	606,914	104,389	0 to 3	0.000 to 0.003
Non-breeding (November to December)	421	341,422	58,725	1 to 15	0.001 to 0.026

Bio-season	Seasonal Abundance (Mona Array Area + 2 km buffer)	Regional Baseline Population		Number of razorbill subject to mortality (indiv.)	Increase in baseline mortality (%)
		Population	Baseline mortality		
Annual	2,524519	606,914	104,389	4 to 88	0.004 to 0.084

Atlantic puffin

5.7.2.53 The estimated mortality (when considering a displacement rate of 15% to 35% and a mortality rate of 1% to 10%) resulting from displacement during construction was assessed for each bio-season and for the combined bio-seasons (Table 5.25) as detailed further in Volume 6, Annex 5.2: Offshore ornithology displacement technical report of the Environmental Statement. (Document reference F6.5.2).

5.7.2.54 In both bio-seasons and annually, the predicted increase in the baseline mortality rate does not surpass the 1% threshold.

5.7.2.55 The impact is predicted to be of local spatial extent, short term duration, intermittent and high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **negligible**.

Table 5.25: Atlantic puffin bio-season and annual displacement estimates for the Mona Array Area plus 2 km buffer during construction.

Bio-season	Seasonal Abundance (Mona Array Area + 2 km buffer)	Regional Baseline Population		Number of Atlantic puffin subject to mortality (indiv.)	Increase in baseline mortality (%)
		Population	Baseline Mortality		
Breeding (April to August)	15	203,302	35,781	0 to 1	0.000 to 0.003
Non-breeding (September to March)	022	304,557	53,602	0 to 01	0.000 to 0.000002
Annual	1537	304,557	53,602	0 to 1	0.000 to 0.002

Northern gannet

5.7.2.56 The estimated mortality (when considering a displacement rate of 30% to 40% and a mortality rate of 1% to 10%) resulting from displacement during construction was

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assessed for each bio-season and for the combined bio-seasons Table 5.26 as detailed further in Volume 6, Annex 5.2: Offshore ornithology displacement technical report of the Environmental Statement. (Document reference F6.5.2).

5.7.2.57 In all three bio-seasons (spring, breeding and autumn) and annually, the predicted increase in the baseline mortality rate does not surpass the 1% threshold.

5.7.2.58 The impact is predicted to be of local spatial extent, short term duration, intermittent and high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **negligible.**

Table 5.26: Northern gannet bio-season and annual displacement estimates for the Mona Array Area plus 2 km buffer during construction.

Bio-season	Seasonal Abundance (Mona Array Area + 2 km buffer)	Regional Baseline Population		Number of Northern gannet subject to mortality (indiv.)	Increase in baseline mortality (%)
		Population	Baseline Mortality		
Spring migration (December to February)	28	661,888	127,744	0 to 1	0.000 to 0.001
Breeding (March to September)	251	~~682,989~~522,888	~~131,817~~100,917	1 to 10	0.001 to 0.~~008~~010
Autumn migration (October to November)	58	545,954	105,369	0 to 2	0.000 to 0.002
Annual ~~(BDMPS)~~	336	~~682,989~~661,888	~~131,817~~127,744	1 to 13	0.001 to 0.010

Black-legged kittiwake

5.7.2.59 The estimated mortality (when considering a displacement rate of 15% to 35% and a mortality rate of 1% to 10%) resulting from displacement during construction was assessed for each bio-season and for the combined bio-seasons (Table 5.27) as detailed further in Volume 6, Annex 5.2: Offshore ornithology displacement technical report of the Environmental Statement. (Document reference F6.5.2).

5.7.2.60 There is no consensus between the SNCBs regarding the inclusion of a displacement assessment for black-legged kittiwake; however, one is presented here for precaution and for the SNCBs that have requested this information.

~~5.7.2.60~~5.7.2.61 In all three bio-seasons (spring, breeding and autumn) and annually, the predicted increase in the baseline mortality rate does not surpass the 1% threshold.

~~5.7.2.61~~5.7.2.62 The impact is predicted to be of local spatial extent, short term duration, intermittent and high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **negligible**.

Table 5.27: Black-legged kittiwake bio-season and annual displacement estimates for the Mona Array Area plus 2 km buffer during construction.

Bio-season	Seasonal Abundance (Mona Array Area + 2 km buffer)	Regional Baseline Population		Number of Black-legged kittiwake subject to mortality (indiv.)	Increase in baseline mortality (%)
		Population	Baseline Mortality		
Spring migration (January to February)	~~884~~574	691,526	107,878	1 to ~~31~~20	0.001 to 0.~~029~~019
Breeding (March to August)	~~355~~726	156,679	24,442	1 to ~~20~~25	0.004 to 0.~~082~~102
Autumn migration (September to December)	560	911,586	142,207	1 to 20	0.001 to 0.014
Annual	1,~~799~~860	911,586	142,207	~~3~~5 to ~~71~~74	0.~~002~~003 to 0.~~050~~052

Manx shearwater

~~5.7.2.62~~5.7.2.63 The estimated mortality (when considering a displacement rate of 15% to 35% and a mortality rate of 1% to 10%) resulting from displacement during construction was assessed for each bio-seasons and for the combined bio-seasons (Table 5.28) as detailed further in Volume 6, Annex 5.2: Offshore ornithology displacement technical report of the Environmental Statement~~.~~ (Document reference F6.5.2).

~~5.7.2.63~~5.7.2.64 In all three bio-seasons (spring, breeding and autumn) and annually, the predicted increase in the baseline mortality rate does not surpass the 1% threshold.

~~5.7.2.64~~5.7.2.65 The impact is predicted to be of local spatial extent, short term duration, intermittent and high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **negligible**.

Table 5.28: Manx shearwater bio-season and annual displacement estimates for the Mona Array Area plus 2 km buffer during construction.

Bio-season	Seasonal Abundance (Mona Array Area + 2 km buffer)	Regional Baseline Population		Number of Manx shearwater subject to mortality (indiv.)	Increase in baseline mortality (%)
		Population	Baseline Mortality		
Spring migration (March)	~~6~~3	1,580,895	205,516	0 to 0	0.000 to 0.000
Breeding (April to August)	1,249	~~2,372,485~~1,821,544	~~308,423~~236,801	2 to 44	0.001 to 0.~~014~~019

Bio-season	Seasonal Abundance (Mona Array Area + 2 km buffer)	Regional Baseline Population		Number of Manx shearwater subject to mortality (indiv.)	Increase in baseline mortality (%)
		Population	Baseline Mortality		
Autumn migration (September to December)	~~18~~216	1,580,895	205,516	0 to ~~6~~1	0.000 to 0.~~003~~000
Annual	1,~~437~~268	~~2,372,485~~1,821,544	~~308,423~~236,801	~~1~~2 to ~~11~~44	0.~~000~~001 to 0.~~004~~019

Sensitivity of the receptor

Common Scoter

~~5.7.2.65~~5.7.2.66 Common scoter are very vulnerable to disturbance and displacement caused by offshore wind farms. The species has a score of five (out of five) for displacement due to vessels (Wade *et al*., 2016).

~~5.7.2.66~~5.7.2.67 Common scoter present within the Mona Offshore Cable Corridor and Access Areas are likely to be part of the Liverpool Bay SPA and therefore, the species is considered to be of high value.

~~5.7.2.67~~5.7.2.68 The wintering population within the UK is increasing at the latest SPA review in the short and long-term (Stroud *et al*., 2016) and therefore it's considered wintering common scoter have a medium recoverability.

~~5.7.2.68~~5.7.2.69 Common scoter is deemed to be of high vulnerability, medium recoverability and high value. The sensitivity of the receptor is therefore, considered to be **high.**

Red-throated diver

~~5.7.2.69~~5.7.2.70 Red-throated diver are very vulnerable to disturbance and displacement caused by offshore wind farms. The species has a score of five (out of five) for displacement due to vessels (Wade *et al*., 2016).

~~5.7.2.70~~5.7.2.71 Red-throated diver present within the Mona Offshore Cable Corridor and Access areas are likely to be part of the Liverpool Bay SPA and therefore, the species is considered to be of high value.

~~5.7.2.71~~5.7.2.72 The wintering population within the UK is increasing at the latest SPA review over the short-term (unknown over the long-term) (Stroud *et al*., 2016) and therefore it's considered wintering common scoter have a medium recoverability. Red-throated diver is deemed to be of high vulnerability, medium recoverability and high value. The sensitivity of the receptor is therefore, considered to be **high.**

Common guillemot

~~5.7.2.72~~5.7.2.73 According to Wade *et al*. (2016), common guillemot are considered to be sensitive to disturbance from vessels and helicopters at offshore wind farms, with a vulnerability score of three (out of five). Whilst there is evidence from studies that auk species respond negatively to vessel traffic (Ronconi and Clair, 2002), behavioural response to underwater and airborne sounds resulting from construction activities are unknown. Although common guillemot are likely to respond to visual stimuli during the construction phase, the impacts of disturbance/displacement are short-term and common guillemot have the ability to return to the baseline abundance and distribution after construction.

~~5.7.2.73~~5.7.2.74 Although the species has a low reproductive success (i.e. laying one egg and not breeding until five years old) (Robinson, 2005), common guillemot have a medium recoverability given their increasing trend in abundance and productivity in the UK (JNCC, 2020).

~~5.7.2.74~~5.7.2.75 Common guillemot is a qualifying interest for several SPAs likely to be connected to the Mona Array Area (within the mean-max + SD foraging range), however as large colonies from non-SPA sites (i.e. SSSI sites) are also within close proximity (e.g. St Bee's Head) the species is considered to be of medium value.

~~5.7.2.75~~5.7.2.76 Common guillemot is deemed to be of medium vulnerability, medium recoverability and medium value. The sensitivity of the receptor is therefore, considered to be **medium**.

Razorbill

~~5.7.2.76~~5.7.2.77 As with common guillemot, razorbill are deemed to be sensitive to disturbance from vessels and helicopters at offshore wind farms, with a vulnerability score of three (out of five). Although razorbill are likely to respond to visual stimuli during the construction phase, the impacts of disturbance/displacement are short-term and razorbill have the ability to return to the baseline conditions after construction.

~~5.7.2.77~~5.7.2.78 Although the species has a low reproductive success (only laying one egg) and does not breed until four years old (Robinson, 2005), razorbill are deemed to have a medium recoverability given their increasing trend in abundance in the UK (JNCC, 2020).

~~5.7.2.78~~5.7.2.79 Razorbill is a qualifying interest for several SPAs likely to be connected to the Mona Array Area (within the mean-max + SD foraging range), however as several non-SPA colonies are also within range of the Mona Array Area, the species is considered to be of medium value.

~~5.7.2.79~~5.7.2.80 Razorbill is deemed to be of medium vulnerability, medium recoverability and medium value. The sensitivity of the receptor is therefore, considered to be **medium**.

Atlantic puffin

~~5.7.2.80~~5.7.2.81 Together with other auk species, Atlantic puffin are considered to be sensitive to disturbance from vessels and helicopters at offshore wind farms. The species is assigned a vulnerability score of three (out of five) by Wade *et al*. (2016).

~~5.7.2.81~~5.7.2.82 Although Atlantic puffin are likely to respond to visual stimuli during the construction phase, the impacts of disturbance/displacement are short-term and the population using the Mona Array Area has the ability to return to the baseline conditions after construction.

5.7.2.825.7.2.83 Atlantic puffin have a low reproductive success (i.e. laying one egg and not breeding until five years old) (Robinson, 2005) and are deemed to have a low recoverability given the lack of up-to-date census of the size of the UK breeding population and the overall declining trend in abundance (1986 to 2018) (JNCC, 2020).

5.7.2.835.7.2.84 Atlantic puffin is a qualifying interest for several SPAs likely to be connected to the Mona Array Area (within the mean-max + SD foraging range), with low to no Atlantic puffin likely coming from the few non-SPA sites within foraging range due to those non-SPA sites consisting of less than 100 birds. The species is therefore considered to be of high value.

5.7.2.845.7.2.85 Atlantic puffin is deemed to be of medium vulnerability, low recoverability and high value. The sensitivity of the receptor is therefore, considered to be **high**.

Northern gannet

5.7.2.855.7.2.86 Northern gannet are considered to have a medium sensitivity to other sources of disturbance such as ship and helicopter traffic (Garthe and Hüppop, 2004; Furness and Wade, 2012), and so northern gannet are considered to be of medium vulnerability.

5.7.2.865.7.2.87 Although northern gannet has a low reproductive success (only laying one egg) and does not breed until five years old (Robinson, 2005), the species is deemed to have a medium recoverability given the consistent increasing trend in abundance since the 1990s (JNCC, 2020). However, the species has suffered significant losses from the outbreak of HPAI during the 2022 breeding season, with it being estimated that around at least 25% of northern gannets within the UK have died due to the disease.

5.7.2.875.7.2.88 Northern gannet is a qualifying interest for several SPAs likely to be connected to the Mona Array Area (within the mean-max + SD foraging range), with a large non-SPA colony within close proximity (Monreith Cliffs and Scar Rocks), the species is therefore considered to be of medium value.

5.7.2.885.7.2.89 Northern gannet is deemed to be of medium vulnerability, medium recoverability and medium value. The sensitivity of the receptor is therefore, considered to be **medium**.

Black-legged kittiwake

5.7.2.895.7.2.90 In terms of behavioural responses to vessels and helicopters at offshore wind farms, black-legged kittiwake are considered to be of low to medium vulnerability to displacement (with a score of two out of five) by Wade *et al*. (2016).

5.7.2.905.7.2.91 Although the reproductive success of black-legged kittiwake is higher (i.e. laying two eggs and breeding until four years old) than auk species and northern gannet (Robinson, 2005), the species is deemed to have a low recoverability given the continuing decline in abundance observed between 1986 and 2018 in the UK (JNCC, 2020). During this period, breeding productivity has declined as the result of food shortage, although it has stabilised in recent years (JNCC, 2020). During the 2022 breeding season HPAI was confirmed in some Kittiwake colonies, but not to the same extent as gannet colonies.

5.7.2.915.7.2.92 Black-legged kittiwake is a qualifying interest for several SPAs likely to be connected to the Mona Array Area (within the mean-max + SD foraging range), with several non-SPA colonies within range and so the species is considered to be of medium value.

5.7.2.925.7.2.93 Black-legged kittiwake is deemed to be of low vulnerability, low recoverability and medium value. The sensitivity of the receptor is therefore, considered to be **medium**.

Manx shearwater

5.7.2.935.7.2.94 In terms of behavioural responses to vessels and helicopters at offshore wind farms, Manx shearwater are considered to be of low vulnerability to displacement (score of one) by Wade *et al*. (2016).

5.7.2.945.7.2.95 Owing to their large foraging range, Manx shearwater is a qualifying interest for several SPAs likely to be connected to the Mona Array Area (within the mean-max + SD foraging range). Most of the world population is found in the UK and over 90% of the UK population is found on the Islands of Rum and Eigg (Scotland) and Skomer and Skokholm (Wales) (Mitchell *et al*., 2004; JNCC, 2020). Therefore, the species is considered to be of high value.

5.7.2.955.7.2.96 Manx shearwater has a low reproductive success (i.e. only laying one egg and not breeding until five years old; Robinson, 2005). There is an incomplete spatial-temporal coverage of breeding abundance at UK colonies and thus a lack of long-term trend (JNCC, 2020). In the light of uncertainly and low reproductive success, Manx shearwater are therefore deemed to have a low recoverability.

5.7.2.965.7.2.97 Manx shearwater is deemed to be of low vulnerability, low recoverability and high value. The sensitivity of the receptor is therefore, considered to be **medium.**

Significance of the effect

5.7.2.975.7.2.98 Given that construction activities will only take place within a small area of the Mona Array Area at any given time, displaced birds will be able to resettle within the Mona Array Area or beyond. As alternative habitats exist, species shown in Table 5.29 are therefore not predicted to suffer a significant decline in bird fitness at a population level. Indeed, the displacement assessment analysis showed the magnitude of the increase in mortality to be negligible and below the 1% threshold increase for the species assessed in Table 5.23 to Table 5.28.

5.7.2.985.7.2.99 For common guillemot, negligible was selected from the negligible to minor range (Table 5.20) due to the impact not exceeding a 0.8% increase in baseline mortality. For razorbill, northern gannet, black-legged kittiwake and Manx shearwater, negligible was selected from the negligible to minor range due to the impact not exceeding a 0.1% increase in baseline mortality and hence, was not regarded as a minor significance of effect.

Table 5.29: Table summarising the significance of effect during construction.

Species	Magnitude of impact	Sensitivity of receptor	Significance of effect
Common guillemot	Negligible	Medium	**Negligible, not significant in EIA terms**
Razorbill	Negligible	Medium	**Negligible, not significant in EIA terms**
Atlantic puffin	Negligible	High	**Minor adverse, not significant in EIA terms**
Northern gannet	Negligible	Medium	**Negligible, not significant in EIA terms**

Species	Magnitude of impact	Sensitivity of receptor	Significance of effect
Black-legged kittiwake	Negligible	Medium	**Negligible, not significant in EIA terms**
Manx shearwater	Negligible	Medium	**Negligible, not significant in EIA terms**
Common scoter	Negligible	High	**Minor adverse, not significant in EIA terms**
Red-throated diver	Negligible	High	**Minor adverse, not significant in EIA terms**

Operations and maintenance phase

Magnitude of impact

Mona Offshore Ornithology Offshore Cable Corridor

5.7.2.995.7.2.100 Routine inspections of the export cable are estimated to occur once per year, with a maximum of two repairs every five years per export cable for the lifetime of the project. It is estimated that a total of 6.4 km of cable repairs would occur per year, with a maximum of eight vessel trips per year (Table 5.21). One reburial even is estimated to occur every five years, with approximately 15 km per reburial event.

5.7.2.1005.7.2.101 The potential for disturbance and displacement from such activities will be very restricted both temporally and spatially. Whilst unscheduled repair events may occur at any time of year, they are expected to be very rare occurrences. Any scheduled repairs would cause minimal disturbance and displacement which would be spatially restricted to the vicinity of the repair site and access routes, and temporally restricted to the time taken to conduct the repairs. Repairs will generally be undertaken in the shortest timespan possible in order to limit disruption.

Mona Offshore Ornithology Array Area

Common scoter

5.7.2.1015.7.2.102 There was no common scoter recorded within the Mona Array Area plus 4 km buffer (or during the DAS) and impact therefore magnitude is considered to be **negligible**.

Red-throated diver

5.7.2.1025.7.2.103 There was no red-throated diver recorded within the Mona Array Area plus 4 km buffer (or during the DAS) and impact therefore magnitude is considered to be **negligible**.

Common guillemot

5.7.2.1035.7.2.104 The estimated mortality (when considering a displacement rate of 30% to 70% and a mortality rate of 1% to 10%) resulting from displacement during the operations and maintenance phase was assessed for each bio-season and for the combined bio-seasons (Table 5.30) as detailed in Volume 6, Annex 5.2: Offshore ornithology displacement technical report of the Environmental Statement. (Document reference F6.5.2).

~~5.7.2.104~~5.7.2.105 In the non-breeding bio-seasons and annually, the predicted increase in the baseline mortality rate does not surpass the 1% threshold increase.

~~5.7.2.105~~5.7.2.106 However, during the breeding bio-season using the unlikely scenario of 70% displacement and 10% mortality, an increase in baseline mortality greater than 1% is predicted (Table 5.30). However, recent evidence from the Beatrice Offshore Wind Farm suggests that 70% displacement and 10% mortality rates are overly precautionary and that common guillemot continued to use the area around Beatrice Offshore Wind Farm regardless of turbine operational status (MacArthur Green, 2023). Taking a more realistic 50% displacement and 5% mortality, the increase in baseline mortality would be 0.52% and therefore below the 1% threshold.

~~5.7.2.106~~5.7.2.107 However, as a precaution, a Population Viability Analysis (PVA) was undertaken for common guillemot to investigate the increase in mortality to two SSSI breeding colonies Pen-y-Gogarth/Great Orme SSSI and Creigiau Rhiwledyn/Little Ormes Head SSSI. Full details of the PVA findings are found in Volume 6, Annex 5.6: Offshore ornithology population viability analysis technical report of the Environmental Statement~~.~~ (Document reference F6.5.6).

~~5.7.2.107~~5.7.2.108 The PVA for common guillemot at Pen-y-Gogarth/Great Orme SSSI revealed that the most extreme scenario of 70% displacement and 10% mortality would reduce the unimpacted baseline population growth rate by 0.015 which would result in a maximum reduction in population increase of 91.90% after 35 years. The more likely scenario of 50% displacement and 1% mortality would result in a growth rate reduction of 0.001 and a reduction in population increase of 8.41%. In all scenarios modelled (displacement rate 30% to 70%, mortality rate 1% to 10%), a positive population growth rate was sustained (1.0 to 1.02) indicating that the population is predicted to be growing and will be 36.1% to 123.0% larger than the current size after 35 years.

~~5.7.2.108~~5.7.2.109 The PVA for common guillemot at Creigiau Rhiwledyn/Little Ormes Head SSSI revealed that the most extreme scenario of 70% displacement and 10% mortality would reduce the unimpacted baseline population growth rate by 0.014 which would result in a maximum reduction in population increase of 90.68% after 35 years. The more likely scenario of 50% displacement and 1% mortality would result in a growth rate reduction of 0.001 and a reduction in population increase by 8.32%. In all scenarios modelled, a positive population growth rate was sustained (1.01 to 1.02) indicating that the population is predicted to be growing and will be 37.1% to 123.3% larger than the current size after 35 years.

~~5.7.2.109~~5.7.2.110 The impact is predicted to be of local spatial extent, medium-term duration, continuous and reversible. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **low.**

Table 5.30: Common guillemot bio-seasons and annual displacement estimates for the Mona Array Area plus 2 km buffer during the operations and maintenance phase.

Bio-season	Seasonal Abundance (Mona Array Area + 2 km buffer)	Regional Baseline Population		Number of common guillemot subject to mortality (no. of indiv.)	Increase in baseline mortality (%)
		Population	Baseline Mortality		
Breeding (March to July)	4,220	136,680	18,178	13 to 295	0.072 to 1.623
Non-breeding (August to February)	3,756	1,139,220	151,516	11 to 263	0.007 to 0.174
Annual	7,976	1,139,220	151,516	24 to 558	0.015 to 0.368

Razorbill

5.7.2.110 5.7.2.111 The estimated mortality (when considering a displacement rate of 30% to 70% and a mortality rate of 1% to 10%) resulting from displacement during the operations and maintenance phase was assessed for each bio-season and for the combined bio-seasons (Table 5.31) as detailed in Volume 6, Annex 5.2: Offshore ornithology displacement technical report of the Environmental Statement. (Document reference F6.5.2).

5.7.2.111 5.7.2.112 In all bio-seasons and for all bio-seasons combined, the predicted increase in the baseline mortality rate does not surpass the 1% threshold increase.

5.7.2.112 5.7.2.113 The impact is predicted to be of local spatial extent, medium-term duration, continuous and reversible. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **negligible**.

Table 5.31: Razorbill bio-seasons and annual displacement estimates for the Mona Array Area plus 2 km buffer during the operations and maintenance phase.

Bio-season	Seasonal Abundance (Mona Array Area + 2 km buffer)	Regional Baseline Population		Number of razorbill subject to mortality (indiv.)	Increase in baseline mortality (%)
		Population	Baseline Mortality		
Spring migration (January to March)	1,924	606,914	104,389	6 to 135	0.006 to 0.129
Breeding (April to July)	92 83	18,345	3,155	0 to 6	0.000 to 0.190
Autumn migration (August to October)	86 91	606,914	104,389	0 to 6	0.000 to 0.006
Non-breeding (November to December)	421	341,422	58,725	1 to 29	0.002 to 0.049
Annual	2,524 519	606,914	104,389	7 8 to 176	0.007 to 0.169

Atlantic puffin

~~5.7.2.113~~5.7.2.114 The estimated mortality (when considering a displacement rate of 30% to 70% and a mortality rate of 1% to 10%) resulting from displacement during the operations and maintenance phase was assessed for each bio-season and for the combined bio-seasons (Table 5.32) as detailed in Volume 6, Annex 5.2: Offshore ornithology displacement technical report of the Environmental Statement~~.~~ (Document reference F6.5.2).

~~5.7.2.114~~5.7.2.115 In both bio-seasons and for all bio-seasons combined, the predicted increase in baseline mortality does not surpass the 1% increase threshold.

~~5.7.2.115~~5.7.2.116 The impact is predicted to be of local spatial extent, medium-term duration, continuous and reversible. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **negligible.**

Table 5.32: Atlantic puffin bio-seasons and annual displacement estimates for the Mona Array Area plus 2 km buffer during the operations and maintenance phase.

Bio-season	Seasonal Abundance (Mona Array Area + 2 km buffer)	Regional Baseline Population		Number of Atlantic puffin subject to mortality (indiv.)	Increase in baseline mortality (%)
		Population	Baseline Mortality		
Breeding (April to August)	15	203,302	35,781	0 to 1	0.000 to 0.003
Non-breeding (September to March)	022	304,557	53,602	0 to 0 2	0.000 to 0.000003
Annual	1537	304,557	53,602	0 to 13	0.000 to 0.002005

Northern gannet

5.7.2.1165.7.2.117 The estimated mortality (when considering a displacement rate of 60% to 80% and a mortality rate of 1% to 10%) resulting from displacement during the operations and maintenance phase was assessed for each bio-season and for the combined bio-seasons (Table 5.33) as detailed in Volume 6, Annex 5.2: Offshore ornithology displacement technical report of the Environmental Statement. (Document reference F6.5.2).

5.7.2.1175.7.2.118 In all three bio-seasons (spring, breeding and autumn) and for the bio-seasons combined, the predicted increase in baseline mortalities remains well the below the 1% increase threshold.

~~5.7.2.118 During the seventh EWG meeting, an assessment against the regional seas population of 552,888 individuals (baseline mortality of 106,707), was requested. Taking the impact of 2 to 20 mortalities would increase the mortality rate by 0.002% and 0.019% respectively in the breeding season.~~

5.7.2.119 The impact is predicted to be of local spatial extent, medium-term duration, continuous and reversible. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **negligible**.

Table 5.33: Northern gannet bio-seasons and annual displacement estimates for the Mona Array Area plus 2 km buffer during the operations and maintenance phase.

Bio-season	Seasonal Abundance (Mona Array Area + 2 km buffer)	Regional Baseline Population		Number of Northern gannet subject to mortality (indiv.)	Increase in baseline mortality (%)
		Population	Baseline Mortality		
Spring migration (December to February)	28	661,888	127,744	0 to 2	0.000 to 0.002
Breeding (March to September)	251	682,989522,888	131,817100,917	2 to 20	0.002 to 0.016020

Bio-season	Seasonal Abundance (Mona Array Area + 2 km buffer)	Regional Baseline Population		Number of Northern gannet subject to mortality (indiv.)	Increase in baseline mortality (%)
		Population	Baseline Mortality		
Autumn migration (October to November)	58	545,954	105,369	0 to 5	0.000 to 0.005
Annual	336	~~682,989~~661,888	~~131,817~~127,744	2 to 27	0.002 to 0.~~020~~021

Black-legged kittiwake

5.7.2.120 The estimated mortality (when considering a displacement rate of 30% to 70% and a mortality rate of 1% to 10%) resulting from displacement during the operations and maintenance phase was assessed for each bio-season and for the combined bio-seasons (Table 5.34) as detailed in Volume 6, Annex 5.2: Offshore ornithology displacement technical report of the Environmental Statement~~.~~ (Document reference F6.5.2).

5.7.2.121 There is no consensus between the SNCBs regarding the inclusion of a displacement assessment for black-legged kittiwake; however, one is presented here for precaution and for the SNCBs that have requested this information.

~~5.7.2.121~~5.7.2.122 In all three bio-seasons (spring, breeding and autumn) and all bio-seasons combined, the predicted increase in baseline mortalities remains well below the 1% increase threshold.

~~5.7.2.122~~5.7.2.123 The impact is predicted to be of local spatial extent, medium-term duration, continuous and reversible. It is predicted that the impact will affect the receptor directly. The magnitude is, therefore, considered to be **negligible.**

Table 5.34: Black-legged kittiwake bio-seasons and annual displacement estimates for the Mona Array Area plus 2 km buffer during the operations and maintenance phase.

Bio-season	Seasonal Abundance (Mona Array Area + 2 km buffer)	Regional Baseline Population		Number of Black-legged kittiwake subject to mortality (indiv.)	Increase in baseline mortality (%)
		Population	Baseline Mortality		
Spring migration (January to February)	~~884~~574	691,526	107,878	3 to ~~62~~40	0.003 to 0.~~057~~037
Breeding (March to August)	~~355~~726	156,679	24,442	~~1~~2 to ~~25~~51	0.~~004~~0094 to 0.~~102~~208
Autumn migration (September to December)	560	911,586	142,207	2 to 39	0.001 to 0.027

Bio-season	Seasonal Abundance (Mona Array Area + 2 km buffer)	Regional Baseline Population		Number of Black-legged kittiwake subject to mortality (indiv.)	Increase in baseline mortality (%)
		Population	Baseline Mortality		
Annual	1,~~799~~860	911,586	142,207	6 to ~~126~~130	0.004 to 0.~~089~~092

Manx shearwater

~~5.7.2.123~~5.7.2.124 The estimated mortality (when considering a displacement rate of 30% to 70% and a mortality rate of 1% to 10%) resulting from displacement during the operations and maintenance phase was assessed for each bio-season and for the combined bio-seasons (Table 5.35) as detailed in Volume 6, Annex 5.2: Offshore ornithology displacement technical report of the Environmental Statement~~.~~ (Document reference F6.5.2).

~~5.7.2.124~~5.7.2.125 In all three bio-seasons (spring, breeding season and autumn migration) and for all bio-seasons combined, the predicted increase in baseline mortalities does not surpass the 1% increase threshold.

~~5.7.2.125 During the seventh EWG meeting, an assessment against the regional seas population of 1,821,544 individuals (baseline mortality of 236,801), was requested. Taking the impact of four to 87 mortalities would increase the mortality rate by 0.002% and 0.037% respectively in the breeding season. Annual this would increase the baseline mortality rate by 0.002% and 0.042%.~~

5.7.2.126 The impact is predicted to be of local spatial extent, medium-term duration, continuous and reversible. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **negligible.**

Table 5.35: Manx shearwater bio-seasons and annual displacement estimates for the Mona Array Area plus 2 km buffer during the operations and maintenance phase.

Bio-season	Seasonal Abundance (Mona Array Area + 2 km buffer)	Regional Baseline Population		Number of Manx shearwater subject to mortality (indiv.)	Increase in baseline mortality (%)
		Population	Baseline Mortality		
Spring migration (March)	~~6~~3	1,580,895	205,516	0 to 0	0.000 to 0.000
Breeding (April to August)	1,249	~~2,372,485~~1,821,544	~~308,423~~236,801	4 to 87	0.~~001~~002 to 0.~~028~~037
Autumn migration (September to October)	~~182~~16	1,580,895	205,516	~~1~~0 to ~~13~~1	0.000 to 0.~~006~~000
Annual	1,~~437~~268	~~2,372,485~~1,821,544	~~308,423~~236,801	~~5~~4 to ~~100~~89	0.002 to 0.~~032~~038

Sensitivity of receptor

Common scoter

5.7.2.127 Common scoter are very vulnerable to disturbance and displacement caused by offshore wind farms. The species has a score of five (out of five) for displacement due to vessels (Wade *et al*., 2016).

5.7.2.128 Common scoter present within the Mona Offshore Cable Corridor are likely to be part of the Liverpool Bay SPA and therefore, the species is considered to be of high value.

5.7.2.129 The wintering population within the UK is increasing at the latest SPA review in the short and long-term (Stroud *et al*., 2016) and therefore it's considered wintering common scoter have a medium recoverability.

5.7.2.130 Common scoter is deemed to be of high vulnerability, medium recoverability and high value. The sensitivity of the receptor is therefore, considered to be **high.**

Red-throated diver

5.7.2.131 Red-throated diver are very vulnerable to disturbance and displacement caused by offshore wind farms. The species has a score of five (out of five) for displacement due to vessels (Wade *et al*., 2016).

5.7.2.132 Red-throated diver present within the Mona Offshore Cable Corridor are likely to be part of the Liverpool Bay SPA and therefore, the species is considered to be of high value.

5.7.2.133 The wintering population within the UK is increasing at the latest SPA review over the short-term (unknown over the long-term) (Stroud *et al*., 2016) and therefore it's considered wintering common scoter have a medium recoverability.

5.7.2.134 Red-throated diver is deemed to be of high vulnerability, medium recoverability and medium value. The sensitivity of the receptor is therefore, considered to be **high.**

Common guillemot

5.7.2.135 Common guillemot is considered to have a high vulnerability to displacement from offshore wind farms, being assigned a score of four (out of five) by Wade *et al.* (2016).

5.7.2.136 Although the species has a low reproductive success (i.e., laying one egg and not breeding until five years old; Robinson, 2005), common guillemot have a medium recoverability given their increasing trend in abundance and productivity in the UK (JNCC, 2020).

5.7.2.137 Common guillemot is a qualifying interest for several SPAs likely to be connected to the Mona Array Area (within the mean-max + SD foraging range), however as large colonies from non-SPA sites are also within close proximity (e.g. St Bee's Head) the species is considered to be of medium value.

5.7.2.138 Common guillemot is deemed to be of high vulnerability, medium recoverability and medium value. The sensitivity of the receptor is, therefore, considered to be **medium**.

Razorbill

5.7.2.139 Razorbill is considered to have a high vulnerability to displacement from offshore wind farms, being assigned a score of four (out of five) by Wade *et al*. (2016).

5.7.2.140 Although the species has a low reproductive success (Robinson, 2005), razorbill are deemed to have a medium recoverability given their increasing trend in abundance in the UK (JNCC, 2020).

5.7.2.141 Razorbill is a qualifying interest for several SPAs likely to be connected to the Mona Array Area (within the mean-max + SD foraging range), however as several non-SPA colonies are also within range of the Mona Array Area, the species is considered to be of medium value.

5.7.2.142 Razorbill is deemed to be of high vulnerability, medium recoverability and medium value. The sensitivity of the receptor is therefore, considered to be **medium**.

Atlantic puffin

5.7.2.143 Atlantic puffin is considered to have a medium vulnerability to displacement from offshore wind farms, being assigned a score of three (out of five) by Wade *et al*. (2016).

5.7.2.144 Although the species has a low reproductive success (i.e. laying one egg and not breeding until five years old) (Robinson, 2005), Atlantic puffin are deemed to have a low recoverability given the lack of up-to-date census of the size of the UK breeding population and the overall declining trend in abundance (1986 to 2018) (JNCC, 2020).

5.7.2.145 As Atlantic puffin is a qualifying interest for several SPAs likely to be connected to the Mona Array Area (within the mean-max + SD foraging range) the species is considered to be of high value.

5.7.2.146 Atlantic puffin is deemed to be of medium vulnerability, low recoverability and high value. The sensitivity of the receptor is therefore, considered to be **high**.

Northern gannet

5.7.2.147 In terms of behavioural response to offshore wind farm structures, northern gannet are considered to be of high vulnerability, with a score of four (out of five) assigned by Wade *et al*. (2016). During the breeding season, northern gannet showed a strong avoidance of offshore wind farms (Peschko *et al*., 2021).

5.7.2.148 Northern gannet is a qualifying interest for several SPAs likely to be connected to the Mona Array Area (within the mean-max + SD foraging range), with a large non-SPA colony within close proximity (Monreith Cliffs and Scar Rocks), the species is therefore considered to be of medium value.

5.7.2.149 Although northern gannet has a low reproductive success (only laying one egg) and does not breed until five years old (Robinson, 2005), the species is deemed to have a medium recoverability given the consistent increasing trend in abundance since the 1990s (JNCC, 2020). However, the species has suffered from the outbreak of avian flu during the 2022 breeding season.

5.7.2.150 Northern gannet is deemed to be of high vulnerability, medium recoverability and medium value. The sensitivity of the receptor is therefore, considered to be **medium**.

Black-legged kittiwake

5.7.2.151 In terms of behavioural response to offshore wind farm structures, black-legged kittiwake are considered to be of low vulnerability, with a score of two (out of five) assigned by Wade *et al.* (2016).

5.7.2.152 Black-legged kittiwake is a qualifying interest for several SPAs likely to be connected to the Mona Array Area (within the mean-max + SD foraging range), with several non-SPA colonies within range and so the species is considered to be of medium value.

5.7.2.153 Although the reproductive success of black-legged kittiwake is higher (i.e. laying two eggs and breeding until four years old) than auk species and northern gannet (Robinson, 2005), the species is deemed to have a low recoverability given the continuing decline in abundance observed between 1986 and 2018 in the UK (JNCC, 2020). During this period, breeding productivity has declined as the result of food shortage, although it has stabilised in recent years (JNCC, 2020).

5.7.2.154 Black-legged kittiwake is deemed to be of low vulnerability, low recoverability and medium value. The sensitivity of the receptor is therefore, considered to be **medium**.

Manx shearwater

5.7.2.155 In terms of behavioural responses to vessels and helicopters at offshore wind farms, Manx shearwater are considered to be of very low vulnerability to displacement (score of one) by Wade *et al*. (2016).

5.7.2.156 Owing to their large foraging range, Manx shearwater is a qualifying interest for several SPAs likely to be connected to the Mona Array Area (within the mean-max + SD foraging range). Most of the world population is found in the UK and over 90% of the UK population is found on the Islands of Rum and Eigg (Scotland) and Skomer and Skokholm (Wales) (Mitchell *et al*., 2004; JNCC, 2020). Therefore, the species is considered to be of high value.

5.7.2.157 Manx shearwater has a low reproductive success (i.e. only laying one egg and not breeding until five years old) (Robinson, 2005). There is an incomplete spatial-temporal coverage of breeding abundance at UK colonies and thus a lack of long-term trend (JNCC, 2020). In the light of uncertainly and low reproductive success, Manx shearwater are therefore deemed to have a medium recoverability.

5.7.2.158 Manx shearwater is deemed to be of low vulnerability, medium recoverability and high value. The sensitivity of the receptor is therefore, considered to be **medium.**

Significance of effect

5.7.2.159 The displacement assessment analysis showed the magnitude of the increase in mortality to be negligible and below the 1% threshold increase for the species assessed in Table 5.30 to Table 5.35. A summary of the significant of disturbance and displacement during the operations and maintenance phase of the Mona Array Area is provided in Table 5.36. For Atlantic puffin negligible was selected from the negligible to minor range due to the impact not exceeding a 0.5 % increase in baseline mortality. Additionally, the population is vast with a change in baseline mortality greater than 0.1% would be unnoticeable and hence, was not regarded as a minor significance of effect. For northern gannet, black-legged kittiwake, Manx shearwater, common scoter and red-throated diver, negligible was selected from the negligible to minor range due to the impact not exceeding a 0.1% increase in baseline mortality and hence, was not regarded as a minor significance of effect.

Table 5.36: Table summarising the significance of effect during the operations and maintenance phase.

Species	Magnitude of impact	Sensitivity of receptor	Significance of effect
Common guillemot	Low	Medium	**Minor adverse, not significant in EIA terms**
Razorbill	Negligible	Medium	**Negligible, not significant in EIA terms**
Atlantic puffin	Negligible	High	**Negligible, not significant in EIA terms**
Northern gannet	Negligible	Medium	**Negligible, not significant in EIA terms**
Black-legged kittiwake	Negligible	Medium	**Negligible, not significant in EIA terms**
Manx shearwater	Negligible	Medium	**Negligible, not significant in EIA terms**
Common scoter	Negligible	High	**Negligible, not significant in EIA terms**
Red-throated diver	Negligible	High	**Negligible, not significant in EIA terms**

Decommissioning phase

5.7.2.160 Decommissioning activities within the Mona Array Area are equal to or less than those carried out during the construction phase within the Mona Array Area. Therefore, for the purpose of this assessment it is assumed that the level of disturbance is likely to be similar and the potential impact on each species is deemed to be reversible in the short-term as birds are likely to return when activities have been completed.

All receptors

5.7.2.161 Overall, the magnitude of the impact during decommissioning is deemed to be negligible and the sensitivity of the receptor is considered to be medium to high, depending on the species. The effect will, therefore, be of **negligible** or **minor** adverse significance, which is not significant in EIA terms.

5.7.3 Indirect impacts from underwater sound affecting prey species

5.7.3.1 Potential effects on the fish assemblages during the construction and decommissioning phases of the Mona Offshore Wind Project, as identified in Volume 2, Chapter 3: Fish and shellfish ecology of the Environmental Statement, (Document reference F2.3), may have indirect effects on offshore ornithology receptors.

5.7.3.2 Herring and sandeel are sensitive to offshore wind development (including underwater sound). Both species are listed as main prey items for several seabird species (Cramp and Simmons, 1983). Volume 2, Chapter 3: Fish and shellfish ecology of the Environmental Statement (Document reference F2.3) detailed the findings of the desktop studies in the Mona Fish and Shellfish Ecology study area. High and low intensity sandeel spawning grounds have been identified by Ellis *et al*. (2012) as being present throughout the Mona Fish and Shellfish Ecology study area. Herring spawning grounds have also been identified by Coull *et al*. (1998) as being present within the Mona Fish and Shellfish Ecology study area. The overlap of possible spawning grounds with the Mona Array Area has the potential to indirectly affect the distribution of seabirds, in particular the species showing a high level of specialisation which feed predominantly on young herring and sandeel.

5.7.3.3 Underwater sound produced during piling activities and cable installation during the construction phase may impact upon the availability of prey items. Indeed, underwater sound may cause fish and mobile invertebrates to avoid the construction area. Underwater sound may also affect the physiology and behaviour of fish and mobile invertebrates.

5.7.3.4 Species were screened and progressed for the assessment of significance on the basis of habitat specialisation (using scoring from Wade *et al.*, 2016), knowledge of the prey species targeted by each species (Cramp and Simmons, 1983) and their abundance in the Mona Array Area.

5.7.3.5 Because the auk species (i.e. Atlantic puffin, razorbill and common guillemot) foraging behaviour and prey species are similar, the species are considered together for the purpose of the assessment of significance.

Table 5.37: Species considered for assessment of underwater sound affecting prey species based on habitat specialisation score (Wade *et al*., 2016).

Ornithological receptor	Habitat specialisation	Abundance recorded in the Mona Array Area	Assessed for significance
Arctic skua	Low	Very Low	No
Arctic tern	Medium	Very Low	No
Atlantic puffin	Medium	Low	Yes
Black-headed gull	Low	Very Low	No
Black-legged kittiwake	Low	High	No
Common guillemot	Medium	Very high	Yes
Common gull	Low	Low	No
Common scoter	High	Absent	No
Common tern	Medium	Very low	No
European shag	Low	Very low	No
Great black-backed gull	Low	Moderate	No
Great cormorant	Medium	Very low	No
Great skua	Low	Very low	No
Herring gull	Very low	Low	No
Leach's storm-petrel	Very low	Very low	No
Lesser black-backed gull	Very low	Low	No
Little gull	N/A	Low	No
Manx shearwater	Very low	Moderate	No
Northern gannet	Very low	High	No
Northern fulmar	Very low	Moderate	No
Razorbill	Medium	High	Yes

Ornithological receptor	Habitat specialisation	Abundance recorded in the Mona Array Area	Assessed for significance
Red-throated diver	High	Very low	No
Sandwich tern	Medium	Very low	No

Construction phase

Magnitude of impact

Auk species (common guillemot, razorbill and Atlantic puffin)

5.7.3.6 Auks directly responding to visual cues are likely to be displaced during construction; the magnitude of the impact on the baseline mortality has been assessed using a displacement assessment matrix in section 5.7.2. However, in addition to direct visual disturbance, birds may be indirectly displaced due to a reduction in prey availability. Because of the short-term duration of the construction work and localised nature, it is however expected that birds will be able to re-settle in the Mona Array Area or beyond.

5.7.3.7 In the absence of quantitative information available, the magnitude is considered qualitatively and taking into consideration the assessment of significance presented in Volume 2, Chapter 3: Fish and shellfish ecology of the Environmental Statement, (Document reference F2.3), which concluded of moderate adverse significance for herring and cod and minor adverse for sprat and sandeel.

5.7.3.8 The impact is predicted to be of local spatial extent, short-duration, intermittent and reversible. It is predicted that the impact will affect the receptor indirectly. The magnitude is therefore, considered to be **low**.

Sensitivity of the receptor

Auk species (common guillemot, razorbill and Atlantic puffin)

5.7.3.9 Although the impact of underwater sound on fish has been well studied, there is no published evidence to our knowledge linking reduction of prey availability to avoidance/displacement of seabirds. In absence of information on vulnerability to underwater sound and reduction of prey availability at offshore wind farms, all species were considered to have a medium vulnerability.

5.7.3.10 Auk species have a low reproductive success (Robinson, 2005), and a low to medium recoverability given their increasing trend in abundance, particularly common guillemot and razorbill (JNCC, 2020).

5.7.3.11 As all three species are qualifying interests for several SPAs likely to be connected to the Mona Array Area (within the mean-max + SD foraging range) the species were considered to be of high value.

5.7.3.12 Auk species are deemed to be of medium vulnerability, low to medium recoverability and high value. The sensitivity of the receptor is therefore, considered to be **medium**.

Significance of the effect

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Auk species (common guillemot, razorbill and Atlantic puffin)

5.7.3.13 Overall, the magnitude of the impact is deemed to be low, and the sensitivity of the receptors is considered to be medium. The effect will, therefore, be of **minor** adverse significance, which is not significant in EIA terms.

Decommissioning phase

5.7.3.14 Decommissioning activities within the Mona Array Area are equal to or less than those carried out during the construction phase. Therefore, for the purpose of this assessment it is assumed that the level of disturbance is likely to be similar and the potential impact is deemed to be reversible in the short-term as birds are likely to return when activities have been completed.

Significance of the effect

Auk species (common guillemot, razorbill and Atlantic puffin)

5.7.3.15 Overall, the magnitude of the impact is deemed to be negligible and the sensitivity of the receptors is considered to be medium to high. The effect will, therefore, be of **minor** adverse significance, which is not significant in EIA terms.

5.7.4 Temporary habitat loss/disturbance and increased suspended sediment concentrations (SSCs)

Construction phase

5.7.4.1 Seabirds may be indirectly disturbed and displaced during the construction phase as a result of direct impacts on habitat and increased SSCs, which may result in the loss of a food resource to birds in the Mona Array Area and along the Mona Offshore Cable Corridor and Access Areas.

5.7.4.2 As a result, displaced seabirds may move to areas already occupied by other birds and thus face higher intra/inter-specific competition due to a higher density of individuals competing for the same resource. Alternatively, displaced birds may be forced to move into areas of lower quality (e.g. areas of lower prey availability). Such disturbance and resulting displacement could ultimately affect their demographic fitness (i.e. survival rates and breeding productivity) as well as potentially impacting on other birds in areas that displaced birds move to.

5.7.4.3 The potential construction phase impacts on fish and shellfish receptors are provided in Volume 2, Chapter 3: Fish and shellfish ecology of the Environmental Statement (Document reference F2.3) and include temporary subtidal habitat loss/disturbance and increased SSCs and associated sediment deposition.

Magnitude of impact

All receptors

5.7.4.4 The increase in SSCs may lead to a short-term avoidance of affected areas that support fish and shellfish species which are susceptible to respond increase SSCs. However, many fish and shellfish species are considered to be tolerant of turbid environments and regularly experience changes in the SSC due to the natural variability in the Irish Sea.

5.7.4.5 In the absence of quantitative information available, the magnitude is considered qualitatively and taking into consideration the assessment of significance on marine fish species presented in Volume 2, Chapter 3: Fish and shellfish ecology of the Environmental Statement, (Document reference F2.3), which concluded of minor adverse significance, which is not significant in EIA terms.

5.7.4.6 Temporary habitat loss could potentially affect spawning, nursery or feeding grounds of fish and shellfish receptors, with demersal fish and shellfish, and demersal spawning species the most vulnerable. The MDS assessed in Volume 2, Chapter 3: Fish and shellfish ecology of the Environmental Statement (Document reference F2.3) represented a very small proportion of the Mona Offshore Wind Project.

5.7.4.7 The impact is predicted to be of local spatial extent, short-duration, intermittent and reversible. It is predicted that the impact will affect the receptor indirectly. The magnitude is therefore, considered to be **negligible**.

Sensitivity of the receptor

All receptors

5.7.4.8 Seabirds are deemed to be of medium vulnerability, medium recoverability and medium to high value. The sensitivity of the receptor is therefore, considered to be **medium**.

Significance of the effect

All receptors

5.7.4.9 Overall, the magnitude of the impact is deemed to be negligible, and the sensitivity of the receptors is considered to be medium. The effect will, therefore, be of **minor** adverse significance, which is not significant in EIA terms.

Operations and maintenance phase

Magnitude of impact

All receptors

5.7.4.10 Maintenance activities within the Mona Array Area may lead to increases in SSCs and associated sediment deposition over the operational lifetime of the Mona Offshore Wind Project. The magnitude of the impacts would be a small fraction of those quantified for the construction phase.

5.7.4.11 The impact is predicted to be of local spatial extent, short-duration, intermittent and reversible. It is predicted that the impact will affect the receptor indirectly. The magnitude is therefore, considered to be **negligible**.

Sensitivity of the receptor

All receptors

5.7.4.12 Seabirds are deemed to be of medium vulnerability, medium recoverability and high value. The sensitivity of the receptor is therefore, considered to be **medium**.

Significance of the effect

All receptors

5.7.4.13 Overall, the magnitude of the impact is deemed to be negligible, and the sensitivity of the receptors is considered to be medium. The effect will, therefore, be of **minor** adverse significance, which is not significant in EIA terms.

Decommissioning phase

5.7.4.14 Decommissioning activities within the Mona Array Area are equal to or less than those carried out during the construction phase within the Mona Array Area. Therefore, for the purpose of this assessment it is assumed that the level of disturbance is likely to be similar and the potential impact is deemed to be reversible in the short-term as seabirds are likely to return when activities have been completed.

Significance of the effect

All receptors

5.7.4.15 Overall, the magnitude of the impact is deemed to be negligible and the sensitivity of the receptors is considered to be high. The effect will, therefore, be of **minor** adverse significance, which is not significant in EIA terms.

5.7.5 Collision risk

5.7.5.1 During the operations and maintenance phase of the Mona Offshore Wind Project, the turning rotors of the wind turbines may present a risk of collision for seabirds. Stationary structures, such as the tower, nacelle or when rotors are not operating, are not expected to result in a material risk of collision. When a collision occurs between the turning rotor blade and the bird, it is assumed to result in direct mortality of the bird, which potentially could result in population level impacts.

5.7.5.2 The ability of seabirds to detect and manoeuvre around wind turbine blades is a factor that is considered when modelling and assessing the risk. In response to this it is standard practice to calculate differing levels of avoidance for different species or species groups. Avoidance rates are applied to collision risk models to predict levels of impact more realistically, based on available literature and expert advice about seabird behaviour and their flight response to wind turbines.

5.7.5.3 Species differ in their susceptibility to collision risk, depending on their flight behaviour and avoidance responses, and the vulnerability of their populations (Garthe and Hüppop, 2004; Furness and Wade, 2012; Wade *et al*., 2016). As sensitivity to collision differs considerably between species, species were screened and progressed for assessment of significance on the basis of the density of flying birds recorded within the Mona Array Area and consideration of their perceived risk from collision (Garthe and Hüppop, 2004; Furness and Wade, 2012; Wade *et al*., 2016, Table 5.12).

5.7.5.4 Five seabird species were identified as potentially at risk due to their recorded abundance in the Mona Array Area and their likelihood of flying at potential collision height between the lowest and highest sweep of the wind turbine rotor blades above sea level. Additionally, consideration was given to species that may not have been accurately captured during baseline DAS due to the diurnal timing of the surveys, with such species likely to be more active during the nocturnal, dusk and dawn periods (e.g.

Manx shearwater and northern fulmar). In total, the significance of the collision effect was assessed for seven seabird species. The magnitude of change was determined by calculating the estimated number of collisions with the wind turbines and the resulting percentage increase in the background mortality rate.

5.7.5.5 There is the potential that aviation and navigation lighting on wind turbines might attract seabirds and thus increase the risk of collision. Conversely, aviation and navigation lighting could repel birds moving through the Mona Array Area. To our knowledge, there is little published evidence showing the effects of lighting on seabird collision and displacement, although earlier work on seaducks by Desholm and Kahlert (2005) showed that migrating flocks were more prone to enter the offshore wind farm but the higher risk of collision in the dark was counteracted by increasing distance from individual turbines and flying in the corridors between turbines. For true seabirds, there is published evidence showing that seabirds are less active at night compared to daytime (Kotzerka *et al*., 2010; Furness *et al*., 2018). Wade *et al*. (2016) ranked vulnerability of seabirds to collision by accounting for the nocturnal activity rate of seabirds.

5.7.5.6 CRM was undertaken using the sCRM developed by Marine Scotland (McGregor *et al*., 2018). The User Guide for the sCRM Shiny App provided by Marine Scotland (Donovan, 2017) has been followed for the modelling of collision impacts predicted for the Mona Array Area. The full methodology is provided in Volume 6, Annex 5.3: Offshore ornithology collision risk technical report of the Environmental Statement. (Document reference F6.5.3).

5.7.5.7 The collision risk models incorporated draft guidance on recommended avoidance rates, bird size, flight speed, flight type and nocturnal activity scores from Natural England (Natural England, pers. Comm., 7 July 2022). Throughout the document, outputs have been presented alongside recently published parameters from JNCC (Ozanlav-Harris *et al*., 2023). In some instances, values for certain species (e.g. northern fulmar and Manx shearwater) had not been provided within the Natural England guidance document. sCRM parameters for these species therefore followed best available evidence (e.g. Garthe and Hüppop, 2004; Pennycuick, 1997; Gibb *et al*., 2017; Robinson, 2005).

5.7.5.8 It is acknowledged that migratory passage movements may be 'missed' by aerial survey methods. Therefore, a combination of two approaches/tools were followed to quantify the number of birds that may cross the Mona Array Area during migration periods:

- The SOSS Migration Assessment Tool (SOSSMAT) was used to assess the population size of migratory bird species designated as features of the UK SPA network that may cross the Mona Array Area; instructions are given in Wright et al. (2012)
- An approach used in a strategic assessment of collision risk of Scottish offshore wind (WWT Consulting and MacArthur Green, 2014) to estimate proportions of the seabird population likely to pass the Scottish offshore wind farm sites.

5.7.5.9 The resulting number of seabird and non-seabirds estimated to cross the Mona Array Area was inputted into the Band (2012) single transit CRM.

5.7.5.10 The methodology and detailed results of the CRM for 60 migratory birds are provided in Volume 6, Annex 5.4: Offshore ornithology migratory bird collision risk modelling technical report of the Environmental Statement. (Document reference F6.5.4).

Operations and maintenance phase

Magnitude of impact

Black-legged kittiwake

5.7.5.11 In all three bio-seasons (pre-breeding, breeding and post breeding) and annually the estimated increase in baseline mortalities remains well below the 1% increase threshold for both the ~~Natural England~~species-group (0.993 ± 0.0003) and ~~JNCC~~species-specific (0.9979 ± 0.0013) avoidance rates. As black-legged kittiwake forage mainly in daytime, aviation and navigation lighting at the Mona Offshore Wind Project is unlikely to result in increasing collision risk.

5.7.5.12 The impact is predicted to be of local spatial extent, medium to long term duration, continuous and reversible. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **negligible**.

Table 5.38: Black-legged kittiwake expected collision mortality across bio-seasons.

Bio-season	Regional baseline population	Baseline mortality	Collision mortality (indiv.) ~~Natural England~~species-group avoidance ~~rates~~rate	Collision mortality (indiv.) ~~JNCC~~species-specific avoidance ~~rates~~rate	Increase in baseline mortality (%) (~~Natural England~~species-group avoidance ~~rates~~rate)	Increase in baseline mortality (%) (~~JNCC~~species-specific avoidance ~~rates~~rate)
Pre-breeding (January to February)	691,526	107,878	~~16.10~~8.74	~~4.83~~2.62	0.~~015~~008	0.~~004~~002
Breeding (March to August)	156,679	24,442	~~8.08~~15.52	~~2.42~~4.66	0.~~033~~063	0.~~010~~019
Post-breeding (September to December)	911,586	142,207	8.~~49~~41	2.~~55~~52	0.006	0.002
Annual	911,586	142,207	32.67	9.80	0.023	0.007

Great black-backed gull

5.7.5.13 In both bio-seasons (breeding and non-breeding) and annually the estimated increase in baseline mortalities remains well below the 1% increase threshold for the ~~JNCC~~species-specific avoidance rate (0.9991 ± 0.0002). However, when using ~~Natural England~~species-group avoidance rate (0.994 ± 0.0004) during the breeding season the increase in baseline mortality is marginally greater than 1%.

5.7.5.14 The impact is predicted to be of local spatial extent, medium to long term duration, continuous and reversible. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **low**.

Table 5.39: Great black-backed gull expected additional mortality due to collisions with turbines across bio-seasons.

Bio-season	Regional baseline population	Baseline mortality	Collision mortality (indiv.) Natural Englandspecies-group avoidance ratesrate	Collision mortality (indiv.) JNCCspecies-specific avoidance ratesrate	Increase in baseline mortality (%) (Natural Englandspecies-group avoidance ratesrate)	Increase in baseline mortality (%) (JNCCspecies-specific avoidance ratesrate)
Breeding (March to August)	1,496	142	1.6467	0.25	1.155176	0.176
Non-breeding (September to February)	17,742	1,685	3.1816	0.4847	0.189187	0.028
Annual	17,742	1,685	4.83	0.72	0.287	0.043

European herring gull

5.7.5.15 In both bio-seasons (breeding and non-breeding) and for all bio-seasons combined, the estimated increase in baseline mortalities remains well below the 1% increase threshold for both the Natural Englandspecies-group (0.994 ± 0.0004) and JNCCspecies-specific (0.9952 ± 0.0003) avoidance rates. As gulls forage mainly in daytime, aviation and navigation lighting at the Mona Offshore Wind Project is unlikely to result in increasing collision risk.

5.7.5.16 The impact is predicted to be of local spatial extent, medium to long term duration, continuous and reversible. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **negligible**.

Table 5.40: European herring gull expected additional mortality due to collisions with turbines across bio-seasons.

Bio-season	Regional baseline population	Baseline mortality	Collision mortality (indiv.) ~~Natural England~~species-group avoidance ~~rates~~rate	Collision mortality (indiv.) ~~JNCC~~species-specific avoidance ~~rates~~rate	Increase in baseline mortality (%) (~~Natural England~~species-group avoidance ~~rates~~rate)	Increase in baseline mortality (%) (~~JNCC avoidance rates~~species-specifiavoidance rate)
Breeding (March to August)	31,214	5,338	0.03	0.02	0.001	<0.~~000~~001
Non-breeding (September to February)	173,299	29,634	1.48	1.18	0.005	0.004
Annual	173,299	29,634	1.51	1.20	0.005	0.004

Lesser black-backed gull

5.7.5.17 When using an avoidance rate of 0.994 (±0.0004), the estimated mortalities in all four bio seasons and for all bio-seasons combined were very low and did not surpass the 1% increase threshold for both the ~~Natural England~~species-group (0.994 ± 0.0004) and ~~JNCC~~species-specific (0.9954 ± 0.0003) avoidance rates. As gulls forage mainly in daytime, aviation and navigation lighting at the Mona Offshore Wind Project is unlikely to result in increasing collision risk.

5.7.5.18 The impact is predicted to be of local spatial extent, medium to long term duration, continuous and reversible. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **negligible**.

Table 5.41: Lesser black-backed gull expected additional mortality due to collisions with turbines across bio-seasons.

Bio-season	Regional baseline population	Baseline mortality	Collision mortality (indiv.) ~~Natural England~~species-group avoidance rates	Collision mortality (indiv.) ~~JNCC~~species-specific avoidance rates	Increase in baseline mortality (%) (~~Natural England~~species-group avoidance rates)	Increase in baseline mortality (%) (~~JNCC~~species-specific avoidance rates)
Pre-breeding (March)	163,304	19,760	0.83	0.64	0.004	0.003
Breeding (April to August)	109,785	13,284	0.33	0.26	0.002	0.002

Bio-season	Regional baseline population	Baseline mortality	Collision mortality (indiv.) ~~Natural England~~species-group avoidance rates	Collision mortality (indiv.) ~~JNCC~~species-specific avoidance rates	Increase in baseline mortality (%) (~~Natural England~~species-group avoidance rates)	Increase in baseline mortality (%) (~~JNCC~~species-specific avoidance rates)
Post-breeding (September to October)	163,304	19,760	~~0.00~~No predicted collisions		~~0.00~~N/A	~~0.000~~
Non-breeding (November to February)	41,159	4,980	0.76	0.58	0.015	0.012
Annual	163,304	19,760	1.92	1.47	0.010	0.007

Northern gannet

5.7.5.19 In all three bio-seasons (pre-breeding, breeding and post-breeding) and for all bio-seasons combined, the estimated increase in baseline ~~mortalities~~mortality remains well below the 1% increase threshold for ~~both~~ the ~~Natural England~~species-group (0.993 ± 0.0003) ~~and JNCC (0.9939 ± 0.0004)~~ avoidance ~~rates~~rate. As northern gannet forage mainly in daytime, aviation and navigation lighting at the Mona Offshore Wind Project is unlikely to result in increasing collision risk.

5.7.5.20 The impact is predicted to be of local spatial extent, medium to long term duration, continuous and reversible. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **negligible**.

Table 5.42: Northern gannet expected additional mortality due to collisions with turbines across bio-seasons, assuming no displacement.

Bio-season	Regional baseline population	Baseline mortality	Collision mortality (indiv.) ~~Natural England~~species-group avoidance rates	~~Collision mortality (indiv.) JNCC avoidance rates~~	Increase in baseline mortality (%) (~~Natural England~~species-group avoidance rates)	~~Increase in baseline mortality (%) (JNCC avoidance rates)~~
Pre-breeding (December to February)	661,888	127,744	0.~~62~~41		<0.~~57~~001	~~0.000~~ ~~0.000~~

Bio-season	Regional baseline population	Baseline mortality	Collision mortality (indiv.) ~~Natural England~~species-group avoidance rates	~~Collision mortality (indiv.) JNCC avoidance rates~~	Increase in baseline mortality (%) (~~Natural England~~species-group avoidance rates)	~~Increase in baseline mortality (%) (JNCC avoidance rates)~~
Breeding (March to September)	~~682,989~~522,888	~~131,817~~100,917	~~3.86~~4.73	~~3.36~~	0.~~003~~005	~~0.003~~
Post-breeding (October to November)	545,954	105,369 ~~1.16~~ ~~1.01~~	0.~~001~~51		<0.~~001~~000	
Annual	~~682,989~~661,888	~~131,817~~127,744	5.~~64~~ 65	~~4.94~~	0.004	~~0.004~~

Table 5.43: Northern gannet expected additional mortality due to collisions with turbines across bio-seasons, assuming 70% displacement.

Bio-season	Regional baseline population	Baseline mortality	Collision mortality (indiv.) ~~Natural England~~species-group avoidance rates	~~Collision mortality (indiv.) JNCC avoidance rates~~	Increase in baseline mortality (%) (~~Natural England~~species-group avoidance rates)	~~Increase in baseline mortality (%) (JNCC avoidance rates)~~
Pre-breeding (December to February)	661,888	127,744	0.~~19~~12		<0.~~16~~001	~~0.000~~ ~~0.000~~
Breeding (March to September)	~~682,989~~522,888	~~131,817~~100,917	1.~~16~~42	~~1.01~~	0.001	~~0.001~~
Post-breeding (October to November)	545,954	105,369	0.~~35~~15		<0.~~30~~001	~~0.000~~ ~~0.000~~
Annual	~~682,989~~661,888	~~131,817~~127,744	1.~~69~~70	~~1.47~~	0.001	~~0.001~~

Northern fulmar

5.7.5.21 When using ~~an~~the species-group avoidance rate of 0.991 (±0.0004~~) recommended by both Natural England and JNCC,~~), the estimated increase in baseline mortality represents negligible impact in all four bio-seasons and for the combined bio-seasons (Table 5.44). In the absence of quantitative information available on the effect of aviation and navigation lighting on collision risk, the magnitude is considered qualitatively for ~~Northern~~northern fulmar. Although the species has a higher activity rate than most seabird species, aviation and navigation lighting at the Mona Offshore Wind Project is unlikely to result in increasing collision risk, with very few flights likely to be at collision risk height (Wade *et al*., 2016).

5.7.5.22 The impact is predicted to be of local spatial extent, medium to long term duration, continuous and reversible. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **negligible**.

Table 5.44: Northern fulmar expected additional mortality due to collisions with turbines across bio-seasons.

Bio-season	Regional baseline population	Baseline mortality	Collision mortality (indiv.) ~~Natural England~~species-group avoidance rates	~~Collision mortality (indiv.) JNCC avoidance rates~~	Increase in baseline mortality (%) (~~Natural England~~species-group avoidance rates)		~~Increase in baseline mortality (%) (JNCC avoidance rates)~~
Pre-breeding (December)	828,194	183,031	0.~~23~~03		<0.~~23~~001	~~0.000~~	~~0.000~~
Breeding (January to August)	54,403	12,023	0.~~12~~32		0.~~12~~002	~~0.001~~	~~0.001~~
Post-breeding (September to October)	828,194	183,031	~~0.00~~No predicted collisions		~~0.00~~N/A	~~0.000~~	~~0.000~~
Non-breeding November	556,367	122,957	0.01		<0.~~01~~001	~~0.000~~	~~0.000~~
Annual	828,194	183,031	0.36		<0.~~36~~001	~~0.000~~	~~0.000~~

Manx shearwater

5.7.5.23 When using ~~an~~the species-group avoidance rate 0.991 (±0.0004)~~ recommended by both Natural England and JNCC,~~ there are no predicted collisions during the operations phase of the offshore wind farm, and thus no increase in mortality relative to the baseline mortality. In the absence of quantitative information available on the effect of aviation and navigation lighting on collision risk, the magnitude is considered qualitatively for Manx shearwater. Although the species has a high activity rate, aviation and navigation lighting at the Mona Offshore Wind Project is unlikely to result in increasing collision risk, with very few flights likely to be at collision risk height (Wade *et al*., 2016) with Manx shearwater flying close to the sea surface.

5.7.5.24 The impact is predicted to be of local spatial extent, medium to long term duration, continuous and reversible. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **negligible**.

Table 5.45: Manx shearwater expected additional mortality due to collisions with turbines across bio-seasons.

Bio-season	Regional baseline population	Baseline mortality	Collision mortality (indiv.) ~~Natural England~~species-group avoidance rates	~~Collision mortality (indiv.) JNCC avoidance rates~~	Increase in baseline mortality (%) (~~Natural England~~species-group avoidance rates)	~~Increase in baseline mortality (%) (JNCC avoidance rates)~~	
Pre-breeding (March)	1,580,895	205,516	~~0.00~~No predicted collisions		~~0.00~~N/A	~~0.000~~	~~0.000~~
Breeding (April to August)	~~2,372,485~~1,821,544	~~308,423~~236,801	~~0.00~~No predicted collisions		~~0.00~~N/A	~~0.000~~	~~0.000~~
Post-breeding (September to October)	1,580,895	205,516	~~0.00~~No predicted collisions		~~0.00~~N/A	~~0.000~~	~~0.000~~
Annual	~~2,372,485~~1,821,544	~~308,423~~236,801	~~0.00~~No predicted collisions		~~0.00~~N/A	~~0.000~~	~~0.000~~

Migratory birds

5.7.5.25 Predictions for collision risk using a range of avoidance rates are provided in Volume 6, Annex 5.4: Offshore ornithology migratory bird collision risk modelling technical report of the Environmental Statement~~,~~ (Document reference F6.5.4), and the annual collision rate of the assessed species is also presented within Table 5.46.

5.7.5.26 Even assuming a highly precautionary avoidance rate of 98%, the estimated numbers of collisions were low and predicted to be below one bird per annum for all but nine species found to be crossing the Mona Array Area. Details of species assessed and the associated increase in baseline mortality as a percentage are provided in Table 5.46. UK population estimates are taken from Woodward *et al*. (2020) unless otherwise stated within Table 5.46.

5.7.5.27 Due to their very large biogeographic population size and migration routes through the Irish Sea, wader species were at the greatest risk of collision. From the nine species identified as having an estimated number of collisions greater than one bird per annum, six belonged to the wader group. The three remaining species were duck species.

5.7.5.28 Of the wader species/populations considered, oystercatcher (non-breeding), European golden plover (non-breeding), northern lapwing, red knot, dunlin (sub-species *schinzii and arctica*) and common snipe were predicted to be above one collision per year (assuming a 98% avoidance rate).

5.7.5.29 Of the non-wader species/populations considered three duck species were predicted to be above one collision per year (assuming a 98% avoidance rate), these were Eurasian wigeon, mallard and Eurasian teal.

5.7.5.30 In the context of their large populations, the estimated increase in baseline mortalities of both the wader and duck species as the result of collision during migration is expected to be minimal and undetectable given the size of the bio-geographic populations.

5.7.5.31 When looking at the predicted increase in baseline mortality, no species are anticipated to experience an increase in baseline mortality greater than 0.03%.

5.7.5.32 The impact is predicted to be of local spatial extent, medium to long term duration, continuous and reversible within the short-term. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **negligible**.

Table 5.46: Summary of collision risk assessment on migratory birds at the Mona Offshore Wind Project.

Note: *denotes species which have had to refer to related species as a proxy for adult baseline mortality rates (goosander used as a proxy for red-breasted merganser, great crested grebe used as a proxy Slavonian grebe, European golden plover used as a proxy for dotterel, common redshank used as a proxy for common greenshank, great skua used as a proxy for pomarine skua and long-tailed skua and long-eared owl used as a proxy for short-eared owl).

Species	UK population	Adult baseline mortality	UK baseline mortality	Avoidance rate (%)	Annual collision rate	Increase in baseline mortality (%)
Tundra swan (Bewick's swan)	4,350	0.178	774	98.0	0.01	0.001
Whooper swan	19,500	0.199	3,881	98.0	0.40	0.010
Greenland white-fronted goose	14,000	0.276	3,864	98.0	0.15	0.004
Light-bellied brent goose (Canadian population)	135,000	0.100	13,500	98.0	0.01	0.0001
Common shelduck	51,000	0.114	5,814	98.0	0.22	0.004
Eurasian wigeon	450,000	0.470	211,500	98.0	1.78	0.001
Gadwall	31,000	0.280	8,680	98.0	0.14	0.002
Eurasian teal	435,000	0.470	204,450	98.0	1.60	0.001
Mallard	675,000	0.373	251,775	98.0	2.89	0.001
Northern pintail	20,000	0.337	6,740	98.0	0.08	0.001
Northern shoveler	19,500	0.420	8,190	98.0	0.08	0.001
Common pochard	29,000	0.350	10,150	98.0	0.12	0.001
Tufted duck	140,000	0.290	40,600	98.0	0.54	0.001
Greater scaup	6,400	0.520	3,328	98.0	0.03	0.001
Long-tailed duck	13,500	0.280	3,780	98.0	0.05	0.001
Common scoter	135,000	0.217	29,295	98.0	0.04	0.0001
Common goldeneye	21,000	0.228	4,788	98.0	0.08	0.002

Species	UK population	Adult baseline mortality	UK baseline mortality	Avoidance rate (%)	Annual collision rate	Increase in baseline mortality (%)
Red-breasted merganser*	11,000	0.180	1,980	98.0	0.04	0.002
Great northern diver*	2,000 (Forrester *et al*. 2007)	0.160	320	98.0	0.02	0.006
European storm petrel	27,214 (Wright *et al*., 2012)	0.130	3,538	98.0	0.30	0.008
Leach's storm petrel	50,658 (Wright *et al*., 2012)	0.120	6,079	98.0	0.75	0.012
Eurasian bittern	795	0.300	239	98.0	0.03	0.013
Great crested grebe*	18,000	0.180	3,240	98.0	0.06	0.002
Horned grebe (Slavonian grebe)*	995	0.180	179	98.0	0.00	0.000
Hen harrier	545	0.190	104	98.0	0.01	0.010
Western osprey	240	0.150	36	98.0	0.01	0.028
Merlin	1,150	0.380	437	98.0	0.01	0.002
Corncrake	1,100	0.714	785	98.0	0.01	0.001
Eurasian oystercatcher (breeding)	95,500	0.120	11,460	98.0	0.57	0.005
Eurasian oystercatcher (non-breeding)	305,000	0.120	36,600	98.0	1.82	0.005
Common ringed plover (breeding)	5,450	0.228	1,243	98.0	0.03	0.002
Common ringed plover (non-breeding)	42,500	0.228	9,690	98.0	0.24	0.002
Eurasian dotterel*	425	0.270	115	98.0	0.00	0.000

Species	UK population	Adult baseline mortality	UK baseline mortality	Avoidance rate (%)	Annual collision rate	Increase in baseline mortality (%)
European golden plover (breeding)	50,500	0.270	13,635	98.0	0.27	0.002
European golden plover (non-breeding)	410,000	0.270	110,700	98.0	2.22	0.002
Grey plover	33,500	0.140	4,690	98.0	0.20	0.004
Northern lapwing	635,000	0.295	187,325	98.0	3.40	0.002
Red knot	265,000	0.159	42,135	98.0	1.55	0.004
Sanderling	20,500	0.170	3,485	98.0	0.11	0.003
Purple sandpiper	9,900	0.205	2,030	98.0	0.05	0.002
Dunlin (sub-species *schinzii* and *arctica*)	350,000	0.260	91,000	98.0	1.77	0.002
Dunlin (sub-species *alpina*)	35,000	0.260	9,100	98.0	0.24	0.003
Ruff	820	0.476	390	98.0	0.01	0.003
Common snipe	1,100,000	0.519	570,900	98.0	6.16	0.001
Black-tailed godwit (Icelandic race)	41,000	0.060	2,460	98.0	0.26	0.011
Bar-tailed godwit	53,500	0.285	15,248	98.0	0.40	0.003
Whimbrel	310	0.110	34	98.0	0.00	0.000
Eurasian curlew (breeding)	58,500	0.101	5,909	98.0	0.39	0.007
Eurasian curlew (non-breeding)	125,000	0.101	12,625	98.0	0.84	0.007
Common greenshank*	290	0.260	75	98.0	0.00	0.000
Wood sandpiper	68	0.464	32	98.0	0.00	0.000

Species	UK population	Adult baseline mortality	UK baseline mortality	Avoidance rate (%)	Annual collision rate	Increase in baseline mortality (%)
Common redshank (breeding)	22,000	0.260	5,720	98.0	0.11	0.002
Common redshank (Icelandic race - non-breeding)	100,000	0.260	26,000	98.0	0.52	0.002
Ruddy turnstone	43,000	0.140	6,020	98.0	0.23	0.004
Great skua	9,634 (Wright *et al*., 2012)	0.112	1,079	98.0	0.22	0.020
Pomarine skua*	2,000 (Forrester *et al*., 2007)	0.112	224	98.0	0.03	0.013
Long-tailed skua*	1,000 (Forrester *et al*., 2007)	0.112	112	98.0	0.01	0.009
Black-headed gull	276,028 (Wright *et al*., 2012)	0.100	27,603	98.0	0.83	0.003
Short-eared owl*	2,200	0.310	682	98.0	0.03	0.004

Sensitivity of the receptor

Black-legged kittiwake

5.7.5.33 Black-legged kittiwake was rated as relatively highly vulnerable to collision impacts by Wade *et al*. (2016), due to the proportion of flights likely to occur at potential risk height and percentage of time in flight.

5.7.5.34 Despite a higher reproductive success (i.e. laying two eggs and breeding until four years old) than most seabird species (Robinson, 2005), the species is deemed to have a low recoverability given the continuing decline in abundance observed between 1986 and 2018 in the UK (JNCC, 2020). During this period, breeding productivity has declined as the result of food shortage, although it has stabilised in recent years (JNCC, 2020).

5.7.5.35 Black-legged kittiwake is a qualifying interest for several SPAs likely to be connected to the Mona Array Area (within the mean-max + SD foraging range), with several non-SPA colonies within range and so the species is considered to be of medium value.

5.7.5.36 Black-legged kittiwake is deemed to be of high vulnerability, low recoverability and medium value. The sensitivity of the receptor is therefore, considered to be **high**.

Great black-backed gull

5.7.5.37 Great black-backed gull was rated as one of the most vulnerable seabird species to collision impacts by Wade *et al*. (2016), due to the proportion of flights likely to occur at potential risk height and percentage of time in flight.

5.7.5.38 The abundance of breeding great black-backed gull in the UK has changed relatively little between census (JNCC, 2020). The species is deemed to have a medium recoverability due to a low reproductive success and the stable trend in breeding abundance.

5.7.5.39 As great black-backed gull is a qualifying interest for several SPAs likely to be connected to the Mona Array Area (within the mean-max + SD foraging range), with a non-SPA colony within range and so the species is considered to be of medium value.

5.7.5.40 Great black-backed gull is deemed to be of high vulnerability, medium recoverability and medium value. The sensitivity of the receptor is therefore, considered to be **medium.**

European herring gull

5.7.5.41 European herring gull was rated as one of the most vulnerable seabird species to collision impacts by Wade *et al*. (2016), due to the proportion of flights likely to occur at potential risk height and percentage of time in flight.

5.7.5.42 As European herring gull is a qualifying interest for several SPAs likely to be connected to the Mona Array Area (within the mean-max + SD foraging range) with multiple non-SPA colonies within range, the species is considered to be of medium value.

5.7.5.43 Although European herring gull have a relatively high reproductive success, breeding abundance is declining in the coastal natural nesting population, and this may be indicative of decline in the entire UK breeding population (JNCC, 2020). There is evidence that the urban nesting gull population has increased in recent years, but census of these sites is lacking to derive a UK wide trend that includes both the urban

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and natural populations. The species is therefore deemed to be of medium recoverability.

5.7.5.44 European herring gull is deemed to be of high vulnerability, medium recoverability and medium value. The sensitivity of the receptor is therefore, considered to be **medium.**

Lesser black-backed gull

5.7.5.45 Lesser black-backed gull was rated as one of the most vulnerable seabird species to collision impacts by Wade *et al*. (2016), due to the proportion of flights likely to occur at potential risk height and percentage of time in flight.

5.7.5.46 As lesser black-backed gull is a qualifying interest for several SPAs likely to be connected to the Mona Array Area (within the mean-max + SD foraging range), with multiple non-SPA colonies within range, the species is considered to be of medium value.

5.7.5.47 Although lesser black-backed gull has a relatively high reproductive success, the species breeding abundance has exhibited a downward trend over the last 15 to 20 years in the UK (JNCC, 2020). It must be noted that this trend excludes urban nesting gulls from the sample and, therefore, may not be representative of trends in the entire UK population. The species is deemed to be of medium recoverability.

5.7.5.48 Lesser black-backed gull is deemed to be of high vulnerability, medium recoverability and medium value. The sensitivity of the receptor is therefore, considered to be **medium**.

Northern gannet

5.7.5.49 Although the latest scientific guidance showed the species to display a high level of macro-avoidance (Peschko *et al*., 2021), the species is rated as relatively vulnerable to collision impacts by Wade *et al*. (2016).

5.7.5.50 Northern gannet is a qualifying interest for several SPAs likely to be connected to the Mona Array Area (within the mean-max + SD foraging range), with a large non-SPA colony within close proximity (Monreith Cliffs and Scar Rocks), the species is therefore considered to be of medium value.

5.7.5.51 Although northern gannet has a low reproductive success, the species is deemed to have a medium recoverability given the consistent increasing trend in abundance since the 1990s (JNCC, 2020). It is of note that the species has suffered from the outbreak of avian flu during the 2022 breeding season. The species is deemed to be of medium recoverability.

5.7.5.52 Northern gannet is deemed to be of medium vulnerability, medium recoverability and medium value. The sensitivity of the receptor is therefore, considered to be **medium**.

Northern fulmar

5.7.5.53 Northern fulmar was rated as the least vulnerable seabird to collision impacts by Wade *et al.* (2016).

5.7.5.54 As northern fulmar is a qualifying interest for several SPAs likely to be connected to the Mona Array Area (within the mean-max + SD foraging range) with multiple non-SPAs within range, the species is considered to be of medium value. Furthermore, the northern fulmar population is endemic to the North Atlantic and most breed in Britain and Ireland (Mitchell *et al*., 2004).

5.7.5.55 The species has a very low reproductive success (Robinson, 2005). Long term trend data suggests that breeding abundance peaked in 1996 (JNCC, 2020) and recent declines represent a period of 're-adjustment' following a period of artificially inflated population size. The species is deemed to be of medium recoverability.

5.7.5.56 Northern fulmar is deemed to be of low vulnerability, medium recoverability and medium value. The sensitivity of the receptor is therefore, considered to be **low**.

Manx shearwater

5.7.5.57 Manx shearwater was rated as the least vulnerable seabirds to collision impacts by Wade *et al*. (2016).

5.7.5.58 As Manx shearwater is a qualifying interest for several SPAs likely to be connected to the Mona Array Area (within the mean-max + SD foraging range) the species is considered to be of high value. Furthermore, the Manx shearwater population is endemic to the North Atlantic and most breed in Britain and Ireland (Mitchell *et al*., 2004).

5.7.5.59 The species has a very low reproductive success (Robinson, 2005). Most of the world population is found in the UK and over 90% of the UK population is found on the Islands of Rum and Eigg (Scotland) and Skomer and Skokholm (Wales) (Mitchell *et al*., 2004; JNCC, 2020). Therefore, the species is considered to be of high value.

5.7.5.60 Manx shearwater has a low reproductive success (i.e. only laying one egg and not breeding until five years old; Robinson, 2005). There is an incomplete spatial-temporal coverage of breeding abundance at UK colonies and thus a lack of long-term trend (JNCC, 2020). In the light of uncertainly and low reproductive success, Manx shearwater are therefore deemed to have a medium recoverability.

5.7.5.61 Manx shearwater is deemed to be of low vulnerability, medium recoverability and high value. The sensitivity of the receptor is therefore, considered to be **medium**.

Migratory bird species

5.7.5.62 Although migratory bird species have not been significantly studied in the offshore environment, vulnerability to collisions is likely to be generally low, since most migration will occur on a broad front and also above rotor height, although during periods of poor weather this risk may increase.

5.7.5.63 Recoverability of populations of migrants may vary considerably, with smaller wader species with a relatively favourable conservation status (e.g. dunlin) faring better than larger species with lower reproductive rates (e.g. Eurasian curlew). This assessment of migratory birds included the following migratory seabirds: European storm petrel, Leach's storm petrel, great skua, pomarine skua, long-tailed skua and black-headed gull. On a precautionary basis and for the purposes of this assessment migratory bird species (including seabirds) are assumed to have **medium** sensitivity to collision.

Significance of the effect

5.7.5.64 Overall, the magnitude of the collision risk impact at the Mona offshore wind farm is expected to be negligible to low depending on the species (Table 5.47). Although sensitivity of the receptor varies from low to high, the effect is expected to be of **negligible to minor adverse** significance depending on species, which is not significant in EIA terms.

5.7.5.65 For great black-backed gull, a minor adverse effect was concluded ~~as if~~when using the ~~Natural England~~species-group avoidance rate ~~an~~as the increase in baseline mortality was estimated ~~at~~to be 1.~~16~~176%. However, the ~~JNCC~~species-specific avoidance rate estimated an increase in baseline mortality of 0.~~18~~176%, therefore for precaution the higher estimate of impact was taken forward to this conclusion of a negligible to minor adverse effect. However, as there ~~was no consensus between the two avoidance rates, no PVA was undertaken for the project alone~~are two potential avoidance rates which provided varying outputs and the species-group avoidance rate was only marginally above the 1% threshold (1.176% increase in baseline mortality), no PVA was undertaken for the project alone. A PVA for cumulative collision impact on great black-backed gull was undertaken (see section 5.9.3), which concluded low magnitude of impact, therefore if a project alone PVA was undertaken the same conclusions would be made.

5.7.5.66 For black-legged kittiwake, European herring gull, lesser black-backed gull, northern gannet, norther fulmar and migratory birds, negligible was selected from the negligible to minor range due to the impact not exceeding a 1% increase in baseline mortality and hence, was not regarded as a minor significance of effect.

Table 5.47: Table summarising the significance of effect of collision from the Mona Offshore Wind Project impacts during the operations and maintenance phase.

Species	Magnitude of impact	Sensitivity of receptor	Significance of effect
Black-legged kittiwake	Negligible	High	**Negligible, not significant in EIA terms**
Great black-backed gull	Low	Medium	**Minor adverse, not significant in EIA terms**
European herring gull	Negligible	Medium	**Negligible, not significant in EIA terms**
Lesser black-backed gull	Negligible	Medium	**Negligible, not significant in EIA terms**
Northern gannet	Negligible	Medium	**Negligible, not significant in EIA terms**
Northern fulmar	Negligible	Low	**Negligible, not significant in EIA terms**
Manx shearwater	Negligible	Medium	**Negligible, not significant in EIA terms**
Migratory birds	Negligible	Medium	**Negligible, not significant in EIA terms**

5.7.6 Combined displacement and collision risk

Operations and maintenance phase

Magnitude of impact

5.7.6.1 Two species are known to be adversely affected by both displacement and collision during the operations and maintenance phase, these are black-legged kittiwake and northern gannet. Impacts must be combined in order for the true magnitude of impact to be understood. There is no consensus between the SNCBs regarding the inclusion of a displacement assessment for black-legged kittiwake; however, one is presented here for precaution and for the SNCBs that have requested this information.

5.7.6.2 It is recognised that assessing these two potential impacts together could amount to double counting, as birds that are subject to displacement could not be subject to potential collision risk as they are already assumed to have not entered the array area.

Equally, birds estimated to be subject to collision risk mortality would not be able to be subjected to displacement consequent mortality as well. As a more refined method to consider displacement and collision together whilst reducing any double counting of impacts is not agreed with SNCBs and therefore the precautionary and highly unlikely approach is presented in this assessment.

5.7.6.3 Outputs from the impact assessments from disturbance and displacement (section 5.7.2) and collision risk (section 5.7.5) combined are tabulated and presented in Table 5.48.

Table 5.48: Combined displacement and collision cumulative impacts.

Species	Impact	Pre-breeding/Spring Migration	Breeding	Post-breeding/Autumn Migration	Annual
Black-legged kittiwake	Displacement (30 to 70% displacement and 1 to 10% mortality)	3 to ~~62~~40	~~1~~2 to ~~25~~51	2 to 39	6 to 126
	Collisions (~~Natural England~~species-group avoidance ~~rates~~rate)	~~16.10~~8.74	~~8.08~~15.52	8.~~49~~41	32.67
	Collisions (~~JNCC~~species-specific avoidance ~~rates~~rate)	~~4.83~~2.55	~~2.42~~4.53	2.~~55~~52	9.80
	Combined (minimum estimate)	~~7.83~~5.55	~~3.42~~6.53	4.~~55~~52	15.80
	Combined (maximum estimate)	~~78.10~~48.74	~~33.08~~66.52	~~37.49~~47.41	158.67
	Regional population baseline mortality	107,878	24,442	142,207	142,207
	Increase in baseline mortality (%)	**0.~~01~~005 to 0.~~07~~045**	**0.~~01~~026 to 0.~~14~~272**	**0.~~00~~003 to 0.~~03~~033**	**0.~~01~~011 to 0.~~11~~112**
Northern gannet	Displacement (60 to 80% displacement and 1 to 10% mortality)	0 to 2	2 to 20	0 to 5	2 to 27
	Collisions (~~Natural England~~species-group avoidance rates)	0.~~62~~41	~~3.86~~4.73	~~1.16~~0.51	5.~~64~~65
	~~Collisions (JNCC avoidance rates)~~	~~0.57~~	~~3.36~~	~~1.01~~	~~4.94~~
	Combined (minimum estimate)	0.~~57~~41	~~5.36~~6.73	~~1.01~~0.51	~~6.94~~7.22
	Combined (maximum estimate)	2.~~62~~41	~~25.89~~26.73	~~6.16~~5.51	~~32.67~~34.22

Species	Impact	Pre-breeding/Spring Migration	Breeding	Post-breeding/Autumn Migration	Annual
	Regional population baseline mortality	127,744	131,817100,917	105,369	131,817127,744
	Increase in baseline mortality (%)	**<0.00001 to 0.00002**	**0.00007 to 0.02026**	**<0.00001 to 0.01005**	**0.01006 to 0.02027**

Black-legged kittiwake

5.7.6.4 The combined estimated mortality (when considering a displacement rate of 30% to 70% and a mortality rate of 1% to 10%) and collisions using both ~~Natural England~~species-group and ~~JNCC~~species-specific avoidance rates was assessed for each bio-season and annually (Table 5.48).

5.7.6.5 In all three bio-seasons (spring, breeding and autumn) and annually, the predicted increase in baseline mortalities remains well below the 1% increase threshold.

5.7.6.6 The impact is predicted to be of local spatial extent, medium-term duration, continuous and reversible. It is predicted that the impact will affect the receptor directly. The magnitude is, therefore, considered to be **negligible.**

Northern gannet

5.7.6.7 The combined estimated mortality (when considering a displacement rate of ~~30~~60% to ~~70~~80% and a mortality rate of 1% to 10%) and collisions using ~~both Natural England and JNCC~~the species-group avoidance ~~rates~~rate was assessed for each bio-season and annually (Table 5.48).

5.7.6.8 In all three bio-seasons (spring, breeding and autumn) and annually, the predicted increase in baseline mortalities remains well the below the 1% increase threshold.

5.7.6.9 The impact is predicted to be of local spatial extent, medium-term duration, continuous and reversible. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **negligible**.

Sensitivity of the receptor

Black-legged kittiwake

5.7.6.10 As previously described in displacement (paragraph 5.7.2.93) and collision (paragraph 5.7.5.36), black-legged kittiwake is deemed to be of overall medium vulnerability, low recoverability and medium value. The sensitivity of the receptor is therefore, considered to be **medium**.

Northern gannet

5.7.6.11 As previously described in displacement (paragraph 5.7.2.89) and collision (paragraph 5.7.5.52), northern gannet is deemed to be overall of medium vulnerability, medium recoverability and medium value. The sensitivity of the receptor is therefore, considered to be **medium**.

Significance of the effect

Black-legged kittiwake

5.7.6.12 Overall, the magnitude of the combined displacement and collision cumulative impact is low, and the sensitivity of the receptor is medium. The effect will, therefore, be of **minor** adverse significance, which is not significant in EIA terms.

Northern gannet

5.7.6.13 Overall, the magnitude of the combined displacement and collision cumulative impact is low and the sensitivity of the receptor is considered to be medium. The effect will, therefore, be of **minor** adverse significance, which is not significant in EIA terms.

5.7.7 Barrier to movement

5.7.7.1 Barrier effects may arise in addition to displacement. Whilst displacement is a reduction in the number of seabirds occurring within or immediately adjacent to an offshore wind farm (Furness *et al*., 2013), the barrier effect refers to the disruption of preferred flight lines. This might impose an additional energetic cost to movements, particularly during the breeding season when seabirds make daily commutes between foraging grounds at sea and nesting sites. Additional energetic costs could have long-term implications for individuals and impact bird fitness (breeding productivity and survival). Birds may also have to navigate around the offshore wind farms during migratory movements. In the case of migrating birds, avoidance of a single offshore wind farm may be trivial relative to the total length and cost of the journey. There is a general lack of empirical data on the barrier effects for migratory birds.

5.7.7.2 For breeding seabirds, in a study of the effects of offshore wind farms as barriers to movement on seabirds of differing morphology, Masden *et al*. (2010) found additional costs, expressed in relation to typical daily energetic expenditures, to be the highest per unit flight for seabirds with high wing loadings, such as cormorants. Most importantly the authors found costs of extra flight to avoid an offshore wind farm to appear to be much less than those imposed by low food abundance or adverse weather, although such costs will be additive to these.

5.7.7.3 Although the Mona Array Area lies within the mean-maximum foraging ranges of several breeding colonies, connectivity has to be established to the Mona Array Area and it is unlikely that the site will provide a barrier to foraging movements given that birds generally forage widely within their mean-maximum foraging ranges. The risk of collision (as detailed in paragraph 5.7.5) is deemed to be greater than the risk of barrier effect.

5.7.7.4 Because the magnitude of the effect is likely to be similar amongst bird species moving through the area, receptors are grouped in the assessment of the barrier effect.

Operations and maintenance phase

Magnitude of impact

All receptors

5.7.7.5 In the absence of quantitative information available, the magnitude is considered qualitatively for breeding seabird and migratory non-seabirds.

5.7.7.6 As breeding seabirds generally forage widely within their foraging range of breeding colonies, the Mona Offshore Wind Project is unlikely to form a significant barrier to the movement from any breeding colonies. Furthermore, the Mona Offshore Wind Project is unlikely to form a barrier to the movement of migratory birds given that migratory movements at sea occur over a broad front.

5.7.7.7 The impact is predicted to be of local spatial extent, long term duration, continuous and reversible. It is predicted that the impact will affect the receptor directly. Due to the

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likely absence of any detectable impact on the fitness of individuals and the demography of the populations, the magnitude is therefore, considered to be **negligible.**

Sensitivity of receptor

All receptors

5.7.7.8 Seabird species vary in their vulnerability to barrier effects. Some species such as gulls, fulmars, gannets and terns are considered to have a low sensitivity (Maclean *et al*., 2009). Other species such as divers and auks are considered to have higher sensitivity to barrier effects due to a higher wing-loading (i.e. they have a higher ratio of body weight to wing area and therefore energy expenditure during flight is likely to be higher. These species are notable by their characteristically direct flight paths) compared with other species (Maclean *et al*., 2009). Evidence from studies at operational offshore wind farms (Everaert and Kuijken, 2007; Krijgsveld *et al.,* 2011; Everaert, 2014) has shown that gulls are unlikely to see wind turbines as a barrier to movement.

5.7.7.9 Overall breeding seabirds and migratory non-seabirds are deemed to be of medium vulnerability, medium recoverability and medium value. The sensitivity of the receptor is therefore, considered to be **medium.**

Significance of effect

5.7.7.10 Overall, the magnitude of the impact is deemed to be negligible and the sensitivity of the receptor is considered to be medium. The effect will, therefore, be of **negligible** adverse significance, which is not significant in EIA terms.

5.7.8 Future monitoring

5.7.8.1 No future monitoring is considered given the level of certainty around the potential effects.

5.8 Cumulative effects assessment methodology

5.8.1 Methodology

5.8.1.1 For offshore ornithology, a ZOI has been applied for the CEA to ensure direct and indirect cumulative effects can be appropriately identified and assessed. The ZOI has been defined as the area within the BDMPS region as defined by Furness (2015) following advice from the EWG (Meeting 6 held 19 October 2023).

5.8.1.2 The CEA takes into account the impact associated with the Mona Offshore Wind Project together with all other projects and plans within the ZOI. The projects and plans selected as relevant to the CEA presented within this chapter are based upon the results of a screening exercise (see Volume 5, Annex 5.1: Cumulative effects screening matrix of the Environmental Statement). (Document reference F5.5.1)). Each project has been considered on a case-by-case basis for screening in or out of this chapter's assessment based upon data confidence, effect-receptor pathways and the spatial/temporal scales involved.

5.8.1.3 The offshore ornithology CEA methodology has followed the methodology set out in Volume 1, Chapter 5: EIA methodology of the Environmental Statement. (Document reference F1.5). As part of the assessment, all projects and plans considered alongside the Mona Offshore Wind Project have been allocated into 'tiers' reflecting their current stage within the planning and development process, these are listed below.

5.8.1.4 The tiered approach uses the following categorisations:

- Tier 1
  - Those currently operational that were not operational when baseline data was collected, and/or those that are operational but have an on-going impact
  - Under construction
  - Permitted application
  - Submitted application
- Tier 2
  - Scoping report has been submitted and is in the public domain
- Tier 3
  - Scoping report has not been submitted and is not in the public domain
  - Identified in a relevant development plan
  - Identified in other plans and programmes.

5.8.1.5 This tiered approach is adopted to provide a clear assessment of the Mona Offshore Wind Project alongside other projects, plans and activities.

5.8.1.6 The specific projects, plans and activities screened into the CEA are outlined in Table 5.49. The location of screened in projects and their proximity to the Mona Offshore Wind Project are further shown in Figure 5.2. All projects screened out are detailed within Volume 5, Annex 5.1 Cumulative effects screening annex of the Environmental Statement. (Document reference F5.5.1). Table 5.49 only includes projects which have been assigned tier 1 or tier 2, with tier 3 projects not listed. This is due to tier 3 projects being predominantly 'proposed' or only identified in development plans, and so may not actually be taken forward. Projects under construction are likely to contribute to cumulative impacts (providing effect or spatial pathways exist), whereas those proposals (listed as tier 3 projects) not yet approved are less likely to contribute to such an impact, as some may not achieve approval or may not ultimately be built due to other factors. Tier 3 projects are detailed within Volume 5, Annex 5.1 Cumulative effects screening annex of the Environmental Statement. (Document reference F5.5.1).

5.8.1.7 Some of the potential impacts considered within the Mona Offshore Wind Project alone assessment are specific to a particular phase of development (e.g. construction, operations and maintenance or decommissioning). Where the potential for cumulative effects with other plans or projects only have potential to occur where there is spatial or temporal overlap with the Mona Offshore Wind Project during certain phases of development, impacts associated with a certain phase may be omitted from further consideration where no plans or projects have been identified that have the potential for cumulative effects during this period.

5.8.1.8 Other aspects, namely indirect impacts associated with prey distribution and availability are very difficult to quantify, and although it is acknowledged that cumulative effects are possible, the magnitude of these impacts is not considered to be significant at a population level for any offshore ornithology receptor and is therefore not considered further within the CEA. The impacts excluded from the cumulative assessment are:

- Indirect impacts (affecting prey species) from airborne noise, underwater sound and the presence of vessels at any phase of the Mona Offshore Wind Project as they will be spatially limited and all were predicted as low
- Temporary habitat loss/disturbance and increased SSCs at any phase of the Mona Offshore Wind Project as there is low potential for cumulative effect because the contribution from the Mona Offshore Wind Project and surrounding offshore wind farms is small (and even if these occurred at the same time this would not constitute a significant effect)
- Impacts associated with the construction phase including construction activities at the landfall and laying of the export cable. Adjudged to cause changes of such small magnitude that these will not contribute in any meaningful way at a population level to a potential cumulative impact (based on determination for the Mona Offshore Wind Project effects alone).

5.8.1.9 Impacts considered in the cumulative assessment are as follows:

- Disturbance and displacement from infrastructure (and barrier effects)
- Collision risk
- Combined displacement and collision risk.

Table 5.49: List of other projects, plans and activities considered within the offshore ornithology CEA.

Project/Plan	Status	Distance from Mona Array Area (km)	Distance from Mona offshore cable corridor (km)	Description of project/plan	Dates of construction (if applicable)	Dates of operation (if applicable)	Overlap with the Mona Offshore Wind Project
Tier 1							
Gwynt y Môr Offshore Wind Farm	Operational	17.8 km	9.9 km	Capacity of 576 MW, 90 km^2 area.	2012	2015 to 2033	Project operations and maintenance phase overlap
Rhyl Flats Offshore Wind Farm	Operational	25.6 km	3.8 km	25 wind turbines, 90 MW capacity.	2007	2009 to 2027	Project operations and maintenance phase overlap
Walney Extension 3 Offshore Wind Farm	Operational	27.3 km	53.6 km	330 MW capacity..	2017	2018 to 2039	Project operations and maintenance phase overlap
Walney Extension 4 Offshore Wind Farm	Operational	27.2 km	47.8 km	329 MW capacity.	2017	2018 to 2039	Project operations and maintenance phase overlap
West of Duddon Sands Offshore Wind Farm	Operational	30.4 km	43.9 km	389 MW capacity	2013	2014 to 2033	Project operations and maintenance phase overlap
Burbo Bank Extension Offshore Wind Farm	Operational	30.6 km	26.1 km	Capacity - 258 MW - 32 wind turbines.	2016	2017 to 2045	Project operations and maintenance phase overlap

Project/Plan	Status	Distance from Mona Array Area (km)	Distance from Mona offshore cable corridor (km)	Description of project/plan	Dates of construction (if applicable)	Dates of operation (if applicable)	Overlap with the Mona Offshore Wind Project
Walney Extension blade tip boosters	Operational	30.7 km	47.8 km	This licence allows for adding aerodynamic tip boosters to each blade (87 wind turbines so 261 total blades), which will increase the rotor diameters for Walney 3 from 164 m to 165 m, and from 154 m to 155.3 m for Walney 4.	unknown	unknown	Project operations and maintenance phase overlap
Walney 1 Offshore Wind Farm	Operational	35.4 km	49.6 km	183.6 MW capacity. Area - 36.5 km^2.	2010	2011 to 2032	Project operations and maintenance phase overlap
Walney 2 Offshore Wind Farm	Operational	34.0 km	51.5 km	183.6 MW capacity. Area - 36.5 km^2.	2011	2012 to 2032	Project operations and maintenance phase overlap
Burbo Bank Offshore Wind Farm	Operational	40.3 km	32.8 km	Capacity of 90 MW. Area - 10 km^2.	2006	2007 to 2039	Project operations and maintenance phase overlap
Ormonde Wind Farm	Operational	44.0 km	58.0 km	150 MW capacity. Area - 8.7 km^2.	2010	2012 to 2036	Project operations and maintenance phase overlap
Robin Rigg Offshore Wind Farm	Operational	98.6 km	126.0 km	174 MW capacity	2009	2010 to 2023	Project operations and maintenance phase overlap
Rampion Offshore Wind Farm	Operational	401.2 km	365.1 km	400 MW capacity. Area - 72 km^2.	2015	2017 to 2042	Project operations and maintenance phase overlap

Project/Plan	Status	Distance from Mona Array Area (km)	Distance from Mona offshore cable corridor (km)	Description of project/plan	Dates of construction (if applicable)	Dates of operation (if applicable)	Overlap with the Mona Offshore Wind Project
Awel y Môr Offshore Wind Farm	Consent granted	13.5 km	3.6 km	500 MW capacity.	2026 to 2029	2030 to 2055	Potential construction phase overlap with the Mona Offshore Wind Project construction phase. Project operations and maintenance phase overlap
West Anglesey Demonstration Zone tidal site (Morlais)	Consent granted	53.8. km	50.6 km	240 MW	unknown	unknown	Project operations and maintenance phase overlap
Holyhead Deep – Tidal energy (Minesto)	Operational	57.9 km	55.6 km	0.5 MW	2018	2018 to unknown	Project operations and maintenance phase overlap
Erebus Floating Wind Demo	Submitted application	259.9 km	240.2 km	100 MW capacity.	2025	2026 to 2051	Potential construction phase overlap with Mona Offshore Wind Project construction phase. Project operations and maintenance phase overlap

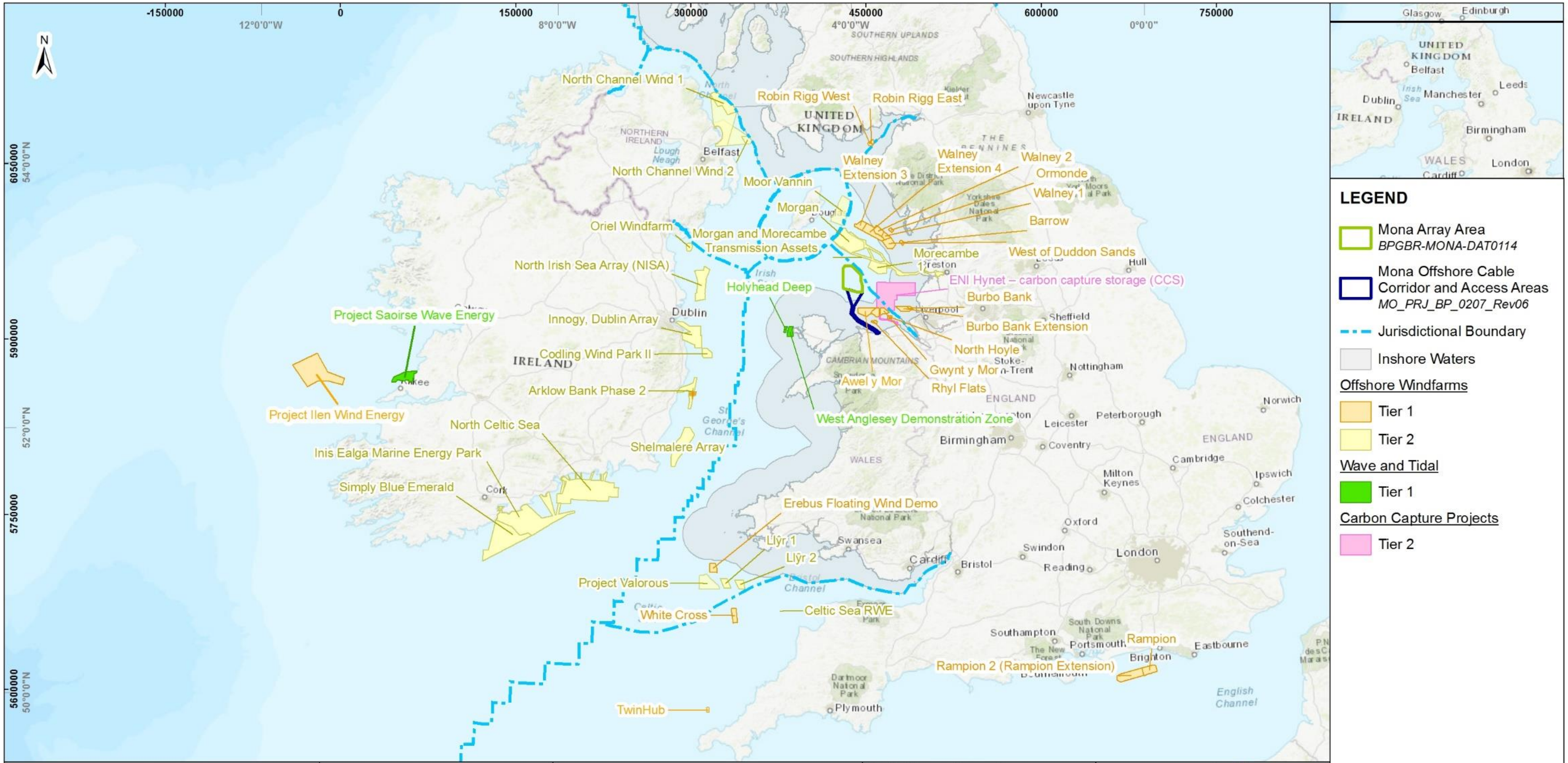
Project/Plan	Status	Distance from Mona Array Area (km)	Distance from Mona offshore cable corridor (km)	Description of project/plan	Dates of construction (if applicable)	Dates of operation (if applicable)	Overlap with the Mona Offshore Wind Project
White Cross Offshore Windfarm	Submitted application	287.7 km	211.2 km	100 MW site. Planned floating offshore wind farm off the coast of Pembrokeshire. Comprises up to 18 wind turbines.	2026	unknown	Potential construction phase overlap with Mona Offshore Wind Project construction phase. Project operations and maintenance phase overlap
TwinHub (Wave Hub Floating Wind Farm)	Consent granted	377.1 km	350.9 km	Two floating offshore wind platforms, each with two wind turbines. Installed capacity of 32 MW.	unknown	unknown	Project operations and maintenance phase overlap
Rampion 2 Offshore Wind Farm	Submitted application	394.8 km	358.1 km	Up to 1,200 MW capacity. Area - 270 km^2.	2025	2029 to unknown	Potential construction phase overlap with Mona Offshore Wind Project construction phase. Project operations and maintenance phase overlap
West of Orkney Windfarm	Submitted application	553.9 km	573.9 km	Offshore wind project comprising up to 125 wind turbines, 30 km from the coast of Orkney.	2027	unknown	Project operations and maintenance phase overlap

Project/Plan	Status	Distance from Mona Array Area (km)	Distance from Mona offshore cable corridor (km)	Description of project/plan	Dates of construction (if applicable)	Dates of operation (if applicable)	Overlap with the Mona Offshore Wind Project
Tier 2							
Morgan Offshore Wind Project Generation Assets (hereafter referred to as the Morgan Generation Assets)	Pre-application	5.52 km	32.93 km	1,500 MW capacity.	2026 to 2029	2030 to 2065	Potential construction phase overlap with Mona Offshore Wind Project construction phase. Project operations and maintenance phase overlap
Morecambe Offshore Windfarm Generation Assets (hereafter referred to as the Morecambe Generation Assets)	Pre-application	8.9 km	21.5 km	480 MW capacity, Area: 497 km^2	2026 to 2028	2029 to 2064	Potential construction phase overlap with Mona Offshore Wind Project construction phase. Project operations and maintenance phase overlap
Morgan and Morecambe Offshore Wind Farms Transmission Assets	Pre-application	8.92 km	21.53 km	Cable coridor	2026 to 2029	2029 to 2065	Potential construction phase overlap

Project/Plan	Status	Distance from Mona Array Area (km)	Distance from Mona offshore cable corridor (km)	Description of project/plan	Dates of construction (if applicable)	Dates of operation (if applicable)	Overlap with the Mona Offshore Wind Project
ENI Hynet – carbon capture storage (CCS)	Pre-application	12.1 km	9.5 km	project in the east Irish Sea. Works will include installation of a new cable, a new Douglas CCS platform and work on the existing Hamilton, Hamilton North and Lennox wellhead platforms.	Unknown	Unknown	Project operations and maintenance phase overlap
Mooir Vannin Offshore Wind Farm	Scoping report submitted	34.53 km	54.45 km	Up to 700 MW capacity	Unknown	Unknown	Project operations and maintenance phase overlap
North Irish Sea Array offshore Wind Farm	Scoping report submitted	112.7 km	118.6 km	500 MW capacity.	unknown	unknown	Project operations and maintenance phase overlap
Codling Wind Park	Scoping report submitted	125.1 km	123.6 km	900 MW planned capacity, off of the coast Wicklow. Spread over an area of 125 km^2	unknown	unknown	Project operations and maintenance phase overlap
Dublin Array Offshore Wind Farm	Scoping report submitted	126.1 km	129.0 km	600 MW offshore wind power project. Area of 54 km^2.	unknown	unknown	Project operations and maintenance phase overlap
North Channel Wind 2	Scoping report submitted	128.5 km	151.5 km	Site area of approx. 38 km2. Using Tension Leg platform. 5-7 wind turbines	unknown	unknown	Project operations and maintenance phase overlap

Project/Plan	Status	Distance from Mona Array Area (km)	Distance from Mona offshore cable corridor (km)	Description of project/plan	Dates of construction (if applicable)	Dates of operation (if applicable)	Overlap with the Mona Offshore Wind Project
Oriel Wind Farm	Scoping report submitted	130.4 km	138.1 km	375 MW capacity, spread over 28 km^2.	unknown	unknown	Project operations and maintenance phase overlap
Arklow Bank Wind Park Phase 2	Scoping report submitted	146.7 km	142.8 km	800 MW capacity.	unknown	unknown	Project operations and maintenance phase overlap
North Channel Wind 1	Scoping report submitted	157.3 km	180.9 km	Site area of approx. 38 km2. Using Tension Leg platform. 5-7 wind turbines	unknown	unknown	Project operations and maintenance phase overlap
Shelmalere Offshore Wind Farm	Scoping report submitted	177.1 km	168.9 km	1,000 MW capacity.	unknown	unknown	Project operations and maintenance phase overlap
North Celtic Sea Ofshore Wind Farm	Scoping report submitted	256.4 km	248.8 km	Up to 800 MW Planned capacity.	unknown	unknown	Project operations and maintenance phase overlap
Llyr 1 Floating Wind Farm	Scoping report submitted	267.0 km	245.9 km	100 MW capacity.	Unknown	Unknown	Project operations and maintenance phase overlap
Llyr 2 Floating Wind Farm	Scoping report submitted	263.17 km	240.12 km	1,000 MW capacity.	Unknown	Unknown	Project operations and maintenance phase overlap
Valorous Floating Offshore Wind Project	Scoping report submitted	271.7 km	252.4 km	300 MW floating offshore wind project in the Celtic Sea region.	Unknown	Unknown	Project operations and maintenance phase overlap

Project/Plan	Status	Distance from Mona Array Area (km)	Distance from Mona offshore cable corridor (km)	Description of project/plan	Dates of construction (if applicable)	Dates of operation (if applicable)	Overlap with the Mona Offshore Wind Project
Inis Ealga Marine Energy Park offshore wind farm	Scoping report submitted	302.1 km	292.0 km	1,000 MW capacity.	Unknown	Unknown	Project operations and maintenance phase overlap
Emerald Floating Wind Project	Scoping report submitted	338.8 km	331.3 km	1,000 MW capacity.	Unknown	Unknown	Project operations and maintenance phase overlap
Project Saoirse Wave energy	Scoping report submitted	392.5 km	395.4 km	Pre-commercial demonstration wave energy conversion project located 4-6 km offshore Co. Clare, starting with 5 MW of capacity	Unknown	Unknown	Project operations and maintenance phase overlap
Project Ilen Floating Offshore Wind Project	Scoping report submitted	433.9 km	436.8 km	1.35 GW floating offshore wind project located at least 35 km offshore Co. Clare. One of the Western Star projects.	Unknown	Unknown	Project operations and maintenance phase overlap



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Project Name: MONA OFFSHORE WIND PROJECT	**Drawing Title:** OTHER PROJECTS, PLANS AND ACTIVITIES SCREENED INTO THE CUMULATIVE EFFECTS ASSESSMENT	**Drawing Number:** RPSE-MN-ORN-ES-007-02	

VER	DATE	DETAILS	BY	CHECK
00	19/12/23	First Issue	MJ	LM
02	17/01/24	Revision	MJ	LM

Figure 5.2: Other projects, plans and activities screened into the cumulative effects assessment.

5.8.1.10 The MDSs identified in Table 5.50 have been selected as those having the potential to result in the greatest effect on an identified receptor or receptor group. The cumulative effects presented and assessed in this section have been selected from the MDS above (Table 5.21) due to there being a potential for cumulative effects. Effects of greater adverse significance are not predicted to arise should any other development scenario (e.g. different wind turbine layout), to that assessed here, be taken forward in the final design scheme.

Table 5.50: Maximum design scenario considered for the assessment of potential cumulative effects on offshore ornithology.

a C=construction, O=operations and maintenance, D=decommissioning
b Barrier effect is included as CEA is based on SNCB Matrix approach (JNCC, 2017)

Potential cumulative effect	Phase[a]			Maximum Design Scenario	Justification
	C	O	D		
Disturbance and displacement from infrastructure	✓	✓	✓	MDS as described for the Mona Offshore Wind Project (Table 5.21) assessed cumulatively with the following offshore wind farms: **Construction phase** **Tier 1** • Awel y Môr Offshore Wind Farm • Erebus Floating Wind Demo • White Cross Offshore Windfarm • Rampion 2 Wind Farm • West of Orkney Windfarm **Tier 2** • Morgan Generation Assets • Morecambe Offshore Windfarm Generation Assets. • Morgan and Morecambe Offshore Wind Farms Transmission Assets **Operations and maintenance Phase** **Tier 1** • Gwynt y Môr Offshore Wind Farm • Rhyl Flats Offshore Wind Farm • Walney (3 & 4) Extension Offshore Wind Farm • West of Duddon Sands Offshore Wind Farm • Burbo Bank Extension Offshore Wind Farm • Walney 1 & 2 Offshore Wind Farms	There is a possibility that construction could overlap temporally with Awel y Môr, the Morgan Generation Assets, Morecambe Offshore Windfarm Generation Assets, Morgan and Morecambe Offshore Wind Farms Transmission Assets and Erebus. There is a possibility that decommissioning could overlap temporally with Awel y Môr and Erebus. However, the impact from construction and decommissioning are of small, temporary magnitude. There is potential for a cumulative effect from operations and maintenance activities and so a quantitative cumulative effect assessment is required.

Potential cumulative effect	Phase[a]			Maximum Design Scenario	Justification
	C	O	D		
				• Burbo Bank Offshore Wind Farm • Ormonde Wind Farm • Robin Rigg Offshore Wind Farm • Rampion Offshore Wind Farm • Awel y Môr Offshore Wind Farm • Erebus Floating Wind Demo • White Cross Offshore Windfarm • TwinHub (Wave Hub Floating Wind Farm) • Rampion 2 Wind Farm • West of Orkney Windfarm **Tier 2**	

- Morgan Generation Assets
- Morecambe Offshore Windfarm Generation Assets
- Morgan and Morecambe Offshore Wind Farms Transmission Assets
- ENI Hynet –CCS
- Mooir Vannin Offshore Wind Farm
- North Irish Sea Array Offshore Wind Farm
- Codling Wind Park
- Dublin Array Offshore Wind Farm
- North Channel Wind 2
- Oriel Wind Farm
- Arklow Bank Wind Park Phase 2
- North Channel Wind 1
- Shelmalere Offshore Wind Farm

- North Celtic Sea
- Llyr 1 Floating Wind Farm
- Llyr 2 Floating Wind Farm
- Valorous Floating Offshore Wind Project
- Inis Ealga Marine Energy Park
- Emerald Floating Wind Project

Decommissioning Phase

Tier 1

- Awel y Môr Offshore Wind Farm
- Erebus Floating Wind Demo
- White Cross Offshore Windfarm
- Rampion 2 Wind Farm
- West of Orkney Windfarm

Potential cumulative effect	Phase[a]			Maximum Design Scenario	Justification
	C	O	D		
Collision risk	×	✓	×	MDS as described for the Mona Offshore Wind Project (Table 5.21) assessed cumulatively with the following offshore wind farms: **Operations and maintenance Phase** **Tier 1** • Gwynt y Môr Offshore Wind Farm • Rhyl Flats Offshore Wind Farm • Walney (3 & 4) Extension Offshore Wind Farm • West of Duddon Sands Offshore Wind Farm • Burbo Bank Extension Offshore Wind Farm • Walney 1 & 2 Offshore Wind Farms • Burbo Bank Offshore Wind Farm • Ormonde Wind Farm • Robin Rigg Offshore Wind Farm • Rampion Offshore Wind Farm • Awel y Môr Offshore Wind Farm • West Anglesey Demonstration Zone Tidal Site (Morlais) • Holyhead Deep – tidal energy (Minesto) • Erebus Floating Wind Demo • White Cross Offshore Windfarm • TwinHub (Wave Hub Floating Wind Farm) • Rampion 2 Wind Farm • West of Orkney Windfarm **Tier 2** • Morgan Generation Assets • Morecambe Offshore Windfarm Generation Assets	There is potential for a cumulative effect from operations and maintenance activities, so a detailed, quantitative cumulative effect assessment is required.

Potential cumulative effect	Phase[a]			Maximum Design Scenario	Justification
	C	O	D		
				• Mooir Vannin Offshore Wind Farm • North Irish Sea Array Offshore Wind Farm • Codling Wind Park • Dublin Array Offshore Wind Farm • North Channel Wind 2 • Oriel Wind Farm • Arklow Bank Wind Park Phase 2 • North Channel Wind 1 • Shelmalere Offshore Wind Farm • North Celtic Sea Wind Farm • Llyr 1 Floating Wind Farm • Llyr 2 Floating Wind Farm • Valorous Floating Offshore Wind Project • Inis Ealga Marine Energy Park • Emerald Floating Wind Project • Project Iien wave energy	

5.9 Cumulative effects assessment

5.9.1 Overview

5.9.1.1 A description of the significance of cumulative effects upon offshore ornithology receptors arising from each identified impact is given below.

5.9.1.2 The CEA is limited by the data available upon which to base the assessment. Due to the age of developments in the Irish Sea and surrounding areas which have the potential to have a cumulative impact upon receptors, few have comparable datasets upon which to base an assessment. However, every effort has been made to obtain quantitative estimates for both displacement and collision from project-specific documentation. For displacement impacts this includes following the approach applied by many previous offshore wind farms using any available population data to calculate mean-pack or peak population estimates for use in displacement analyses

5.9.1.3 Additionally, older developments did not carry out certain impact assessments (e.g. displacement and/or collision risk) for species such as black-legged kittiwake, northern gannet, northern fulmar, Manx shearwater and gull species (European herring gull, great black-backed gull and lesser black-backed gull) due to limited data at the time of assessment on the species' behavioural response to the presence of offshore turbines. As such the CEA is carried out using data from offshore wind farms with available species data to do so. For projects in early stages (i.e. Tier 3) there was insufficient project information in the public domain to allow the effects to be reasonably understood and a cumulative assessment undertaken. Tier 3 projects have therefore not been included in the cumulative assessment below.

5.9.1.4 For the cumulative assessment, impacts from Tier 1 and Tier 2 projects have been assessed together to provide the most precautionary impact on the population. If any Tier 2 project does not get consented/built the assessment presented here still includes the impacts.

5.9.1.5 There is a possibility that construction and decommissioning could overlap temporally with Morgan and Morecambe Offshore Wind Farms Transmission Assets, with the potential to impact red-throated diver. However, the impact from construction and decommissioning are of small, temporary magnitude. Additionally, there is no spatial overlap between Mona Offshore Wind Project and Morgan and Morecambe Offshore Wind Farms Transmission Assets during construction and decommissioning. As such, the cumulative impact on red-throated divers is not considered further.

5.9.2 Disturbance and displacement from airborne noise, underwater sound, and presence of vessels and infrastructure

5.9.2.1 There is potential for cumulative displacement as a result of construction and operations and maintenance activities associated with the Mona Offshore Wind Project along with other developments.

5.9.2.2 Disturbance and subsequent displacement of seabirds during the construction phase is primarily centred around where construction vessels and piling activities are occurring. The activities may displace individuals that would normally reside within and around the area of sea where the Mona Offshore Wind Project is located. This in effect represents indirect habitat loss, which will potentially reduce the area available to those seabirds to forage, loaf and/or moult.

5.9.2.3 The level of data available and the ease with which disturbance and displacement impacts can be combined across the offshore wind farms is quite variable, reflecting the availability of relevant data for other projects and the approach to assessment taken. A maximum design approach would be to assume complete overlap in construction for all projects, while the minimum design approach would be to assume no overlap. The most realistic assumption is that at most there will be a degree of construction overlap (and hence increased vessel and helicopter activity), but that it will be limited to a small number of CEA projects and other activities.

5.9.2.4 During the operations and maintenance phase, the presence of offshore wind turbines has the potential to directly disturb and displace seabirds that would normally reside within and around the area of sea where offshore wind farms are located. Displacement may contribute to individual birds experiencing fitness consequences, which at an extreme level could lead to the mortality of individuals. Cumulative displacement therefore has the potential to lead to effects on a wider scale.

5.9.2.5 The species assessed for cumulative displacement impacts were common guillemot, razorbill, Atlantic puffin, northern gannet, black-legged kittiwake and Manx shearwater.

5.9.2.6 The cumulative results are presented as displacement matrices ranging from 1% to 100% mortality and 5% to 100% displacement. Each cell presents potential cumulative bird mortality following displacement from the Mona Offshore Wind Project and the other offshore wind farm projects during each bio-season. Light blue highlighted cells are based on the displacement and mortality rates used in the alone assessment. Additionally, orange highlighted cells represent a displacement rate within the middle of the range presented.

5.9.2.7 With regards to vessels in the Mona Offshore Wind Project, there is no method to quantify the displacement impact of the activities due to their local and temporary nature. An offshore EMP that will include measures to minimise disturbance to rafting birds from transiting vessels is secured as a requirement of the draft DCO (Document Reference C1). It is therefore expected that impacts of vessels on seabirds are negligible due to the management of vessel traffic.

Tier 1 and Tier 2

Construction phase

Magnitude of impact

Common guillemot

5.9.2.8 The estimated number of birds present within the array area of each of the other relevant projects (projects that potentially overlap in their construction activities with Mona Offshore Wind Project) during each bio-season are presented in Table 5.51.

Table 5.51: Common guillemot cumulative abundances for potential overlapping construction phase offshore wind projects for disturbance and displacement assessment.

Project	Annual Abundance	Breeding Season Abundance	Non-breeding Season Abundance
Tier 1			

Project	Annual Abundance	Breeding Season Abundance	Non-breeding Season Abundance
Awel y Môr Offshore Wind Farm	4,488	1,569	2,919
Erebus Floating Wind Demo	35,~~389~~339	7,001	28,~~388~~338
White Cross Offshore Windfarm	4,363	3,304	1,059
West of Orkney Windfarm	9,136	4,861	4,275
Tier 2			
Morecambe Offshore Windfarm Generation Assets	11,697	4,050	7,647
Morgan Offshore Wind Project Generation Assets	8,994	4,893	4,101
TOTAL (minus the Mona Offshore Wind Project)	**74,~~067~~017**	**25,678**	**48,~~389~~339**
Mona Offshore Wind Project	7,976	4,220	3,756
TOTAL (all projects)	**~~82,043~~81,993**	**29,898**	**52,~~145~~095**

5.9.2.9 The following displacement matrices provide the estimated cumulative mortality of common guillemot predicted to occur due to displacement during construction, as determined by the relevant specified rates of displacement and mortality (Table 5.52 to Table 5.54). The approach used for the cumulative displacement assessment follows that presented in Volume 6, Annex 5.2: Offshore ornithology displacement technical report of the Environmental Statement~~.~~ (Document reference F6.5.2).

Table 5.52: Construction phase cumulative common guillemot mortality following displacement from offshore wind farms in the breeding season.

Displacement level (% at risk of displacement)52145	Mortality level (% of displaced birds at risk of mortality)						
	1%	**2%**	**5%**	**10%**	**25%**	**50%**	**100%**
5%	15	30	75	149	374	747	1,495
10%	30	60	149	299	747	1,495	2,990
15%	45	90	224	448	1,121	2,242	4,485
20%	60	120	299	598	1,495	2,990	5,980
25%	75	149	374	747	1,869	3,737	7,475
30%	90	179	448	897	2,242	4,485	8,969
35%	105	209	523	1,046	2,616	5,232	10,464
60%	179	359	897	1,794	4,485	8,969	17,939
80%	239	478	1,196	2,392	5,980	11,959	23,918
100%	299	598	1,495	2,990	7,475	14,949	29,898

Table 5.53: Construction phase cumulative common guillemot mortality following displacement from offshore wind farms in the non-breeding season.

Displacement level (% at risk of displacement)	Mortality level (% of displaced birds at risk of mortality)						
	1%	2%	5%	10%	25%	50%	100%
5%	26	52	130	~~261~~260	~~652~~651	1,~~304~~302	2,~~607~~605
10%	52	104	~~261~~260	521	1,~~304~~302	2,~~607~~605	5,~~215~~210
15%	78	156	391	~~782~~781	1,~~955~~954	3,~~911~~907	7,~~822~~814
20%	104	~~209~~208	521	1,~~043~~042	2,~~607~~605	5,~~215~~210	10,~~429~~419
25%	130	~~261~~260	~~652~~651	1,~~304~~302	3,~~259~~256	6,~~518~~512	13,~~036~~024
30%	156	313	~~782~~781	1,~~564~~563	3,~~911~~907	7,~~822~~814	15,~~644~~629
35%	~~183~~182	365	~~913~~912	1,~~825~~823	4,~~563~~558	9,~~125~~117	18,~~251~~233
60%	313	~~626~~625	1,~~564~~563	3,~~129~~126	7,~~822~~814	15,~~644~~629	31,~~287~~257
80%	417	834	2,~~086~~084	4,~~172~~168	10,~~429~~419	20,~~858~~838	41,~~716~~676
100%	521	1,~~043~~042	2,~~607~~605	5,~~215~~210	13,~~036~~024	26,~~073~~048	52,~~145~~095

Table 5.54: Construction phase cumulative common guillemot mortality following displacement from offshore wind farms annually.

Displacement level (% at risk of displacement)	Mortality level (% of displaced birds at risk of mortality)						
	1%	2%	5%	10%	25%	50%	100%
5%	41	82	205	410	1,~~026~~025	2,~~051~~050	4,~~102~~100
10%	82	164	410	820	2,~~051~~050	4,~~102~~100	8,~~204~~199
15%	123	246	615	1,~~231~~230	3,~~077~~075	6,~~153~~149	12,~~306~~299
20%	164	328	820	1,~~641~~640	4,~~102~~100	8,~~204~~199	16,~~409~~399
25%	205	410	1,~~026~~025	2,~~051~~050	5,~~128~~122	10,~~255~~249	20,~~511~~498
30%	246	492	1,~~231~~230	2,~~461~~460	6,~~153~~149	12,~~306~~299	24,~~613~~598
35%	287	574	1,~~436~~435	2,~~872~~870	7,~~179~~174	14,~~358~~349	28,~~715~~698
60%	492	~~985~~984	2,~~461~~460	4,~~923~~920	12,~~306~~299	24,~~613~~598	49,~~226~~196
80%	656	1,~~313~~312	3,~~282~~280	6,~~563~~559	16,~~409~~399	32,~~817~~797	65,~~634~~594
100%	820	1,~~641~~640	4,~~102~~100	8,~~204~~199	20,~~511~~498	~~41,022~~40,997	~~82,043~~81,993

5.9.2.10 During the breeding season, the potential displacement from construction when using a displacement rate of 25% (range: 15 to 35%) and a mortality of 1% (range: 1% to 10%), results in an additional loss of 75 (45 to 1,046) individuals from the breeding population (Table 5.52). The justification for the displacement and mortality rates are given in section 5.7.2. The regional seas UK Western Waters BDMPS population of common guillemots within the breeding season is estimated to be 1,145,528 individuals (Table 5.14). Assuming an average baseline mortality rate of 0.133 (Table 5.15), background mortality in the breeding season is 152,355 individuals. The addition of 75 (45 to 1,046) individual mortalities due to cumulative displacement from construction activities would increase the mortality relative to the baseline mortality by 0.049 % (0.030 to 0.687%).

5.9.2.11 During the non-breeding season, the displacement from construction results in an additional loss of 130 (78 to 1,~~825~~823) individuals from the non-breeding population (Table 5.53). The regional seas UK Western Waters BDMPS population of common guillemots within the non-breeding season is estimated to be 1,139,~~200~~220 individuals (Table 5.14). Assuming an average baseline mortality rate of 0.133, background mortality in the non-breeding season is 151,516 individuals. The addition of 130 (78 to 1,~~825~~823) individual mortalities due to cumulative displacement from construction activities would increase the mortality relative to the baseline mortality by 0.086 % (0.051 to 1.~~205~~203%).

5.9.2.12 The annual estimated mortality resulting from displacement during construction is 205 (123 to 2,~~872~~870) individuals (Table 5.54). Using the largest BDMPS UK Western Waters population of 1,145,528 individuals and, using the average baseline mortality rate of 0.133 (Table 5.15), the annual background predicted mortality would be 152,355. The of 205 (123 to 2,~~872~~870) mortalities would increase the baseline mortality rate by 0.134% (0.081% to 1.~~885~~883%). The annual predicted mortality from the cumulative assessment during construction is above the 1% threshold increase when using 35% displacement and 10% mortality, which is highly precautionary. The construction period is short term, with the extent of construction overlap varying between each offshore wind farm (Table 5.51) and so it is likely that the impact estimated even at the 25% displacement and 1% mortality range is an overestimate. Expected mortality arising from construction activities is likely to be on the lower end of the range considered.

5.9.2.13 The cumulative impact is therefore predicted to be of national spatial extent, short term duration, intermittent and high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore considered to be **low**.

Razorbill

5.9.2.14 The estimated cumulative abundance of razorbill from the relevant projects (projects that overlap in their construction activities with the Mona Offshore Wind Project) are presented in Table 5.55.

Table 5.55: Razorbill cumulative abundances for overlapping construction phase offshore wind projects for disturbance and displacement assessment.

Project	Annual Cumulative Abundance	Pre-breeding Cumulative Abundance	Breeding Season Cumulative Abundance	Post-breeding Cumulative Abundance	Non-breeding Cumulative Abundance
Tier 1					
Awel y Môr Offshore Wind Farm	692	336	140	66	150
Erebus Floating Wind Demo	3,867	896	194	1,708	1,069
West of Orkney Windfarm	326	97	70	144	15
White Cross Offshore Windfarm	786	345	40	40	361
Tier 2					
Morecambe Offshore Windfarm Generation Assets	1,881	389	222	674	596
Morgan Offshore Wind Project Generation Assets	622	166	120	103	233
TOTAL (minus the Mona Offshore Wind Project)	**8,174**	**2,229**	**786**	**2,735**	**2,424**
Mona Offshore Wind Project	2,519	1,924	83	91	421
TOTAL (all projects)	**10,693**	**4,153**	**869**	**2,826**	**2,845**

5.9.2.15 The following displacement matrices provide the estimated cumulative mortality of guillemot predicted to occur due to displacement during construction, as determined by the relevant specified rates of displacement and mortality (Table 5.56 to Table 5.60). The approach used for the cumulative displacement assessment follows that presented in Volume 6, Annex 5.2: Offshore ornithology displacement technical report of the Environmental Statement. (Document reference F6.5.2).

Table 5.56: Construction phase cumulative razorbill mortality following displacement from offshore wind farms in the pre-breeding season.

Displacement level (% at risk of displacement)	Mortality level (% of displaced birds at risk of mortality)						
	1%	2%	5%	10%	25%	50%	100%
5%	2	4	10	21	52	104	208
10%	4	8	21	42	104	208	415
15%	6	12	31	62	156	311	623
20%	8	17	42	83	208	415	831
25%	10	21	52	104	260	519	1,038
30%	12	25	62	125	311	623	1,246
35%	15	29	73	145	363	727	1,454
60%	25	50	125	249	623	1,246	2,492
80%	33	66	166	332	831	1,661	3,322
100%	42	83	208	415	1,038	2,077	4,153

Table 5.57: Construction phase cumulative razorbill mortality following displacement from offshore wind farms in the breeding season.

Displacement level (% at risk of displacement)	Mortality level (% of displaced birds at risk of mortality)						
	1%	2%	5%	10%	25%	50%	100%
5%	0	1	2	4	11	22	43
10%	1	2	4	9	22	43	87
15%	1	3	7	13	33	65	130
20%	2	3	9	17	43	87	174
25%	2	4	11	22	54	109	217
30%	3	5	13	26	65	130	261
35%	3	6	15	30	76	152	304
60%	5	10	26	52	130	261	521
80%	7	14	35	70	174	348	695
100%	9	17	43	87	217	435	869

Table 5.58: Construction phase cumulative razorbill mortality following displacement from offshore wind farms in the post-breeding season.

Displacement level (% at risk of displacement)	Mortality level (% of displaced birds at risk of mortality)						
	1%	2%	5%	10%	25%	50%	100%
5%	1	3	7	14	35	71	141
10%	3	6	14	28	71	141	283
15%	4	8	21	42	106	212	424
20%	6	11	28	57	141	283	565
25%	7	14	35	71	177	353	707
30%	8	17	42	85	212	424	848
35%	10	20	49	99	247	495	989
60%	17	34	85	170	424	848	1,696
80%	23	45	113	226	565	1,130	2,261
100%	28	57	141	283	707	1,413	2,826

Table 5.59: Construction phase cumulative razorbill mortality following displacement from offshore wind farms in the non-breeding season.

Displacement level (% at risk of displacement)	Mortality level (% of displaced birds at risk of mortality)						
	1%	2%	5%	10%	25%	50%	100%
5%	1	3	7	14	36	71	142
10%	3	6	14	28	71	142	285
15%	4	9	21	43	107	213	427
20%	6	11	28	57	142	285	569
25%	7	14	36	71	178	356	711
30%	9	17	43	85	213	427	854
35%	10	20	50	100	249	498	996
60%	17	34	85	171	427	854	1,707
80%	23	46	114	228	569	1,138	2,276
100%	28	57	142	285	711	1,423	2,845

Table 5.60: Construction phase cumulative razorbill mortality following displacement from offshore wind farms annually.

Displacement level (% at risk of displacement)	Mortality level (% of displaced birds at risk of mortality)							
		1%	2%	5%	10%	25%	50%	100%
	5%	5	11	27	53	134	267	535
	10%	11	21	53	107	267	535	1,069
	15%	16	32	80	160	401	802	1,604
	20%	21	43	107	214	535	1,069	2,139
	25%	27	53	134	267	668	1,337	2,673
	30%	32	64	160	321	802	1,604	3,208
	35%	37	75	187	374	936	1,871	3,743
	60%	64	128	321	642	1,604	3,208	6,416
	80%	86	171	428	855	2,139	4,277	8,554
	100%	107	214	535	1,069	2,673	5,347	10,693

5.9.2.16 During the spring migration (pre-breeding) season the displacement from construction when using a displacement rate of 25% (range: 15% to 35%) and a mortality of 1% (range: 1 to 10%), results in an additional loss of 10 (six to 145) individuals (Table 5.56). The regional seas UK Western Waters BDMPS population of razorbill in the spring migration period is estimated to be 606,914 individuals (Table 5.14). Assuming an average baseline mortality rate of 0.172 (Table 5.15), background mortality during spring migration is 104,389 individuals. The addition of 10 (six to 145) individual mortalities due to cumulative displacement from construction activities would increase the mortality relative to the baseline mortality by 0.009 % (0.006 to 0.139%).

5.9.2.17 During the breeding season, displacement from construction results in the loss of 2 (1 to 30) individual from the breeding population (Table 5.57). The regional seas UK Western Waters BDMPS population of razorbill within the breeding season is estimated to be 198,969 individuals (Table 5.14). Assuming an average baseline mortality rate of 0.172, background mortality in the breeding season is 34,223 individuals. The addition of two (one to 30) individual mortalities due to cumulative displacement from construction activities would increase the mortality relative to the baseline mortality by 0.006 % (0.003 to 0.088%).

5.9.2.18 During the autumn migration season (post-breeding), displacement from construction results in a loss of seven (four to 99) individual from the migratory population (Table 5.58). The regional seas UK Western Waters BDMPS population of razorbill during the autumn migration period is estimated to be 606,914 individuals (Table 5.14). Assuming an average baseline mortality rate of 0.172, background mortality during autumn migration is 104,389 individuals. The addition of seven (four to 99) individual mortalities due to cumulative displacement from construction activities would increase the mortality relative to the baseline mortality by 0.007 % (0.004 to 0.095%).

5.9.2.19 During the non-breeding season (winter season), displacement from construction results a in a loss of seven (four to 100) individuals from the non-breeding population

(Table 5.59). The regional seas UK Western Waters BDMPSS population of razorbill within the non-breeding season is estimated to be 341,422 individuals (Table 5.14). Assuming an average baseline mortality rate of 0.172, background mortality in the breeding season is 58,724 individuals. The addition of seven (four to 100) individual mortalities due to cumulative displacement from construction activities would increase the mortality relative to the baseline mortality by 0.046 % (0.003 to 0.066%).

5.9.2.20 The annual estimated mortality resulting from displacement during construction is 27 (16 to 374) individuals (Table 5.60). Using the largest UK Western Waters BDMPS population of 606,914 razorbill and, using the average baseline mortality rate of 0.172, the background predicted mortality would be 104,389 individuals. The addition of 27 (16 to 374) mortalities would increase the baseline mortality rate by 0.026% (0.003% to 0.358%). The annual predicted mortality from the cumulative assessment is below the 1% threshold increase in baseline mortality.

5.9.2.21 The cumulative effect is predicted to be of national spatial extent, medium term duration, intermittent and high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore considered to be **negligible**.

Atlantic puffin

5.9.2.22 The estimated cumulative abundance of Atlantic puffin from the relevant projects is presented in Table 5.61.

Table 5.61: Atlantic puffin cumulative abundances for overlapping construction phase offshore wind projects for disturbance and displacement assessment.

Project	Annual Abundance	Breeding Season Abundance	Non-breeding Season Abundance
Tier 1			
Awel y Môr Offshore Wind Farm	8	8	0
Erebus Floating Wind Demo	~~15~~1,576	~~15~~1,416	~~0~~160
West of Orkney Windfarm	6,449	5,272	1,177
White Cross Offshore Wind Farm	80	49	31
Tier 2			
Morecambe generation	67	57	10
Morgan Offshore Wind Project Generation Assets	18	18	0
TOTAL (minus Mona)	**~~6,637~~8,198**	**~~5,419~~6,820**	**1,~~218~~378**
Mona	~~15~~37	15	~~0~~22
TOTAL (all projects)	**~~6,652~~8,235**	**~~5,434~~6,835**	**1,~~218~~400**

5.9.2.23 The following displacement matrices provide the estimated cumulative mortality of Atlantic puffin predicted to occur due to displacement, as determined by the relevant specified rates of displacement and mortality (Table 5.62 to Table 5.64). The approach used for the cumulative displacement assessment follows that presented in Volume 6, Annex 5.2: Offshore ornithology displacement technical report of the Environmental Statement. (Document reference F6.5.2).

Table 5.62: Construction phase cumulative Atlantic puffin mortality following displacement from offshore wind farms in the breeding season.

Displacement level (% at risk of displacement)	Mortality level (% of displaced birds at risk of mortality)						
	1%	2%	5%	10%	25%	50%	100%
5%	3	57	1417	2734	6885	136171	272342
10%	87	1614	4134	8268	204171	408342	815684
15%	1110	2221	5451	109103	272256	543513	1,087025
20%	14	27	68	136137	340342	679684	1,359367
25%	1617	3334	8285	163171	408427	815854	1,630709
30%	1921	3841	95103	190205	475513	9511,025	1,9022,051
35%	2224	4348	109120	217239	543598	1,087196	2,174392
60%	3341	6582	163205	326410	8151,025	1,6302,051	3,2604,101
80%	4355	87109	217273	435547	1,087367	2,174734	4,3475,468
100%	5468	109137	272342	543684	1,359709	2,7173,418	5,4346,835

Table 5.63: Construction phase cumulative Atlantic puffin mortality following displacement from offshore wind farms in the non-breeding season.

Displacement level (% at risk of displacement)	Mortality level (% of displaced birds at risk of mortality)						
	1%	2%	5%	10%	25%	50%	100%
5%	1	13	37	614	1535	3070	61140
10%	23	46	914	1828	4670	91140	183280
15%	24	58	1221	2442	61105	122210	244420
20%	36	611	1528	3056	76140	152280	305560
25%	47	714	1835	3770	91175	183350	365700
30%	48	917	2142	4384	107210	213420	426840
35%	510	1020	2449	4998	122245	244490	487980
60%	711	1522	3756	73112	183280	365560	7311,120
80%	1013	1925	4963	97126	244315	487630	9741,260
100%	1214	2428	6170	122140	305350	609700	1,218400

Table 5.64: Construction phase cumulative Atlantic puffin mortality following displacement from offshore wind farms annually.

		Mortality level (% of displaced birds at risk of mortality)						
Displacement level (% at risk of displacement)/		1%	2%	5%	10%	25%	50%	100%
	5%	~~3~~8	~~7~~16	~~17~~41	~~33~~82	~~83~~206	~~166~~412	~~333~~824
	10%	~~10~~16	~~20~~33	~~50~~82	~~100~~165	~~249~~412	~~499~~824	~~998~~1,647
	15%	~~13~~25	~~27~~49	~~67~~124	~~133~~247	~~333~~618	~~665~~1,235	~~1,330~~2,471
	20%	~~17~~33	~~33~~66	~~83~~165	~~166~~329	~~416~~824	~~832~~1,647	~~1,663~~3,294
	25%	~~20~~41	~~40~~82	~~100~~206	~~200~~412	~~499~~1,029	~~998~~2,059	~~1,996~~4,118
	30%	~~23~~49	~~47~~99	~~116~~247	~~233~~494	~~582~~1,235	~~1,164~~2,471	~~2,328~~4,941
	35%	~~27~~58	~~53~~115	~~133~~288	~~266~~576	~~665~~1,441	~~1,330~~2,882	~~2,661~~5,765
	60%	~~40~~66	~~80~~132	~~200~~329	~~399~~659	~~998~~1,647	~~1,996~~3,294	~~3,991~~6,588
	80%	~~53~~74	~~106~~148	~~266~~371	~~532~~741	1,~~330~~853	~~2,661~~3,706	~~5,322~~7,412
	100%	~~67~~82	~~133~~165	~~333~~412	~~665~~824	~~1,663~~2,059	~~3,326~~4,118	~~6,652~~8,235

5.9.2.24 During the breeding season, the displacement from construction when using a displacement rate of 25% (range: 15% to 35%) and a mortality of 1% (range: 1 to 10%), results in an additional loss of ~~16 (11~~17 (10 to ~~217~~239) individuals from the breeding population (Table 5.62). The regional seas UK Western Waters BDMPSS population of Atlantic puffin within the breeding season is estimated to be 1,482,791 individuals (Table 5.14). Assuming an average baseline mortality rate of 0.176 (Table 5.15), background mortality in the breeding season is 260,971 individuals. The addition of ~~16 (11~~17 (10 to ~~217~~239) individual mortalities due to cumulative displacement from construction activities would increase the mortality relative to the baseline mortality by 0.006 % (0.~~004~~003 to 0.~~083~~092%).

5.9.2.25 During the non-breeding season, the displacement from construction results in an additional loss of seven (four ~~(two~~ to ~~49~~98) individual from the non-breeding population (Table 5.63). The regional seas UK Western Waters BDMPSS population of common guillemots within the non-breeding season is estimated to be 304,557 individuals (Table 5.14). Assuming an average baseline mortality rate of 0.176, background mortality in the non-breeding season is 53,602 individuals. The addition of seven (four ~~(two~~ to ~~49~~98) individual mortalities due to cumulative displacement from construction activities would increase the mortality relative to the baseline mortality by 0.~~007~~013% (0.~~004~~007 to 0.~~091~~183%).

5.9.2.26 The annual estimated mortality resulting from displacement during construction is ~~20 (13~~41 (25 to ~~266) individual~~576) individuals (Table 5.64). Using the largest UK Western Waters BDMPS population of 1,482,791 Atlantic puffin and, using the average baseline mortality rate of 0.176, the background predicted mortality would be 260,971 individuals. The addition of 20 (13 to 266) mortalities would increase the baseline mortality rate by 0.~~008~~016% (0.~~005~~010% to 0.~~102~~221%). The annual predicted mortality from the cumulative assessment is below the 1% threshold increase in baseline mortality.

5.9.2.27 The cumulative effect is predicted to be of national spatial extent, medium term duration, intermittent and high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **negligible**.

Northern gannet

5.9.2.28 The estimated cumulative abundance of northern gannet from the relevant projects is presented in Table 5.65.

Table 5.65: Northern gannet cumulative abundances for overlapping construction phase offshore wind projects for disturbance and displacement assessment.

Project	Annual Abundance	Pre-breeding Abundance	Breeding Season Abundance	Post-breeding Abundance
Tier 1				
Awel y Môr Offshore Wind Farm	529	0	328	201
Erebus Floating Wind Demo	~~558~~658	~~0~~100	224	334
West of Orkney Windfarm	2,188	59	958	1,171
White Cross Offshore Wind Farm	456	141	239	76
Tier 2				
Morecambe Offshore Windfarm Generation Assets	912	0	748	164
Morgan Offshore Wind Project Generation Assets	454	53	209	192
TOTAL (minus the Mona Offshore Wind Project)	**5,~~097~~197**	**~~253~~353**	**2,706**	**2,138**
Mona Offshore Wind Project	337	28	251	58
TOTAL (all projects)	**5,~~434~~534**	**~~281~~381**	**2,957**	**2,196**

5.9.2.29 The following displacement matrices provide the estimated cumulative mortality of northern gannet predicted to occur due to displacement, as determined by the relevant specified rates of displacement and mortality (Table 5.66 to Table 5.69). The approach used for the cumulative displacement assessment follows that presented in Volume 6, Annex 5.2: Offshore ornithology displacement technical report of the Environmental Statement~~.~~ (Document reference F6.5.2).

Table 5.66: Construction phase cumulative northern gannet mortality following displacement from offshore wind farms in the pre-breeding season.

281	Mortality level (% of displaced birds at risk of mortality)						
Displacement level (% at risk of displacement)	**1%**	**2%**	**5%**	**10%**	**25%**	**50%**	**100%**
10%	0	1	~~1~~2	~~3~~4	~~7~~10	~~14~~19	~~28~~38
20%	1	~~1~~2	~~3~~4	~~6~~8	~~14~~19	~~28~~38	~~56~~76
30%	1	2	~~4~~6	~~8~~11	~~21~~29	~~42~~57	~~84~~114
35%	1	~~2~~3	~~5~~7	~~10~~13	~~25~~33	~~49~~67	~~98~~133
40%	~~1~~2	~~2~~3	~~6~~8	~~11~~15	~~28~~38	~~56~~76	~~112~~152
50%	~~1~~2	~~3~~4	~~7~~10	~~14~~19	~~35~~48	~~70~~95	~~141~~191
60%	2	~~3~~5	~~8~~11	~~17~~23	~~42~~57	~~84~~114	~~169~~229
70%	~~2~~3	~~4~~5	~~10~~13	~~20~~27	~~49~~67	~~98~~133	~~197~~267
80%	~~2~~3	~~4~~6	~~11~~15	~~22~~30	~~56~~76	~~112~~152	~~225~~305
90%	3	~~5~~7	~~13~~17	~~25~~34	~~63~~86	~~126~~171	~~253~~343
100%	~~3~~4	~~6~~8	~~14~~19	~~28~~38	~~70~~95	~~141~~191	~~281~~381

Table 5.67: Construction phase cumulative northern gannet mortality following displacement from offshore wind farms in the breeding season.

	Mortality level (% of displaced birds at risk of mortality)						
Displacement level (% at risk of displacement)	**1%**	**2%**	**5%**	**10%**	**25%**	**50%**	**100%**
10%	3	6	15	30	74	148	296
20%	6	12	30	59	148	296	591
30%	9	18	44	89	222	444	887
35%	10	21	52	103	259	517	1,035
40%	12	24	59	118	296	591	1,183
50%	15	30	74	148	370	739	1,479
60%	18	35	89	177	444	887	1,774
70%	21	41	103	207	517	1,035	2,070
80%	24	47	118	237	591	1,183	2,366
90%	27	53	133	266	665	1,331	2,661
100%	30	59	148	296	739	1,479	2,957

Table 5.68: Construction phase cumulative northern gannet mortality following displacement from offshore wind farms in the post-breeding season.

Displacement level (% at risk of displacement)	Mortality level (% of displaced birds at risk of mortality)						
	1%	2%	5%	10%	25%	50%	100%
10%	2	4	11	22	55	110	220
20%	4	9	22	44	110	220	439
30%	7	13	33	66	165	329	659
35%	8	15	38	77	192	384	769
40%	9	18	44	88	220	439	878
50%	11	22	55	110	275	549	1,098
60%	13	26	66	132	329	659	1,318
70%	15	31	77	154	384	769	1,537
80%	18	35	88	176	439	878	1,757
90%	20	40	99	198	494	988	1,976
100%	22	44	110	220	549	1,098	2,196

Table 5.69: Construction phase cumulative northern gannet mortality following displacement from offshore wind farms annually.

Displacement level (% at risk of displacement)	Mortality level (% of displaced birds at risk of mortality)						
	1%	2%	5%	10%	25%	50%	100%
10%	~~5~~6	11	~~27~~28	~~54~~55	~~136~~138	~~272~~277	~~543~~553
20%	11	22	~~54~~55	~~109~~111	~~272~~277	~~543~~553	1,~~087~~107
30%	~~16~~17	33	~~82~~83	~~163~~166	~~408~~415	~~815~~830	1,~~630~~660
35%	19	~~38~~39	~~95~~97	~~190~~194	~~475~~484	~~951~~968	1,~~902~~937
40%	22	~~43~~44	~~109~~111	~~217~~221	~~543~~553	1,~~087~~107	2,~~174~~214
50%	~~27~~28	~~54~~55	~~136~~138	~~272~~277	~~679~~692	1,~~359~~384	2,~~717~~767
60%	33	~~65~~66	~~163~~166	~~326~~332	~~815~~830	1,~~630~~660	3,~~260~~320
70%	~~38~~39	~~76~~77	~~190~~194	~~380~~387	~~951~~968	1,~~902~~937	3,~~804~~874
80%	~~43~~44	~~87~~89	~~217~~221	~~435~~443	1,~~087~~107	2,~~174~~214	4,~~347~~427
90%	~~49~~50	~~98~~100	~~245~~249	~~489~~498	1,~~223~~245	2,~~445~~490	4,~~891~~981
100%	~~54~~55	~~109~~111	~~272~~277	~~543~~553	1,~~359~~384	2,~~717~~767	5,~~434~~534

5.9.2.30 During the spring migration (pre-breeding) season the displacement from construction when using a displacement rate of 35% (range: 30% to 40%) and a mortality of 1% (range: 1 to 10%), results in an additional loss of 1 (1 to ~~11~~15) individual (Table 5.66).

The regional seas UK Western Waters BDMPS population of northern gannet in the spring migration period is estimated to be 661,888 individuals (Table 5.14). Assuming an average baseline mortality rate of 0.193 (Table 5.15), background mortality during spring migration is 127,744 individuals. The addition of one (one to ~~11~~15) individual mortalities due to cumulative displacement from construction activities would increase the mortality relative to the baseline mortality by 0.001 % (0.001 to 0.009%).

5.9.2.31 During the breeding season, displacement from construction results in the loss of 10 (9 to 118) individuals from the breeding population (Table 5.67). The regional seas UK Western Waters BDMPS population of northern gannet within the breeding season is estimated to be 522,888 individuals (Table 5.14). Assuming an average baseline mortality rate of 0.193, background mortality in the breeding season is 100,917 individuals. The addition of 10 (nine to 118) individual mortalities due to cumulative displacement from construction activities would increase the mortality relative to the baseline mortality by 0.010 % (0.009 to 0.117%).

5.9.2.32 During the post breeding season, displacement from construction results in the loss of eight (seven to 88) individuals (Table 5.68). The regional seas UK Western Waters BDMPS population of northern gannet during the autumn migration period is estimated to be 545,954 individuals (Table 5.14). Assuming an average baseline mortality rate of 0.193, background mortality during autumn migration is 105,369 individuals. The addition of eight (seven to 88) individual mortalities due to cumulative displacement from construction activities would increase the mortality relative to the baseline mortality by 0.008 % (0.007 to 0.084%).

5.9.2.33 The annual estimated mortality resulting from displacement during construction is 19 (~~16~~17 to ~~217~~221) individuals (Table 5.69). Using the largest UK Western Waters BDMPS population of 661,888 individuals, with an average baseline mortality rate of 0.193, the background predicted mortality would be 127,744. The addition of 19 (~~16~~17 to ~~217~~221) mortalities would increase the baseline mortality rate by 0.015% (0.~~012~~013% to 0.~~170~~173%). The annual predicted mortality from the cumulative assessment is below the 1% threshold increase in baseline mortality.

5.9.2.34 The cumulative effect is predicted to be of national spatial extent, medium term duration, intermittent and high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **negligible**.

Black-legged kittiwake

5.9.2.35 The estimated cumulative abundance of black-legged kittiwake from the relevant projects is presented in Table 5.70.

Table 5.70: Black-legged kittiwake cumulative abundances for overlapping construction phase offshore wind projects for disturbance and displacement assessment.

Project	Annual Abundance	Pre-breeding Abundance	Breeding Season Abundance	Post-breeding Abundance
Tier 1				
Awel y Môr Offshore Wind Farm	467	298	87	82
Erebus Floating Wind Demo	2,532	2	2,022	508

Project	Annual Abundance	Pre-breeding Abundance	Breeding Season Abundance	Post-breeding Abundance
West of Orkney Windfarm	2,706	1,217	690	799
White Cross Offshore Windfarm	914	698	44	172
Tier 2				
Morecambe Offshore Windfarm Generation Assets	9,106	1,161	3,899	4,046
Morgan Offshore Wind Project Generation Assets	2,724	645	460	1,619
Rampion 2 (Rampion Extension)	388	286	5	97
TOTAL (minus the Mona Offshore Wind Project)	**18,837**	**4,307**	**7,207**	**7,323**
Mona Offshore Wind Project	1,~~799~~860	~~884~~574	~~355~~726	560
TOTAL (all projects)	**20,~~636~~697**	**~~5,191~~4,881**	**7,~~562~~933**	**7,883**

5.9.2.36 The following displacement matrices provide the estimated cumulative mortality of black-legged kittiwake predicted to occur due to displacement, as determined by the relevant specified rates of displacement and mortality (Table 5.71 to Table 5.74). The approach used for the cumulative displacement assessment follows that presented in Volume 6, Annex 5.2: Offshore ornithology displacement technical report of the Environmental Statement~~.~~ (Document reference F6.5.2).

Table 5.71: Construction phase cumulative black-legged kittiwake mortality following displacement from offshore wind farms in the pre-breeding season.

Displacement level (% at risk of displacement)	Mortality level (% of displaced birds at risk of mortality)						
	1%	2%	5%	10%	25%	50%	100%
5%	~~3~~2	5	~~13~~12	~~26~~24	~~65~~61	~~130~~122	~~260~~244
10%	5	10	~~26~~24	~~52~~49	~~130~~122	~~260~~244	~~519~~488
15%	~~8~~7	~~16~~15	~~39~~37	~~78~~73	~~195~~183	~~389~~366	~~779~~733
20%	10	~~21~~20	~~52~~49	~~104~~98	~~260~~244	~~519~~488	~~1,038~~977
25%	~~13~~12	~~26~~24	~~65~~61	~~130~~122	~~324~~305	~~649~~611	1,~~298~~221
30%	~~16~~15	~~31~~29	~~78~~73	~~156~~147	~~389~~366	~~779~~733	1,~~557~~465
35%	~~18~~17	~~36~~34	~~91~~85	~~182~~171	~~454~~427	~~908~~855	1,~~817~~709
60%	~~31~~29	~~62~~59	~~156~~147	~~311~~293	~~779~~733	1,~~557~~465	~~3,115~~2,930
80%	~~42~~39	~~83~~78	~~208~~195	~~415~~391	~~1,038~~977	~~2,076~~1,954	~~4,153~~3,907

	100%	~~52~~49	~~104~~98	~~260~~244	~~519~~488	1,~~298~~221	2,~~596~~442	~~5,191~~4,884

Table 5.72: Construction phase cumulative black-legged kittiwake mortality following displacement from offshore wind farms in the breeding season.

Displacement level (% at risk of displacement)	Mortality level (% of displaced birds at risk of mortality)						
	1%	**2%**	**5%**	**10%**	**25%**	**50%**	**100%**
5%	4	8	~~19~~20	~~38~~40	~~95~~99	~~189~~198	~~378~~397
10%	8	~~15~~16	~~38~~40	~~76~~79	~~189~~198	~~378~~397	~~756~~793
15%	~~11~~12	~~23~~24	~~57~~59	~~113~~119	~~284~~297	~~567~~595	1,~~134~~190
20%	~~15~~16	~~30~~32	~~76~~79	~~151~~159	~~378~~397	~~756~~793	1,~~512~~587
25%	~~19~~20	~~38~~40	~~95~~99	~~189~~198	~~473~~496	~~945~~992	1,~~891~~983
30%	~~23~~24	~~45~~48	~~113~~119	~~227~~238	~~567~~595	1,~~134~~190	2,~~269~~380
35%	~~26~~28	~~53~~56	~~132~~139	~~265~~278	~~662~~694	1,~~323~~388	2,~~647~~777
60%	~~45~~48	~~91~~95	~~227~~238	~~454~~476	1,~~134~~190	2,~~269~~380	4,~~537~~760
80%	~~60~~63	~~121~~127	~~302~~317	~~605~~635	1,~~512~~587	3,~~025~~173	6,~~050~~346
100%	~~76~~79	~~151~~159	~~378~~397	~~756~~793	1,~~891~~983	3,~~781~~967	7,~~562~~933

Table 5.73: Construction phase cumulative black-legged kittiwake mortality following displacement from offshore wind farms in the post-breeding season.

Displacement level (% at risk of displacement)	Mortality level (% of displaced birds at risk of mortality)						
	1%	**2%**	**5%**	**10%**	**25%**	**50%**	**100%**
5%	4	8	20	39	99	197	394
10%	8	16	39	79	197	394	788
15%	12	24	59	118	296	591	1,182
20%	16	32	79	158	394	788	1,577
25%	20	39	99	197	493	985	1,971
30%	24	47	118	236	591	1,182	2,365
35%	28	55	138	276	690	1,380	2,759
60%	47	95	236	473	1,182	2,365	4,730
80%	63	126	315	631	1,577	3,153	6,306
100%	79	158	394	788	1,971	3,942	7,883

Table 5.74: Construction phase cumulative black-legged kittiwake mortality following displacement from offshore wind farms annually.

Displacement level (% at risk of displacement)	Mortality level (% of displaced birds at risk of mortality)						
	1%	2%	5%	10%	25%	50%	100%
5%	10	21	52	103	~~258~~259	~~516~~517	1,~~032~~035
10%	21	41	103	~~206~~207	~~516~~517	1,~~032~~035	2,~~064~~070
15%	31	62	155	310	~~774~~776	1,~~548~~552	3,~~095~~105
20%	41	83	~~206~~207	~~413~~414	1,~~032~~035	2,~~064~~070	4,~~127~~139
25%	52	103	~~258~~259	~~516~~517	1,~~290~~294	2,~~580~~587	5,~~159~~174
30%	62	124	310	~~619~~621	1,~~548~~552	3,~~095~~105	6,~~191~~209
35%	72	~~144~~145	~~361~~362	~~722~~724	1,~~806~~811	3,~~611~~622	7,~~223~~244
60%	124	248	~~619~~621	1,~~238~~242	3,~~095~~105	6,~~191~~209	12,~~382~~418
80%	~~165~~166	~~330~~331	~~825~~828	1,~~651~~656	4,~~127~~139	8,~~254~~279	16,~~509~~558
100%	~~206~~207	~~413~~414	1,~~032~~035	2,~~064~~070	5,~~159~~174	10,~~318~~349	20,~~636~~697

5.9.2.37 During the spring migration (pre-breeding) season the displacement from construction when using a displacement rate of 25% (range: 15% to 35%) and a mortality of 1% (range: 1 to 10%), results in an additional loss of ~~13 (8~~12 (seven to ~~182~~171) individuals (Table 5.71). The regional seas UK Western Waters & Channel BDMPS population of black-legged kittiwake in the spring migration period is estimated to be 691,526 individuals (Table 5.14). Assuming an average basline mortality rate of 0.156 (Table 5.15), background mortality during spring migration is 107,878 individuals. The addition of ~~13 (eight~~132(seven to ~~182~~171) individual mortalities due to cumulative displacement from construction activities would increase the mortality relative to the baseline mortality by 0.~~012~~011 % (0.~~007~~006 to 0.~~169~~159%).

5.9.2.38 During the breeding season, displacement from construction results in the loss of ~~19 (11~~20 (12 to ~~265~~278) individuals from the breeding population (Table 5.72) The regional seas UK Western Waters & Channel BDMPS population of black-legged kittiwake within the breeding season is estimated to be 245,234 individuals (Table 5.14). Assuming an average baseline mortality rate of 0.156, background mortality in the breeding season is 38,256 individuals. The addition of ~~19 (11~~20 (12 to ~~265~~278) individual mortalities due to cumulative displacement from construction activities would increase the mortality relative to the baseline mortality by 0.~~050~~052 % (0.~~029~~031 to 0.~~693~~727%).

5.9.2.39 During the autumn migration season (post-breeding), displacement from construction results in a loss of 20 (12 to 276) individuals from the migratory population (Table 5.73). The regional seas UK Western Waters & Channel BDMPS population of black-legged kittiwake during the autumn migration period is estimated to be 911,586 individuals (Table 5.14). Assuming an average baseline mortality rate of 0.156, background mortality during autumn migration is 142,207 individuals. The addition of 20 (12 to 276) individual mortalities due to cumulative displacement from construction activities would increase the mortality relative to the baseline mortality by 0.014 % (0.008 to 0.194%).

5.9.2.40 The annual estimated mortality resulting from displacement during construction is 52 (31 to ~~722~~724) individuals (Table 5.74).Using the largest UK Western Waters & Channel BDMPS population of 911,586 individuals, with an average baseline mortality rate of 0.156, the background predicted mortality would be 142,207. The addition of 52 (31 to ~~722~~724) mortalities would increase the baseline mortality rate by 0.036% (0.022% to 0.~~508~~509%). The annual predicted mortality from the cumulative assessment is below the 1% threshold increase in baseline mortality.

5.9.2.41 The cumulative effect is predicted to be of national spatial extent, medium term duration, intermittent and high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **negligible**.

Manx shearwater

5.9.2.42 The estimated cumulative abundances of Manx shearwater are presented in Table 5.75 for the relevant projects.

Table 5.75: Manx shearwater cumulative abundances for overlapping construction phase offshore wind projects for disturbance and displacement assessment.

Project	Annual Cumulative Abundance	Pre-breeding Cumulative Abundance	Breeding Season Cumulative Abundance	Post-breeding Cumulative Abundance
Tier 1				
Awel y Môr Offshore Wind Farm	417	~~177~~214	26	177
Erebus Floating Wind Demo	2,115	18	1,540	557
West of Orkney Windfarm	~~10~~11	0	8	3
White Cross Offshore Windfarm	12,181	12,126	33	22
Tier 2				
Morecambe Offshore Windfarm Generation Assets	7,~~580~~583	0	7,577	6
Morgan Offshore Wind Project Generation Assets	993	59	467	467
Rampion 2 (Rampion Extension) Offshore Wind Farm	0	0	0	0
TOTAL (minus the Mona Offshore Wind Project)	**23,~~296~~300**	**12,~~380~~417**	**9,651**	**1,232**
Mona Offshore Wind Project	1,~~434~~268	3	1,249	~~182~~16
TOTAL (all projects)	**24,~~730~~568**	**12,~~383~~420**	**10,900**	**1,~~414~~248**

5.9.2.43 The following displacement matrices provide the estimated cumulative mortality of Manx shearwater predicted to occur due to displacement, as determined by the relevant specified rates of displacement and mortality (Table 5.76 to Table 5.79). The approach used for the cumulative displacement assessment follows that presented in Volume 6, Annex 5.2: Offshore ornithology displacement assessment technical report of the Environmental Statement~~.~~ (Document reference F6.5.2).

Table 5.76: Construction phase cumulative Manx shearwater mortality following displacement from offshore wind farms in the pre-breeding season.

Displacement level (% at risk of displacement)	Mortality level (% of displaced birds at risk of mortality) 1%	2%	5%	10%	25%	50%	100%
5%	6	12	31	62	155	~~310~~311	~~619~~621
10%	~~19~~12	~~37~~25	~~93~~62	~~186~~124	~~464~~311	~~929~~621	1,~~857~~242
15%	~~25~~19	~~50~~37	~~124~~93	~~248~~186	~~619~~466	~~1,238~~932	~~2,477~~1,863
20%	~~31~~25	~~62~~50	~~155~~124	~~310~~248	~~774~~621	1,~~548~~242	~~3,096~~2,484
25%	~~37~~31	~~74~~62	~~186~~155	~~371~~311	~~929~~776	1,~~857~~553	3,~~715~~105
30%	~~43~~37	~~87~~75	~~217~~186	~~433~~373	~~1,084~~932	~~2,167~~1,863	~~4,334~~3,726
35%	~~50~~43	~~99~~87	~~248~~217	~~495~~435	1,~~238~~087	2,~~477~~174	4,~~953~~347
60%	~~74~~75	149	~~371~~373	~~743~~745	1,~~857~~863	3,~~715~~726	7,~~430~~452
80%	99	~~198~~199	~~495~~497	~~991~~994	2,~~477~~484	4,~~953~~968	9,~~906~~936
100%	124	248	~~619~~621	1,~~238~~242	3,~~096~~105	6,~~192~~210	12,~~383~~420

Table 5.77: Construction phase cumulative Manx shearwater mortality following displacement from offshore wind farms in the breeding season.

Displacement level (% at risk of displacement)	Mortality level (% of displaced birds at risk of mortality) 1%	2%	5%	10%	25%	50%	100%
5%	5	11	27	55	136	273	545
10%	16	33	82	164	409	818	1,635
15%	22	44	109	218	545	1,090	2,180
20%	27	55	136	273	681	1,363	2,725
25%	33	65	164	327	818	1,635	3,270
30%	38	76	191	382	954	1,908	3,815
35%	44	87	218	436	1,090	2,180	4,360
60%	65	131	327	654	1,635	3,270	6,540
80%	87	174	436	872	2,180	4,360	8,720
100%	109	218	545	1,090	2,725	5,450	10,900

Table 5.78: Construction phase cumulative Manx shearwater mortality following displacement from offshore wind farms in the post-breeding season.

Displacement level (% at risk of displacement)	Mortality level (% of displaced birds at risk of mortality): 1%	2%	5%	10%	25%	50%	100%
5%	1	1	~~4~~3	~~7~~6	~~18~~16	~~35~~31	~~71~~62
10%	~~2~~1	~~4~~2	~~11~~6	~~21~~12	~~53~~31	~~106~~62	~~212~~125
15%	~~3~~2	~~6~~4	~~14~~9	~~28~~19	~~71~~47	~~141~~94	~~283~~187
20%	~~4~~2	~~7~~5	~~18~~12	~~35~~25	~~88~~62	~~177~~125	~~354~~250
25%	~~4~~3	~~8~~6	~~21~~16	~~42~~31	~~106~~78	~~212~~156	~~424~~312
30%	~~5~~4	~~10~~7	~~25~~19	~~49~~37	~~124~~94	~~247~~187	~~495~~374
35%	~~6~~4	~~11~~9	~~28~~22	~~57~~44	~~141~~109	~~283~~218	~~566~~437
60%	~~8~~7	~~17~~15	~~42~~37	~~85~~75	~~212~~187	~~424~~374	~~848~~749
80%	~~11~~10	~~23~~20	~~57~~50	~~113~~100	~~283~~250	~~566~~499	~~1,131~~998
100%	~~14~~12	~~28~~25	~~71~~62	~~141~~125	~~354~~312	~~707~~624	1,~~414~~248

Table 5.79: Construction phase cumulative Manx shearwater mortality following displacement from offshore wind farms annually.

Displacement level (% at risk of displacement)	Mortality level (% of displaced birds at risk of mortality): 1%	2%	5%	10%	25%	50%	100%
5%	12	25	~~62~~61	~~124~~123	~~309~~307	~~618~~614	1,~~237~~228
10%	~~37~~25	~~74~~49	~~185~~123	~~371~~246	~~927~~614	1,~~855~~228	~~3,710~~2,457
15%	~~49~~37	~~99~~74	~~247~~184	~~495~~369	~~1,237~~921	~~2,473~~1,843	~~4,946~~3,685
20%	~~62~~49	~~124~~98	~~309~~246	~~618~~491	1,~~546~~229	~~3,091~~2,457	~~6,183~~4,914
25%	~~74~~61	~~148~~123	~~371~~307	~~742~~614	1,~~855~~536	3,~~710~~071	~~7,419~~6,142
30%	~~87~~74	~~173~~147	~~433~~369	~~866~~737	~~2,164~~1,843	~~4,328~~3,685	~~8,656~~7,370
35%	~~99~~86	~~198~~172	~~495~~430	~~989~~860	2,~~473~~150	4,~~946~~299	~~9,892~~8,599
60%	~~148~~147	~~297~~295	~~742~~737	1,~~484~~474	3,~~710~~686	7,~~419~~370	14,~~838~~741
80%	~~198~~197	~~396~~393	~~989~~983	1,~~978~~966	4,~~946~~914	9,~~892~~827	19,~~784~~654
100%	~~247~~246	~~495~~491	1,~~237~~229	2,~~473~~457	6,~~183~~142	12,~~365~~284	24,~~730~~568

5.9.2.44 During the spring migration (pre-breeding) season the displacement from construction when using a displacement rate of 25% (range: 15% to 35%) and a mortality of 1% (range: 1 to 10%), results in an additional loss of ~~37 (25~~31 (19 to ~~495~~435) individuals (Table 5.76). The regional seas UK Western Waters & Channel BDMPS population of Manx shearwater in the spring migration period is estimated to be 1,580,895 individuals (Table 5.14). Assuming an average baseline mortality rate of 0.130 (Table 5.15), background mortality during spring migration is 205,516 individuals. The addition of ~~37 (25~~31 (19 to ~~495~~435) individual mortalities due to cumulative displacement from construction activities would increase the mortality relative to the baseline mortality by 0.~~018~~015 % (0.~~012~~009 to 0.~~241~~212%).

5.9.2.45 During the breeding season the displacement from construction when using a displacement rate of 25% (range: 15% to 35%) and a mortality of 1% (range: 1 to 10%), results in an additional loss of 33 (22 to 436) individuals (Table 5.77). The regional seas UK Western Waters & Channel BDMPS population of Manx shearwater within the breeding season is estimated to be 1,821,544 individuals (Table 5.14). Assuming an average baseline mortality rate of 0.130, background mortality in the breeding season is 236,801 individuals. The addition of 33 (22 to 436) individual mortalities due to cumulative displacement from construction activities would increase the mortality relative to the baseline mortality by 0.014 % (0.009 to 0.184%).

5.9.2.46 During the autumn migration season (post-breeding), displacement from construction results in a loss of ~~four (~~three (two to ~~57~~44) individuals from the migratory population (Table 5.78). The regional seas UK Western Waters & Channel BDMPS population of Manx shearwater during the autumn migration period is estimated to be 1,580,895 individuals (Table 5.14). Assuming an average baseline mortality rate of 0.130, background mortality during autumn migration is 205,516 individuals. The addition of ~~four (~~three (two to ~~57~~44) individual mortalities due to cumulative displacement from construction activities would increase the mortality relative to the baseline mortality by 0.~~002~~001 % (0.001 to 0.~~028~~021%).

5.9.2.47 The annual estimated mortality resulting from displacement during construction ~~74 (49~~61 (37 to ~~989~~860) individuals (Table 5.79). Using the largest population of 1,821,544 individuals, with an average baseline mortality rate of 0.130), the background predicted mortality would be 236,801. The addition of ~~74 (49~~61 (37 to ~~989~~860) mortalities would increase the baseline mortality rate by 0.~~031~~026% (0.~~021~~016 to 0.~~418~~363%). The annual predicted mortality from the cumulative assessment is below the 1% threshold increase in baseline mortality.

5.9.2.48 The cumulative effect is predicted to be of national spatial extent, medium term duration, intermittent and high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **negligible**.

Sensitivity of the receptor

Common guillemot

5.9.2.49 Evidence of common guillemot sensitivity to displacement from the construction phase of offshore wind farms is summarised from paragraph 5.9.2.8 onwards. Overall, based on evidence from studies and reviews, common guillemot is deemed to be of medium vulnerability, medium recoverability and medium value. The sensitivity of the receptor is therefore, considered to be **medium**.

Razorbill

5.9.2.50 Evidence of razorbill sensitivity to displacement from the construction phase of offshore wind farms is summarised in paragraph 5.9.2.14 onwards. Overall, based on evidence from studies and reviews, razorbill is deemed to be of medium vulnerability, medium recoverability and medium value. The sensitivity of the receptor is therefore, considered to be **medium.**

Atlantic puffin

5.9.2.51 Evidence of Atlantic puffin sensitivity to displacement from the construction phase of offshore wind farms is summarised in paragraph 5.9.2.22 onwards. Overall, based on evidence from studies and reviews, Atlantic puffin is deemed to be of medium vulnerability, low recoverability and high value. The sensitivity of the receptor is therefore, considered to be **high**.

Northern gannet

5.9.2.52 Evidence of northern gannet sensitivity to displacement from the construction phase of offshore wind farms is summarised in paragraph 5.9.2.28 onwards. Based on evidence from operational wind farms demonstrating that northern gannet show a high avoidance of offshore wind farms, this species is deemed to be of medium vulnerability, medium recoverability and medium value. The sensitivity of the receptor is therefore, considered to be **medium.**

Black-legged kittiwake

5.9.2.53 Evidence of black-legged kittiwake sensitivity to displacement from the construction phase of offshore wind farms is summarised in paragraph 5.9.2.35 onwards. For kittiwake, there is evidence from other operating offshore wind farm projects that displacement is not likely to occur to any significant level. However, due to low reproductive rates, black-legged kittiwake is deemed to be of low vulnerability, low recoverability and medium value. The sensitivity of the receptor is therefore, considered to be **medium.**

Manx shearwater

5.9.2.54 For Manx shearwater, there is evidence from other operating offshore wind farm projects that displacement is not likely to occur to any significant level (JNCC, 2022). However, due to low reproductive rates, Manx shearwater is deemed to be of low vulnerability, low recoverability and high value. The sensitivity of the receptor is therefore, considered to be **medium**.

Significance of effect

5.9.2.55 Table 5.80 summarises the significance of effect cumulative on the species susceptible to disturbance and displacement impacts. Common guillemot was the only species with a magnitude assessed to be greater than negligible. All impacts are considered non-significant in EIA terms.

Table 5.80:-_Table summarising the cumulative significance of effect during construction.

Species	Magnitude of impact	Sensitivity of receptor	Significance of effect
Common guillemot	Low	Medium	**Minor adverse, not significant in EIA terms**
Razorbill	Negligible	Medium	**Negligible, not significant in EIA terms**
Atlantic puffin	Negligible	High	**Negligible, not significant in EIA terms**
Northern gannet	Negligible	Medium	**Negligible, not significant in EIA terms**
Black-legged kittiwake	Negligible	Medium	**Negligible, not significant in EIA terms**

Species	Magnitude of impact	Sensitivity of receptor	Significance of effect
Manx shearwater	Negligible	Medium	**Negligible, not significant in EIA terms**

Tier 1 and Tier 2

Operations and maintenance phase

Magnitude of impact

Common guillemot

5.9.2.56 The estimated cumulative abundance of guillemots from the relevant projects with available data is presented in Table 5.81. There are several projects for which there are no, or limited, data on the number of guillemot predicted to be displaced, for some of the earlier developments which are discussed in Table 5.85.

Table 5.81: Guillemot cumulative abundances for offshore wind projects for disturbance and displacement assessment during the operations and maintenance phase.

Project	Annual Abundance	Breeding Season Abundance	Non-breeding Season Abundance
Tier 1			
Awel y Môr Offshore Wind Farm	4,488	1,569	2,919
Burbo Bank Offshore Wind Farm	Unavailable	Unavailable	Unavailable
Burbo Bank Extension Offshore Wind Farm	~~5,963~~2,562	~~2,414~~1,000	~~3,549~~1,561
Erebus Floating Wind Demo	35,~~389~~339	7,001	28,~~388~~338
Gwynt y Môr Offshore Wind Farm	unavailable	Unavailable	Unavailable
Twinhub (Wave Hub Floating Wind Farm)	~~355~~256	~~238~~39	~~172~~217
Ormonde Wind Farm	~~238~~912	~~238~~912	Unavailable
Robin Rigg Offshore Wind Farm	~~28~~138	~~28~~138	Unavailable
Rhyl Flats Offshore Wind Farm	Unavailable	Unavailable	Unavailable
Walney 1 & 2 Offshore Wind Farms	Unavailable	Unavailable	Unavailable
Walney (3 & 4) Extension Offshore Wind Farm	6,~~093~~096	4,~~167~~169	1,~~926~~927
West of Duddon Sands Offshore Windfarm	~~833~~1,321	~~347~~1,321	Unavailable~~486~~
West of Orkney Windfarm	9,136	4,861	4,275

Project	Annual Abundance	Breeding Season Abundance	Non-breeding Season Abundance
White Cross Offshore Windfarm	4,363	3,304	1,059
Tier 2			
Morecambe Offshore Windfarm Generation Assets	11,697	4,050	7,647
Morgan Offshore Wind Project Generation Assets	8,994	4,893	4,101
Total abundance (minus the Mona Offshore Wind Project)	**85,302**	**33,257**	**52,044**
Mona Offshore Wind Project	7,976	4,220	3,756
Cumulative total abundance (all projects)	**93,278**	**37,477**	**55,800**
Collision impacts			
Tier 1			
Holyhead Deep – Tidal Energy	8	Unavailable	Unavailable
West Anglesey Demonstration Zone tidal site	46	38	8
~~**Total (minus the Mona Offshore Wind Project)**~~	~~**87,577**~~	~~**33,055**~~	~~**54,522**~~
~~Mona Offshore Wind Project~~	~~7,976~~	~~4,220~~	~~3,756~~
~~**Cumulative total (all projects)**~~	~~**95,553**~~	~~**37,275**~~	~~**58,278**~~

5.9.2.57 The following displacement matrices provide the estimated cumulative mortality of guillemot predicted to occur due to displacement, as determined by the relevant specified rates of displacement and mortality (Table 5.82 to Table 5.84). The approach used for the cumulative displacement assessment follows that presented in Volume 6, Annex 5.2: Offshore ornithology displacement technical report of the Environmental Statement~~.~~ (Document reference F6.5.2).

Table 5.82: Operations and maintenance phase cumulative guillemot mortality following displacement from offshore wind farms in the breeding season.

Displacement level (% at risk of)	Mortality level (% of displaced birds at risk of mortality)						
	1%	2%	5%	10%	25%	50%	100%
10%	37	75	~~186~~187	~~373~~375	~~932~~937	1,~~864~~874	3,~~728~~748
20%	75	~~149~~150	~~373~~375	~~746~~750	1,~~864~~874	3,~~728~~748	7,~~455~~495
30%	112	~~224~~225	~~559~~562	1,~~118~~124	2,~~796~~811	5,~~591~~622	11,~~183~~243
40%	~~149~~150	~~298~~300	~~746~~750	1,~~491~~499	3,~~728~~748	7,~~455~~495	14,~~910~~991
50%	~~186~~187	~~373~~375	~~932~~937	1,~~864~~874	4,~~659~~685	9,~~319~~369	18,~~638~~739

	60%	224225	447450	1,118124	2,237249	5,591622	11,183243	22,365486
	70%	261262	522525	1,305312	2,609623	6,523558	13,046177	26,093234
	80%	298300	596600	1,491499	2,982998	7,455495	14,910991	29,820982
	90%	335337	671675	1,677686	3,355373	8,387342	16,774865	33,548729
	100%	373375	746750	1,864874	3,728748	9,319369	18,638739	37,275477

Table 5.83: Operations and maintenance phase cumulative guillemot mortality following displacement from offshore wind farms in the non-breeding season.

Displacement level (% at risk of displacement)		Mortality level (% of displaced birds at risk of mortality)						
		1%	2%	5%	10%	25%	50%	100%
	10%	5856	117112	291279	583558	1,457395	2,914790	5,828580
	20%	117112	233223	583558	1,166116	2,914790	5,828580	11,656160
	30%	175167	350335	874837	1,748674	4,371185	8,742370	17,48316,740
	40%	233223	466446	1,166116	2,331232	5,828580	11,656160	23,31122,320
	50%	291279	583558	1,457395	2,914790	7,2856,975	14,57013,950	29,13927,900
	60%	350335	699670	1,748674	3,497348	8,742370	17,48316,740	34,96733,480
	70%	408391	816781	2,0401,953	4,0793,906	10,1999,765	20,39719,530	40,79539,060
	80%	466446	932893	2,331232	4,662464	11,656160	23,31122,320	46,62244,640
	90%	525502	1,049004	2,623511	5,245022	13,11312,555	26,22525,110	52,45050,220
	100%	583558	1,166116	2,914790	5,828580	14,57013,950	29,13927,900	58,27855,800

Table 5.84: Operations and maintenance phase cumulative guillemot mortality following displacement from offshore wind farms annually.

Displacem		Mortality level (% of displaced birds at risk of mortality)						
		1%	2%	5%	10%	25%	50%	100%
	10%	9693	191187	478466	956933	2,389332	4,778664	9,555328

	20%	~~191~~187	~~382~~373	~~956~~933	1,~~911~~866	4,~~778~~664	9,~~555~~328	~~19,111~~18,656
	30%	~~287~~280	~~573~~560	1,~~433~~399	2,~~867~~798	~~7,166~~6,996	~~14,333~~13,992	~~28,666~~27,983
	40%	~~382~~373	~~764~~746	1,~~911~~866	3,~~822~~731	9,~~555~~328	~~19,111~~18,656	~~38,221~~37,311
	50%	~~478~~466	~~956~~933	2,~~389~~332	4,~~778~~664	11,~~944~~660	23,~~888~~320	~~47,777~~46,639
	60%	~~573~~560	1,~~147~~119	2,~~867~~798	5,~~733~~597	~~14,333~~13,992	~~28,666~~27,983	~~57,332~~55,967
	70%	~~669~~653	1,~~338~~306	3,~~344~~265	6,~~689~~529	16,~~722~~324	~~33,444~~32,647	~~66,887~~65,295
	80%	~~764~~746	1,~~529~~492	3,~~822~~731	7,~~644~~462	~~19,111~~18,656	~~38,221~~37,311	~~76,442~~74,622
	90%	~~860~~840	1,~~720~~679	4,~~300~~198	8,~~600~~395	~~21,499~~20,988	~~42,999~~41,975	~~85,998~~83,950
	100%	~~956~~933	1,~~911~~866	4,~~778~~664	9,~~555~~328	23,~~888~~320	~~47,777~~46,639	~~95,553~~93,278

Table 5.85: Qualitative assessment of projects considered cumulatively with the Mona Offshore Wind Project for which quantitative consideration of displacement impacts was not undertaken in project-specific documentation for guillemot.

Project	Reason for estimates being unavailable	Qualitative assessment	Final conclusion
Tier 1			
Burbo Bank Offshore Wind Farm (Seascape Energy Ltd., 2002)	Disturbance impacts considered qualitatively	Surveys of the project comprised aerial and boat-based surveys both of which were undertaken during winter months (aerial = November to April and boat-based = December and February). Aerial surveys covered a large area encompassing the Liverpool Bay SPA with boat-based surveys covering the project area. The surveys were undertaken to provide abundance and distribution data for those species considered to be of most importance, namely common scoter and red-throated diver. Guillemots were recorded in all months during which aerial surveys were undertaken however, there is no information on the numbers recorded within the wind farm. During boat-based surveys, which were undertaken across a much smaller area, numbers of guillemot were far smaller with a highest count of 34 birds.	Low levels of disturbance were predicted resulting in a conclusion of a negligible magnitude and a very low significance.
Gwynt y Môr Offshore Wind Farm (RWE Group and Npower Renewables, 2005)	Disturbance impacts considered qualitatively	Site-specific surveys undertaken in support of the project included boat-based surveys undertaken between February 2003 and March 2005. Surveys between February 2003 and February 2004 covered a large area along the Welsh coast incorporating the project area with surveys between March 2004 and March 2005 more focussed on the project area. The assessment also used data from aerial surveys undertaken between 2000 2005 which were targeted at recording common scoter. The majority of guillemot identified to species level during aerial surveys occurred in July and August. Based on the aerial survey data collected during the November 2004 survey, 32 guillemot were estimated to be present in the wind farm area. Birds were seen in or around the wind farm area in most months during which boat-based survey were undertaken with fewer observed between June and September.	It was considered that displacement (termed avoidance of turbines in the assessments conducted) would result in an impact of low significance for auk species.

Project	Reason for estimates being unavailable	Qualitative assessment	Final conclusion
Ormonde Wind Farm (Ecology Consulting, 2005)	Disturbance impacts considered qualitatively	Site-specific surveys included boat-based surveys undertaken monthly between May 2004 and April 2005. In addition, three aerial surveys were conducted during the summer of 2004 with four further aerial surveys in the winter of 2004/5. The peak population of guillemot recorded in the wind farm plus a 2 km buffer during boat-based surveys was 238 birds. During aerial surveys the equivalent population was 0, although 1,086 auk species were recorded. Peak numbers occurred in autumn months (September or November) The species was considered to be regionally important in the context of the assessments conducted.	The magnitude of the effect for guillemot was considered to be low with a low significance.
Robin Rigg Offshore Wind Farm (Natural Power, 2002)	Disturbance impacts considered qualitatively	The project utilised site-specific boat-based surveys to characterise the baseline environment. Two surveys were completed in each month from May 2001 for one year. In addition, aerial surveys were undertaken from November 2001 on a monthly basis through winter and spring to verify the distribution and abundance of seaduck. The mean count of guillemot during boat-based surveys in the wind farm was 7.9 (and 0.4 for auk species) birds with a peak of 39 birds (3 for auk species). Guillemot was considered to be of local importance based on the populations recorded in the wind farm. Aerial surveys undertaken in the non-breeding season recorded a maximum of two auks.	The magnitude of the effect was considered to be low with a low significance.
Rhyl Flats Offshore Wind Farm (Ecology Consulting, 2002)	Disturbance impacts considered qualitatively	Surveys of the project comprised aerial and boat-based surveys. Aerial surveys were undertaken between December 2001 and January 2002 and targeted common scoter, with non-target species not uniformly reported upon. Boat-based surveys were undertaken between January and March 2002 to record movements of common scoter and the flight height of birds. Few auks were recorded in the wind farm area. It was considered that the wind farm area represented an area of low importance for foraging for guillemot from the Puffin Island, Anglesey and moderate importance for guillemot from the Great Ormes Head SSSI.	Wind farm area not considered to be importance for seabirds and significant effects were considered unlikely.

Project	Reason for estimates being unavailable	Qualitative assessment	Final conclusion
Walney 1 & 2 Offshore Wind Farms (RPS, 2006)	Disturbance impacts considered qualitatively	Site-specific surveys included boat-based surveys undertaken across an area of 512 km^2 in the vicinity of the project between May 2004 and September 2005. The project also utilised survey data collected by regional aerial surveys, undertaken across their aerial survey area between 2002 and 2006 and radar survey data collected between 1st October and 29th October 2005. The peak population of guillemot recorded in the project area plus 2 km buffer during aerial surveys was 30 birds with a peak count of 391 auk species in the same area. In boat-based surveys the equivalent populations were 1,256 guillemot and 65 auk species.	It was considered that the wind farm area did not represent a favoured foraging habitat and the magnitude of any impact was considered to be low. The species was considered to be of medium importance (termed sensitivity in the Walney 1&2 assessments). The overall significance of impacts associated with the project was considered to be low.

5.9.2.58 During the breeding season, the displacement from operation when using a displacement of 50% (range of 30 to 70%) and a mortality of 1% (range of 1 to 10%), results in an additional loss of ~~186~~ 187 (112 to 2,~~609~~623) individuals from the breeding population. The regional seas UK Western Waters BDMPS population of common guillemots within the breeding season is estimated to be 1,145,528 individuals (Table 5.14). Assuming an average baseline mortality rate of 0.133 (Table 5.15), background mortality in the breeding season is 152,355 individuals. The addition of ~~186~~ 187 (112 to 2,~~609~~623) individual mortalities due to cumulative displacement from the presence of infrastructure, plus the additional 38 mortalities from collision with underwater turbines, would increase the mortality relative to the baseline mortality by 0.~~147~~ 123% (0.~~098~~074 to 1.~~738~~722%).

5.9.2.59 During the non-breeding season, the displacement from operation results in an additional loss of ~~291 (175~~279 (167 to ~~4,709~~3,906) individuals from the non-breeding population (Table 5.83). The regional seas UK Western Waters BDMPS population of common guillemots within the non-breeding season is estimated to be 1,139,~~200~~220 individuals (Table 5.14). Assuming an average baseline mortality rate of 0.133, background mortality in the non-breeding season is 151,516 individuals. The addition of ~~291 (175~~279 (167 to ~~4,079~~3,906) individual mortalities due to cumulative displacement from the presence of infrastructure, plus the additional 8 mortalities from collision with underwater turbines, would increase the mortality relative to the baseline mortality by 0.~~198~~184 % (0.~~121~~110 to 2.~~698~~578%).

5.9.2.60 The annual estimated mortality resulting from displacement during operation is ~~478 (287~~466 (280 to 6,~~689~~529) individuals (Table 5.84). Using the largest BDMPS UK Western Waters population of 1,145,528 individuals and, using the average baseline mortality rate of 0.133 (Table 5.15), the annual background predicted mortality would be 152,355. The additional of ~~478 (287~~466 (280 to 6,~~689~~529) mortalities, plus the additional 54 mortalities from collision with underwater turbines would increase the baseline mortality rate by 0.~~349~~306% (0.~~224~~184% to 4.~~426~~286%).

5.9.2.61 These numbers demonstrate that the operations and maintenance phase of the Mona Offshore Wind Project combined with the operations phase of the surrounding offshore wind farms in the Irish Sea could cumulatively cause an increase greater than a 1% increase in baseline mortality and further assessment (using PVA) was required.

5.9.2.62 If the upper ranges of displacement and mortality are used, the predicted increase in baseline mortality of the BDMPS populations for common guillemot would exceed a threshold increase of 1%. To understand the consequence of a 1% increase or above in baseline mortality, the impact on the demographic rates was assessed in Volume 6, Annex 5.6: Offshore ornithology PVA of the Environmental Statement.

~~5.9.2.62~~5.9.2.63 The PVA revealed that the ~~most extreme~~SNCB recommended upper scenario of 70% displacement and 10% mortality would ~~reduce~~result in the population being 20.6% smaller after 35 years (in 2065), than a non-impacted population. The counterfactual of growth rate ~~by~~would be 0.~~067~~994, but the population is still predicted to increase with a median growth rate of 1.091 (1.014 to 1.024, lower and upper confidence intervals). Under all of the nine modelled scenarios, which ~~would result in a maximum decrease in population size by 60.97%.~~present a range of potential impacts as suggested by the SNCBs, the population is predicted to continue to grow. The full PVA results are presented in Volume 6, Annex 5.6: Offshore Ornithology Population Viability Analysis Technical Report (Document reference F6.5.6). The more likely scenario of 50% displacement and 1% mortality resulted in a counterfactual growth rate ~~reduction~~ of ~~0.005~~1.000 resulting in a ~~5.37~~1.6% decrease in population size after 35 years.

~~5.9.2.63~~ Regardless of ~~whether the most likely~~ which of the nine modelled scenarios (up to 70% displacement and 10% mortality ~~scenario (50% and 1%) or the maximum scenario (70% and 30%) is utilised~~) is considered, the common guillemot population in the UK Western waters BDMPS is ~~observed~~predicted to ~~be growing~~grow. The population is still expected to continue to grow and will be larger after 35 years than that which is currently recorded, even in the event of the largest impact~~.~~

5.9.2.64 ~~The reduction in growth rate of between 0.005 and 0.067 (depending on the displacement and mortality rate used) would not trigger a risk of population decline and would only result in a slight reduction in the growth rate currently seen in the BDMPS population~~, which is not significant in EIA terms.

5.9.2.65 Due to the minimal level of change to baseline conditions, the cumulative effect is predicted to be of national spatial extent, long term duration, continuous and high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **low**.

Razorbill

5.9.2.66 The estimated cumulative abundance of razorbill from the relevant projects with available data is presented in Table 5.86. There are several projects for which there are no, or limited, data on the number of razorbill predicted to be displaced, for some of the earlier developments which are discussed in Table 5.92.

Table 5.86: Razorbill cumulative abundances for offshore wind projects for disturbance and displacement assessment during the operations and maintenance phase.

Project	Annual Abundance	Pre-breeding Abundance	Breeding Season Abundance	Post-breeding Abundance	Non-breeding Abundance
Tier 1					
Awel y Môr Offshore Wind Farm	692	336	140	66	150
Burbo Bank Offshore Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Burbo Bank Extension Offshore Wind Farm	~~2,354~~93	~~1,252~~Bioseason not presented in original application	~~534~~64	~~193~~Bioseason not presented in original application	~~375~~29
Erebus Floating Wind Demo	3,867	896	194	1,708	1,069
Gwynt y Môr Offshore Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
TwinHub (Wave Hub Floating Wind Farm)	~~46~~65	Unavailable~~16~~	~~6~~12	Unavailable~~1~~	~~23~~53
Ormonde Wind Farm	~~85~~174	Unavailable	~~85~~174	Unavailable	Unavailable
Robin Rigg Offshore Wind Farm	~~7~~63	Unavailable	~~7~~63	Unavailable	Unavailable

Project	Annual Abundance	Pre-breeding Abundance	Breeding Season Abundance	Post-breeding Abundance	Non-breeding Abundance
Rhyl Flats Offshore Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Walney 1 & 2 Offshore Wind Farms	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Walney (3 & 4) Extension Offshore Wind Farm	~~3,938~~4,016	0	~~0~~76	~~873~~874	3,~~065~~066
West of Duddon Sands Offshore Windfarm	~~455~~202	Unavailable~~91~~	Unavailable~~91~~	Unavailable~~121~~	~~152~~202
West of Orkney Windfarm	326	97	70	144	15
White Cross Offshore Windfarm	786	345	40	40	361
Tier 2					
Morecambe Offshore Windfarm Generation Assets	1,881	389	222	674	596
Morgan Offshore Wind Project Generation Assets	622	166	120	103	233
Total (minus the Mona Offshore Wind Project)	**12,787**	**2,229**	**1,175**	**3,609**	**5,774**
Mona Offshore Wind Project	2,519	1,924	83	91	421
Cumulative total (all projects)	**15,306**	**4,153**	**1,258**	**3,700**	**6,195**
Collision impacts					
Tier 1					
Holyhead Deep – Tidal Energy	1	Unavailable	Unavailable	Unavailable	Unavailable
West Anglesey Demonstration Zone tidal site	23.7	0	11.7	0	12
~~**Total (minus the Mona Offshore Wind Project)**~~	~~**15,059**~~	~~**3,588**~~	~~**1,509**~~	~~**3,923**~~	~~**6,039**~~
~~Mona Offshore Wind Project~~	~~2,519~~	~~1,924~~	~~83~~	~~91~~	~~421~~
~~**Cumulative total (all projects)**~~	~~**17,578**~~	~~**5,512**~~	~~**1,592**~~	~~**4,014**~~	~~**6,460**~~

5.9.2.67 The following displacement matrices provide the estimated cumulative mortality of razorbill predicted to occur due to displacement, as determined by the relevant specified rates of displacement and mortality (Table 5.87 to Table 5.91). The approach used for the cumulative displacement assessment follows that presented in Volume 6, Annex 5.2: Offshore ornithology displacement technical report of the Environmental Statement. (Document reference F6.5.2).

Table 5.87: Operations and maintenance phase cumulative razorbill mortality following displacement from offshore wind farms in the pre-breeding season.

Displacement level (% at risk of displacement)	Mortality level (% of displaced birds at risk of mortality)						
	1%	2%	5%	10%	25%	50%	100%
10%	~~6~~4	~~11~~8	~~28~~21	~~55~~42	~~138~~104	~~276~~208	~~551~~415
20%	~~11~~8	~~22~~17	~~55~~42	~~110~~83	~~276~~208	~~551~~415	~~1,102~~831
30%	~~17~~12	~~33~~25	~~83~~62	~~165~~125	~~413~~311	~~827~~623	1,~~654~~246
40%	~~22~~17	~~44~~33	~~110~~83	~~220~~166	~~551~~415	~~1,102~~831	~~2,205~~1,661
50%	~~28~~21	~~55~~42	~~138~~104	~~276~~208	~~689~~519	1,~~378~~038	2,~~756~~077
60%	~~33~~25	~~66~~50	~~165~~125	~~331~~249	~~827~~623	1,~~654~~246	~~3,307~~2,492
70%	~~39~~29	~~77~~58	~~193~~145	~~386~~291	~~965~~727	1,~~929~~454	~~3,858~~2,907
80%	~~44~~33	~~88~~66	~~220~~166	~~441~~332	~~1,102~~831	~~2,205~~1,661	~~4,410~~3,322
90%	~~50~~37	~~99~~75	~~248~~187	~~496~~374	~~1,240~~934	~~2,480~~1,869	~~4,961~~3,738
100%	~~55~~42	~~110~~83	~~276~~208	~~551~~415	1,~~378~~038	2,~~756~~077	~~5,512~~4,153

Table 5.88: Operations and maintenance phase cumulative razorbill mortality following displacement from offshore wind farms in the breeding season.

Displacement level (% at risk of displacement)	Mortality level (% of displaced birds at risk of mortality)						
	1%	2%	5%	10%	25%	50%	100%
10%	~~2~~1	3	~~8~~6	~~16~~13	~~40~~31	~~80~~63	~~159~~126
20%	3	~~6~~5	~~16~~13	~~32~~25	~~80~~63	~~159~~126	~~318~~252
30%	~~5~~4	~~10~~8	~~24~~19	~~48~~38	~~119~~94	~~239~~189	~~478~~377
40%	~~6~~5	~~13~~10	~~32~~25	~~64~~50	~~159~~126	~~318~~252	~~637~~503
50%	~~8~~6	~~16~~13	~~40~~31	~~80~~63	~~199~~157	~~398~~315	~~796~~629
60%	~~10~~8	~~19~~15	~~48~~38	~~96~~75	~~239~~189	~~478~~377	~~955~~755
70%	~~11~~9	~~22~~18	~~56~~44	~~111~~88	~~279~~220	~~557~~440	~~1,114~~881
80%	~~13~~10	~~25~~20	~~64~~50	~~127~~101	~~318~~252	~~637~~503	1,~~274~~006
90%	~~14~~11	~~29~~23	~~72~~57	~~143~~113	~~358~~283	~~716~~566	1,~~433~~132
100%	~~16~~13	~~32~~25	~~80~~63	~~159~~126	~~398~~315	~~796~~629	1,~~592~~258

Table 5.89: Operations and maintenance phase cumulative razorbill mortality following displacement from offshore wind farms in the post-breeding season.

Displacement level (% at risk of displacement)	Mortality level (% of displaced birds at risk of mortality)						
	1%	2%	5%	10%	25%	50%	100%
10%	4	~~8~~7	~~20~~19	~~40~~37	~~100~~93	~~201~~185	~~401~~370
20%	~~8~~7	~~16~~15	~~40~~37	~~80~~74	~~201~~185	~~401~~370	~~803~~740
30%	~~12~~11	~~24~~22	~~60~~56	~~120~~111	~~301~~278	~~602~~555	1,~~204~~110
40%	~~16~~15	~~32~~30	~~80~~74	~~161~~148	~~401~~370	~~803~~740	1,~~606~~480
50%	~~20~~19	~~40~~37	~~100~~93	~~201~~185	~~502~~463	~~1,004~~925	~~2,007~~1,850
60%	~~24~~22	~~48~~44	~~120~~111	~~241~~222	~~602~~555	1,~~204~~110	2,~~408~~220
70%	~~28~~26	~~56~~52	~~140~~130	~~281~~259	~~702~~648	1,~~405~~295	2,~~810~~590
80%	~~32~~30	~~64~~59	~~161~~148	~~321~~296	~~803~~740	1,~~606~~480	~~3,211~~2,960
90%	~~36~~33	~~72~~67	~~181~~167	~~361~~333	~~903~~833	1,~~806~~665	3,~~613~~330
100%	~~40~~37	~~80~~74	~~201~~185	~~401~~370	~~1,004~~925	~~2,007~~1,850	~~4,014~~3,700

Table 5.90: Operations and maintenance phase cumulative razorbill mortality following displacement from offshore wind farms in the non-breeding season.

Displacement level (% at risk of displacement)	Mortality level (% of displaced birds at risk of mortality)						
	1%	2%	5%	10%	25%	50%	100%
10%	6	~~13~~12	~~32~~31	~~65~~62	~~162~~155	~~323~~310	~~646~~620
20%	~~13~~12	~~26~~25	~~65~~62	~~129~~124	~~323~~310	~~646~~620	1,~~292~~239
30%	19	~~39~~37	~~97~~93	~~194~~186	~~485~~465	~~969~~929	1,~~938~~859
40%	~~26~~25	~~52~~50	~~129~~124	~~258~~248	~~646~~620	1,~~292~~239	2,~~584~~478
50%	~~32~~31	~~65~~62	~~162~~155	~~323~~310	~~808~~774	1,~~615~~549	3,~~230~~098
60%	~~39~~37	~~78~~74	~~194~~186	~~388~~372	~~969~~929	1,~~938~~859	3,~~876~~717
70%	~~45~~43	~~90~~87	~~226~~217	~~452~~434	1,~~131~~084	2,~~261~~168	4,~~522~~337
80%	~~52~~50	~~103~~99	~~258~~248	~~517~~496	1,~~292~~239	2,~~584~~478	~~5,168~~4,956
90%	~~58~~56	~~116~~112	~~291~~279	~~581~~558	1,~~454~~394	2,~~907~~788	5,~~814~~576
100%	~~65~~62	~~129~~124	~~323~~310	~~646~~620	1,~~615~~549	3,~~230~~098	6,~~460~~195

Table 5.91: Operations and maintenance phase cumulative razorbill mortality following displacement from offshore wind farms annually.

Displacement level (% at risk of displacement)	Mortality level (% of displaced birds at risk of mortality)						
	1%	2%	5%	10%	25%	50%	100%
10%	1815	3531	8877	176153	439383	879765	1,758531
20%	3531	7061	176153	352306	879765	1,758531	3,516061
30%	5346	10592	264230	527459	1,318148	2,637296	5,2734,592
40%	7061	141122	352306	703612	1,758531	3,516061	7,0316,122
50%	8877	176153	439383	879765	2,1971,913	4,3953,827	8,7897,653
60%	10592	211184	527459	1,055918	2,637296	5,2734,592	10,5479,184
70%	123107	246214	615536	1,230071	2,6793,076	6,1525,357	12,30510,714
80%	141122	281245	703612	1,406224	3,516061	7,0316,122	14,06212,245
90%	158138	316276	791689	1,582378	3,955444	7,9106,888	15,82013,775
100%	176153	352306	879765	1,758531	4,3953,827	8,7897,653	17,57815,306

Table 5.92: Qualitative assessment of projects considered cumulatively with the Mona Offshore Wind Project for which quantitative consideration of displacement impacts was not undertaken in project-specific documentation for razorbill.

Project	Reason for estimates being unavailable	Qualitative assessment	Final conclusion
Tier 1			
Burbo Bank Offshore Wind Farm (Seascape Energy Ltd., 2002)	Disturbance impacts considered qualitatively	Surveys of the project comprised aerial and boat-based surveys both of which were undertaken during winter months (aerial = November to April and boat-based = December and February). Aerial surveys covered a large area encompassing the Liverpool Bay SPA with boat-based surveys covering the project area. The surveys were undertaken to provide abundance and distribution data for those species considered to be of most importance, namely common scoter and red-throated diver. Razorbill was not identified during aerial surveys however, it is likely that any razorbill present were recorded as auk species with this group recorded in all months during which aerial surveys were undertaken. There is however, no information on the numbers recorded within the wind farm. During boat-based surveys, only three razorbill were seen.	Low levels of disturbance were predicted resulting in a conclusion of a negligible magnitude and a very low significance.
Gwynt y Môr Offshore Wind Farm (RWE Group and Npower Renewables, 2005)	Disturbance impacts considered qualitatively	Site-specific surveys undertaken in support of the project included boat-based surveys undertaken between February 2003 and March 2005. Surveys between February 2003 and February 2004 covered a large area along the Welsh coast incorporating the project area with surveys between March 2004 and March 2005 more focussed on the project area. The assessment also used data from aerial surveys undertaken between 2000 2005 which were targeted at recording common scoter. The number of razorbill recorded during surveys was lower than the number of guillemot recorded. The greatest numbers recorded during boat-based surveys was between October and March with only three observations in the wind farm area between June and September with all in September.	It was considered that displacement (termed avoidance of turbines in the assessments conducted) would result in an impact of low significance for auk species.

Project	Reason for estimates being unavailable	Qualitative assessment	Final conclusion
Ormonde Wind Farm (Ecology Consulting, 2005)	Disturbance impacts considered qualitatively	Site-specific surveys included boat-based surveys undertaken monthly between May 2004 and April 2005. In addition, three aerial surveys were conducted during the summer of 2004 with four further aerial surveys in the winter of 2004/5. The peak population of razorbill recorded in the wind farm plus a 2 km buffer during boat-based surveys was 85 birds. During aerial surveys the equivalent population was 0, although 1,086 auk species were recorded. Peak numbers occurred in autumn months (November). The species was considered to be regionally important in the context of the assessments conducted.	The magnitude of the effect for razorbill was considered to be low with a low significance.
Robin Rigg Offshore Wind Farm (Natural Power, 2002)	Disturbance impacts considered qualitatively	The project utilised site-specific boat-based surveys to characterise the baseline environment. Two surveys were completed in each month from May 2001 for one year. In addition, aerial surveys were undertaken from November 2001 on a monthly basis through winter and spring to verify the distribution and abundance of seaduck. The mean count of razorbill during boat-based surveys in the wind farm was 2.0 (and 0.4 for auk species) birds with a peak of 18 birds (three for auk species). Razorbill was considered to be of local importance based on the populations recorded in the wind farm. Aerial surveys undertaken in the non-breeding season recorded a maximum of two auks.	The magnitude of the effect was considered to be low with a low significance.
Rhyl Flats Offshore Wind Farm (Ecology Consulting, 2002)	Disturbance impacts considered qualitatively	Surveys of the project comprised aerial and boat-based surveys. Aerial surveys were undertaken between December 2001 and January 2002 and targeted common scoter, with non-target species not uniformly reported upon. Boat-based surveys were undertaken between January and March 2002 to record movements of common scoter and the flight height of birds. Few auks were recorded in the wind farm area. It was considered that the wind farm area represented an area of negligible importance for foraging for razorbill from the Puffin Island, Anglesey and moderate importance for razorbill from the Great Ormes Head SSSI.	Wind farm area not considered to be importance for seabirds and significant effects were considered unlikely.

Project	Reason for estimates being unavailable	Qualitative assessment	Final conclusion
Walney 1 & 2 Offshore Wind Farms (RPS, 2006)	Disturbance impacts considered qualitatively	Site-specific surveys included boat-based surveys undertaken across an area of 512 km^2 in the vicinity of the project between May 2004 and September 2005. The project also utilised survey data collected by regional aerial surveys, undertaken across their aerial survey area between 2002 and 2006 and radar survey data collected between 1st October and 29th October 2005. The peak population of razorbill recorded in the project area plus 2 km buffer during aerial surveys was two birds with a peak count of 391 auk species in the same area. In boat-based surveys the equivalent populations were 292 razorbill and 65 auk species.	It was considered that the wind farm area did not represent a favoured foraging habitat and the magnitude of any impact was considered to be low. The species was considered to be of medium sensitivity. The overall significance of impacts associated with the project was considered to be low.

5.9.2.68 During the spring migration (pre-breeding) season the displacement from operation when using the displacement of 50% (range of 30 to 70%) and a mortality rate of 1% (range of 1 to 10%), results in an additional loss of ~~28 (17~~21 (12 to ~~386~~291) individuals (Table 5.87). The regional seas UK Western Waters BDMPS population of razorbill in the spring migration period is estimated to be 606,914 individuals (Table 5.14). Assuming an average baseline mortality rate of 0.172 (Table 5.15), background mortality during spring migration is 104,389 individuals. The addition of ~~28 (17~~21 (12 to ~~386~~291) individual mortalities, due to cumulative displacement from the presence of infrastructure would increase the mortality relative to the baseline mortality by 0.~~026~~020% (0.~~016~~012 to 0.~~370~~278%). Zero mortalities were estimated for underwater collision.

5.9.2.69 During the breeding season, displacement from operation results in the loss of ~~eight (five~~six (four to ~~111~~88) individuals from the breeding population (Table 5.87). The regional seas UK Western Waters BDMPS population of razorbill within the breeding season is estimated to be 198,969 individuals (Table 5.14). Assuming an average baseline mortality rate of 0.172, background mortality in the breeding season is 34,223 individuals. The addition of ~~eight (five~~six (four to ~~111~~88) individual mortalities due to cumulative displacement from the presence of infrastructure, plus the additional 11.7 mortalities from collision with underwater turbines would increase the mortality relative to the baseline mortality by 0.~~057~~ 053% (0.~~048~~45% to 0.~~360%).~~292%) .

5.9.2.70 During the autumn migration season (post-breeding), displacement from operation results in a loss of ~~20 (~~19 (11 to ~~281~~259) individuals from the migratory population (Table 5.89). The regional seas UK Western Waters BDMPS population of razorbill during the autumn migration period is estimated to be 606,914 individuals (Table 5.14). Assuming an average baseline mortality rate of 0.172, background mortality during autumn migration is 104,389 individuals. The addition of ~~20 (~~19 (11 to ~~281~~259) individual mortalities due to cumulative displacement from the presence of infrastructure would increase the mortality relative to the baseline mortality by 0.~~019~~018 % (0.~~012~~011 to 0.~~269.%).~~428%). Zero mortalities were estimated for underwater collision.

5.9.2.71 During the non-breeding season (winter season), displacement from operation results in a loss of ~~32~~31 (19 to ~~452~~434) individuals from the non-breeding population (Table 5.90). The regional seas UK Western Waters BDMPS population of razorbill within the non-breeding season is estimated to be 341,422 individuals (Table 5.14). Assuming an average baseline mortality rate of 0.172, background mortality in the breeding season is 58,724 individuals. The addition of ~~32~~31 (19 to ~~452~~434) individual mortalities due to cumulative displacement from the presence of infrastructure, plus the additional 12 mortalities from collision with underwater turbines would increase the mortality relative to the baseline mortality by 0.~~075~~ 073% (0.~~053~~052 to 0.~~790~~759%).

5.9.2.72 The annual estimated mortality resulting from displacement during construction is ~~88 (53~~77 (46 to 1,~~230~~071 individuals) (Table 5.91). Using the largest BDMPS population of 606,914 individuals and, using the average baseline mortality rate of 0.172, the background predicted mortality would be 104,389. The addition of ~~88 (53~~77 (46 to 1,~~230~~071 individuals) mortalities, plus the additional 24.7 mortalities from collision with underwater turbines would increase the baseline mortality rate by 0.~~107~~097% (0.~~074~~068 to 1.~~202~~050%). The annual predicted mortality from the most extreme scenario cumulative assessment (70% displacement, 10% mortality) is marginally above the 1% threshold increase in baseline mortality.

5.9.2.73 However, recent evidence suggests that 70% displacement and 10% mortality is overly cautious and that razorbill continued to use the area around a windfarm (MacArthur Green, 2023). Taking a more realistic 50% displacement and considering a precautionary mortality rate of 5%, the increase in baseline mortality would be 0.~~444~~ 390%, which is below the 1% threshold for further investigation.

5.9.2.74 The cumulative effect is predicted to be of national spatial extent, long term duration, continuous and high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **low**.

Atlantic puffin

5.9.2.75 The estimated cumulative abundance of Atlantic puffin from the relevant projects is presented in Table 5.93. There are a number of projects for which there are no, or limited, data on the number of Atlantic puffin predicted to be displaced, in particular, for some of the earlier developments discussed in Table 5.97.

Table 5.93: Atlantic puffin cumulative abundances for offshore wind projects for disturbance and displacement assessment during the operations and maintenance phase.

Project	Annual Abundance	Breeding Season Abundance	Non-breeding Season Abundance
Tier 1			
Awel y Môr Offshore Wind Farm	8	8	0
Burbo Bank Offshore Wind Farm	0	Unavailable	Unavailable
Burbo Bank Extension Offshore Wind Farm	10	10	0
Erebus Floating Wind Demo	~~15~~1,576	~~15~~1,416	~~0~~160
Gwynt y Môr Offshore Wind Farm	0	Unavailable	Unavailable
TwinHub (Wave Hub Floating Wind Farm)	0	0	0
Ormonde Wind Farm	1	1	0
Robin Rigg Offshore Wind Farm	0	0	0
Rhyl Flats Offshore Wind Farm	0	Unavailable	Unavailable
Walney 1 & 2 Offshore Wind Farms	0	Unavailable	Unavailable
Walney (3 & 4) Extension Offshore Wind Farm	172	53	119
West of Duddon Sands Offshore Windfarm	96	61	35
West of Orkney Windfarm	6,449	5,272	1,177

Project	Annual Abundance	Breeding Season Abundance	Non-breeding Season Abundance
White Cross Offshore Wind Farm	80	49	31
Tier 2			
Morecambe Offshore Windfarm Generation Assets	67	57	10
Morgan Offshore Wind Project Generation Assets	18	18	0
Total (minus the Mona Offshore Wind Project)	**8,477**	**6,945**	**1,532**
Mona Offshore Wind Project	37	15	22
Cumulative total (all projects)	**8,514**	**6,960**	**1,554**
Collision impacts			
Tier 1			
Holyhead Deep – Tidal Energy	0	Unavailable	Unavailable
West Anglesey Demonstration Zone tidal site	~~1~~0.9	0.9	0
~~**Total (minus the Mona Offshore Wind Project)**~~	~~**6,916**~~	~~**5,544**~~	~~**1,372**~~
~~Mona Offshore Wind Project~~	~~15~~	~~15~~	~~0~~
~~**Cumulative total (all projects)**~~	~~**6,931**~~	~~**5,559**~~	~~**1,372**~~

~~5.9.2.76~~ The following displacement matrices provide the estimated cumulative mortality of Atlantic puffin predicted to occur due to displacement, as determined by the relevant specified rates of displacement and mortality (Table 5.94 to

~~5.9.2.77 Table 5.96). The approach used for the cumulative displacement assessment follows that of the project alone displacement assessment Volume 6, Annex 5.2: Offshore ornithology displacement technical report of the Environmental Statement.~~

5.9.2.76 Table 5.96). The approach used for the cumulative displacement assessment follows that of the project alone displacement assessment Volume 6, Annex 5.2: Offshore ornithology displacement technical report of the Environmental Statement (Document reference F6.5.2).

Table 5.94: Operations and maintenance phase cumulative Atlantic puffin mortality following displacement from offshore wind farms in the breeding season.

Displacement level (% at risk of displacement)	Mortality level (% of displaced birds at risk of mortality)						
	1%	2%	5%	10%	25%	50%	100%
10%	67	1114	2835	5670	139174	278348	556696
20%	1114	2228	5670	111139	278348	556696	1,112392
30%	1721	3342	83104	167209	417522	8341,044	1,6682,088
40%	2228	4456	111139	222278	556696	1,112392	2,224784
50%	2835	5670	139174	278348	695870	1,390740	2,7803,480
60%	3342	6784	167209	334418	8341,044	1,6682,088	3,3354,176
70%	3949	7897	195244	389487	9731,218	1,9462,436	3,8914,872
80%	4456	89111	222278	445557	1,112392	2,224784	4,4475,568
90%	5063	100125	250313	500626	1,251566	2,5023,132	5,0036,264
100%	5670	111139	278348	556696	1,390740	2,7803,480	5,5596,960

Table 5.95: Operations and maintenance phase cumulative Atlantic puffin mortality following displacement from offshore wind farms in the non-breeding season.

Displacement level (% at risk of displacement)	Mortality level (% of displaced birds at risk of mortality)						
	1%	2%	5%	10%	25%	50%	100%
10%	12	3	78	1416	3439	6978	137155
20%	3	56	1416	2731	6978	137155	274311
30%	45	89	2123	4147	103117	206233	412466
40%	56	1112	2731	5562	137155	274311	549622
50%	78	1416	3439	6978	172194	343389	686777
60%	89	1619	4147	8293	206233	412466	823932
70%	1011	1922	4854	96109	240272	480544	9601,088
80%	1112	2225	5562	110124	274311	549622	1,098243
90%	1214	2528	6270	123140	309350	617699	1,235399
100%	1416	2731	6978	137155	343389	686777	1,372554

Table 5.96: Operations and maintenance phase cumulative Atlantic puffin mortality following displacement from offshore wind farms annually.

Mortality level (% of displaced birds at risk of mortality)

Displacement level (% at risk of displacement)		1%	2%	5%	10%	25%	50%	100%
	10%	~~7~~9	~~14~~17	~~35~~43	~~69~~85	~~173~~213	~~347~~426	~~693~~851
	20%	~~14~~17	~~28~~34	~~69~~85	~~139~~170	~~347~~426	~~693~~851	1,~~386~~703
	30%	~~21~~26	~~42~~51	~~104~~128	~~208~~255	~~520~~639	1,~~040~~277	2,~~079~~554
	40%	~~28~~34	~~55~~68	~~139~~170	~~277~~341	~~693~~851	1,~~386~~703	~~2,772~~3,406
	50%	~~35~~43	~~69~~85	~~173~~213	~~347~~426	~~866~~1,064	~~1,733~~2,129	~~3,466~~4,257
	60%	~~42~~51	~~83~~102	~~208~~255	~~416~~511	1,~~040~~277	2,~~079~~554	~~4,159~~5,108
	70%	~~49~~60	~~97~~119	~~243~~298	~~485~~596	1,~~213~~490	2,~~426~~980	~~4,852~~5,960
	80%	~~55~~68	~~111~~136	~~277~~341	~~554~~681	1,~~386~~703	~~2,772~~3,406	~~5,545~~6,811
	90%	~~62~~77	~~125~~153	~~312~~383	~~624~~766	1,~~559~~916	3,~~119~~831	~~6,238~~7,663
	100%	~~69~~85	~~139~~170	~~347~~426	~~693~~851	~~1,733~~2,129	~~3,466~~4,257	~~6,931~~8,514

Table 5.97: Qualitative assessment of projects considered cumulatively with the Mona Offshore Wind Project for which quantitative consideration of displacement impacts was not undertaken in project-specific documentation for Atlantic puffin.

Project	Reason for estimates being unavailable	Qualitative assessment	Final conclusion
Tier 1			
Burbo Bank Offshore Wind Farm (Seascape Energy Ltd., 2002)	Disturbance impacts considered qualitatively	Surveys of the project comprised aerial and boat-based surveys both of which were undertaken during winter months (aerial = November to April and boat-based = December and February). Aerial surveys covered a large area encompassing the Liverpool Bay SPA with boat-based surveys covering the project area. The surveys were undertaken to provide abundance and distribution data for those species considered to be of most importance, namely common scoter and red-throated diver. Atlantic puffin was not identified during aerial surveys.	No impact and no significance.
Gwynt y Môr Offshore Wind Farm (RWE Group and Npower Renewables, 2005)	Disturbance impacts considered qualitatively	Site-specific surveys undertaken in support of the project included boat-based surveys undertaken between February 2003 and March 2005. Surveys between February 2003 and February 2004 covered a large area along the Welsh coast incorporating the project area with surveys between March2004 and March 2005 more focussed on the project area. The assessment also used data from aerial surveys undertaken between 2000 2005 which were targeted at recording common scoter. Atlantic puffin was not identified during aerial surveys.	No impact and no significance.
Robin Rigg Offshore Wind Farm (Natural Power, 2002)	Disturbance impacts considered qualitatively	The project utilised site-specific boat-based surveys to characterise the baseline environment. Two surveys were completed in each month from May 2001 for one year. In addition, aerial surveys were undertaken from November 2001 on a monthly basis through winter and spring to verify the distribution and abundance of seaduck. The mean count of puffin during boat-based surveys in the wind farm zero (and 0.4 for auk species) birds with a peak of 10 birds observed across the full study site. Aerial surveys undertaken in the non-breeding season recorded no puffins	The magnitude of the effect was considered to be negligible with a negligible significance.

Project	Reason for estimates being unavailable	Qualitative assessment	Final conclusion
Rhyl Flats Offshore Wind Farm (Ecology Consulting, 2002)	Disturbance impacts considered qualitatively	Surveys of the project comprised aerial and boat-based surveys. Aerial surveys were undertaken between December 2001 and January 2002 and targeted common scoter, with non-target species not uniformly reported upon. Boat-based surveys were undertaken between January and March 2002 to record movements of common scoter and the flight height of birds. Atlantic puffin was not identified during surveys.	No impact and no significance.
Walney 1 & 2 Offshore Wind Farms (RPS, 2006)	Disturbance impacts considered qualitatively	Site-specific surveys included boat-based surveys undertaken across an area of 512 km^2 in the vicinity of the project between May 2004 and September 2005. The project also utilised survey data collected by regional aerial surveys, undertaken across their aerial survey area between 2002 and 2006 and radar survey data collected between 1st October and 29th October 2005. The population of puffin recorded in the project area plus 2 km buffer during aerial surveys was 11 birds	It was considered that the wind farm area did not represent a favoured foraging habitat and the magnitude of any impact was considered to be negligible.

~~5.9.2.78~~5.9.2.77 During the breeding season, the displacement from operation when using the displacement rate of 50% (range of 30 to 70%) and a mortality rate of 1% (range of 1 to 10%), results in an additional loss of ~~28 (17~~35 (21 to ~~389~~487) individuals from the breeding population (Table 5.94). The regional seas UK Western Waters BDMPS population of Atlantic puffin within the breeding season is estimated to be 1,482,791 individuals (Table 5.14). Assuming an average baseline mortality rate of 0.176 (Table 5.15), background mortality in the breeding season is 260,971 individuals. The addition of ~~28 (17~~35 (21 to ~~389~~487) individual mortalities due to cumulative displacement from the presence of infrastructure, plus the additional 0.9 mortalities from underwater collision would increase the mortality relative to the baseline mortality by 0.~~011~~014 % (0.~~007~~008 to 0.~~149~~187%).

~~5.9.2.79~~5.9.2.78 During the non-breeding season, the displacement from operation results in an additional loss of ~~seven (four~~eight (five to ~~96~~109) individual from the non-breeding population (Table 5.95). The regional seas UK Western Waters BDMPS population of common guillemots within the non-breeding season is estimated to be 304,557 individuals (Table 5.14). Assuming an average baseline mortality rate of 0.176, background mortality in the non-breeding season is 53,602 individuals. The addition of ~~seven (four~~eight (five to ~~96~~109) individual mortalities due to cumulative displacement from the presence of infrastructure would increase the mortality relative to the baseline mortality by 0.~~013~~014% (0.~~008~~009 to 0.~~179~~203%). Zero mortalities were estimated for underwater collision.

~~5.9.2.80~~5.9.2.79 The annual estimated mortality resulting from displacement during operation is ~~35 (21~~43 (26 to ~~485~~596) individuals (Table 5.96). Using the largest UK Western Waters BDMPS population of 1,482,791 Atlantic puffin and, using the average baseline mortality rate of 0.176, the background predicted mortality would be 260,971 individuals. The addition of ~~35 (21~~43 (26 to ~~485~~596) mortalities, plus the additional ~~1 mortality~~0.9 mortalities from underwater collision would increase the baseline mortality rate by 0.~~014~~017% (0.~~008~~010% to 0.~~186~~229%). The annual predicted mortality from the cumulative assessment is below the 1% threshold increase in baseline mortality.

~~5.9.2.81~~5.9.2.80 The cumulative effect is predicted to be of national spatial extent, long term duration, continuous and high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **negligible**.

Northern gannet

~~5.9.2.82~~5.9.2.81 The estimated cumulative abundance of northern gannet from the relevant projects is presented in Table 5.98. There are a number of projects for which there are no, or limited, data on the number of northern gannet predicted to be displaced, in particular, for some of the earlier developments which are discussed in.

Table 5.98: Northern gannet cumulative abundances for offshore wind projects for disturbance and displacement assessment during the operations and maintenance phase.

Project	Annual Abundance	Pre-breeding Season	Breeding Season Abundance	Post-breeding Season Abundance
Tier 1				
Awel y Môr Offshore Wind Farm	529	0	328	201

Project	Annual Abundance	Pre-breeding Season	Breeding Season Abundance	Post-breeding Season Abundance
Burbo Bank Offshore Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable
Burbo Bank Extension Offshore Wind Farm	695~~Unavailable~~	25~~Unavailable~~	~~429~~648	22~~Unavailable~~
Erebus Floating Wind Demo	~~558~~658	~~0~~100	224	334
Gwynt y Môr Offshore Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable
TwinHub (Wave Hub Floating Wind Farm)	~~283~~397	Unavailable~~56~~	~~169~~244	~~58~~153
Ormonde Wind Farm	199~~Unavailable~~	Unavailable	199 ~~Unavailable~~	Unavailable
Robin Rigg Offshore Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable
Rhyl Flats Offshore Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable
Walney 1 & 2 Offshore Wind Farms	Unavailable	Unavailable	Unavailable	Unavailable
Walney (3 & 4) Extension Offshore Wind Farm	~~973~~433	~~509~~24	~~172~~150	~~292~~259
West of Duddon Sands Offshore Wind Farm	431~~Unavailable~~	Unavailable	431~~Unavailable~~	Unavailable
West of Orkney Windfarm	2,188	59	958	1,171
White Cross Offshore Windfarm	456	141	239	76
Tier 2				
Morecambe Offshore Windfarm Generation Assets	912	0	748	164
Morgan Offshore Wind Project Generation Assets	454	53	209	192
Total (minus the Mona Offshore Wind Project)	**7,352**	**402**	**4,378**	**2,572**
Mona Offshore Wind Project	337	28	251	58
Cumulative total (all projects)	**7,689**	**430**	**4,629**	**2,630**
Collision impacts				

Project	Annual Abundance	Pre-breeding Season	Breeding Season Abundance	Post-breeding Season Abundance
Tier 1				
Holyhead Deep – Tidal Energy	8	Unavailable	Unavailable	Unavailable
West Anglesey Demonstration Zone tidal site	46.1	grouped into breeding	38	8.1
~~**Total (minus the Mona Offshore Wind Project)**~~	~~**6,353**~~	~~**818**~~	~~**3,476**~~	~~**2,488**~~
~~Mona Offshore Wind Project~~	~~337~~	~~28~~	~~251~~	~~58~~
~~**Cumulative total (all projects)**~~	~~**6,690**~~	~~**846**~~	~~**3,727**~~	~~**2,546**~~

~~5.9.2.83~~5.9.2.82 The following displacement matrices provide the estimated cumulative mortality of northern gannet predicted to occur due to displacement, as determined by the relevant specified rates of displacement and mortality (Table 5.99 to Table 5.102). The approach used for the cumulative displacement assessment follows that of the project alone displacement assessment Volume 6, Annex 5.2: Offshore ornithology displacement technical report of the Environmental Statement~~.~~ (Document reference F6.5.2).

Table 5.99: Operations and maintenance phase cumulative northern gannet mortality following displacement from offshore wind farms in the pre-breeding season.

Displacement level (% at risk of displacement)	Mortality level (% of displaced birds at risk of mortality)						
	1%	**2%**	**5%**	**10%**	**25%**	**50%**	**100%**
10%	~~1~~0	~~2~~1	~~4~~2	~~8~~4	~~21~~11	~~42~~22	~~85~~43
20%	~~2~~1	~~3~~2	~~8~~4	~~17~~9	~~42~~22	~~85~~43	~~169~~86
30%	~~3~~1	~~5~~3	~~13~~6	~~25~~13	~~63~~32	~~127~~65	~~254~~129
40%	~~3~~2	~~7~~3	~~17~~9	~~34~~17	~~85~~43	~~169~~86	~~338~~172
50%	~~4~~2	~~8~~4	~~21~~11	~~42~~22	~~106~~54	~~212~~108	~~423~~215
60%	~~5~~3	~~10~~5	~~25~~13	~~51~~26	~~127~~65	~~254~~129	~~508~~258
70%	~~6~~3	~~12~~6	~~30~~15	~~59~~30	~~148~~75	~~296~~151	~~592~~301
80%	~~7~~3	~~14~~7	~~34~~17	~~68~~34	~~169~~86	~~338~~172	~~677~~344
90%	~~8~~4	~~15~~8	~~38~~19	~~76~~39	~~190~~97	~~381~~194	~~761~~387
100%	~~8~~4	~~17~~9	~~42~~22	~~85~~43	~~212~~108	~~423~~215	~~846~~430

Table 5.100: Operations and maintenance phase cumulative northern gannet mortality following displacement from offshore wind farms in the breeding season.

Displacement level (% at risk of displacement)	Mortality level (% of displaced birds at risk of mortality)						
	1%	2%	5%	10%	25%	50%	100%
10%	~~4~~5	~~7~~9	~~19~~23	~~37~~46	~~93~~116	~~186~~231	~~373~~463
20%	~~7~~9	~~15~~19	~~37~~46	~~75~~93	~~186~~231	~~373~~463	~~745~~926
30%	~~11~~14	~~22~~28	~~56~~69	~~112~~139	~~280~~347	~~559~~694	1,~~118~~389
40%	~~15~~19	~~30~~37	~~75~~93	~~149~~185	~~373~~463	~~745~~926	1,~~491~~852
50%	~~19~~23	~~37~~46	~~93~~116	~~186~~231	~~466~~579	~~932~~1,157	~~1,864~~2,315
60%	~~22~~28	~~45~~56	~~112~~139	~~224~~278	~~559~~694	1,~~118~~389	2,~~236~~777
70%	~~26~~32	~~52~~65	~~130~~162	~~261~~324	~~652~~810	1,~~304~~620	~~2,609~~3,240
80%	~~30~~37	~~60~~74	~~149~~185	~~298~~370	~~745~~926	1,~~491~~852	~~2,982~~3,703
90%	~~34~~42	~~67~~83	~~168~~208	~~335~~417	~~839~~1,042	~~1,677~~2,083	~~3,354~~4,166
100%	~~37~~46	~~75~~93	~~186~~231	~~373~~463	~~932~~1,157	~~1,864~~2,315	~~3,727~~4,629

Table 5.101: Operations and maintenance phase cumulative norther gannet mortality following displacement from offshore wind farms in the post- breeding season.

Displacement level (% at risk of displacement)	Mortality level (% of displaced birds at risk of mortality)						
	1%	2%	5%	10%	25%	50%	100%
10%	3	5	13	~~25~~26	~~64~~66	~~127~~132	~~255~~263
20%	5	~~10~~11	~~25~~26	~~51~~53	~~127~~132	~~255~~263	~~509~~526
30%	8	~~15~~16	~~38~~39	~~76~~79	~~191~~197	~~382~~395	~~764~~789
40%	~~10~~11	~~20~~21	~~51~~53	~~102~~105	~~255~~263	~~509~~526	1,~~018~~052
50%	13	~~25~~26	~~64~~66	~~127~~132	~~318~~329	~~637~~658	1,~~273~~315
60%	~~15~~16	~~31~~32	~~76~~79	~~153~~158	~~382~~395	~~764~~789	1,~~528~~578
70%	18	~~36~~37	~~89~~92	~~178~~184	~~446~~460	~~891~~921	1,~~782~~841
80%	~~20~~21	~~41~~42	~~102~~105	~~204~~210	~~509~~526	1,~~018~~052	2,~~037~~104
90%	~~23~~24	~~46~~47	~~115~~118	~~229~~237	~~573~~592	1,~~146~~184	2,~~291~~367
100%	~~25~~26	~~51~~53	~~127~~132	~~255~~263	~~637~~658	1,~~273~~315	2,~~546~~630

Table 5.102: Operations and maintenance phase cumulative northern gannet mortality following displacement from offshore wind farms annually.

Displacement level (% at risk of displacement)	Mortality level (% of displaced birds at risk of mortality)						
	1%	2%	5%	10%	25%	50%	100%
10%	78	1315	3338	6777	167192	335384	669769
20%	1315	2731	6777	134154	335384	669769	1,338538
30%	2023	4046	100115	201231	502577	1,004153	2,007307
40%	2731	5462	134154	268308	669769	1,338538	2,6763,076
50%	3338	6777	167192	335384	836961	1,673922	3,345845
60%	4046	8092	201231	401461	1,004153	2,007307	4,014613
70%	4754	94108	234269	468538	1,171346	2,342691	4,6835,382
80%	5462	107123	268308	535615	1,338538	3,0762,676	5,3526,151
90%	6069	120138	301346	602692	1,505730	3,011460	6,021920
100%	6777	134154	335384	669769	1,673922	3,345845	6,6907,689

Table 5.103: Qualitative assessment of projects considered cumulatively with the Mona Offshore Wind Project for which quantitative consideration of displacement impacts was not undertaken in project-specific documentation for northern gannet.

Project	Reason for estimates being unavailable	Qualitative assessment	Final conclusion
Tier 1			
Burbo Bank Offshore Wind Farm (Seascape Energy Ltd., 2002)	Disturbance impacts considered qualitatively	Surveys of the project comprised aerial and boat-based surveys both of which were undertaken during winter months (aerial = November to April and boat-based = December and February). Aerial surveys covered a large area encompassing the Liverpool Bay SPA with boat-based surveys covering the project area. The surveys were undertaken to provide abundance and distribution data for those species considered to be of most importance, namely common scoter and red-throated diver. Gannet was not recorded during boat-based surveys with relatively low numbers recorded during aerial surveys.	Gannet was not considered to be a species of International or National importance in the context of the assessments undertaken. Although gannet was not specifically assessed due to the species being considered of limited importance, low levels of disturbance were predicted for other species with conclusions of a negligible magnitude and very low significance reached.
Gwynt y Môr Offshore Wind Farm (RWE Group and Npower Renewables, 2005)	Disturbance impacts considered qualitatively	Site-specific surveys undertaken in support of the project included boat-based surveys undertaken between February 2003 and March 2005. Surveys between February 2003 and February 2004 covered a large area along the Welsh coast incorporating the project area with surveys between March 2004 and March 2005 more focussed on the project area. The assessment also used data from aerial surveys undertaken between 2000 2005 which were targeted at recording common scoter. Very few gannet were recorded during boat-based surveys between October and March. More birds were present in summer months with a large proportion on the sea surface.	It was considered that displacement (termed avoidance of turbines in the assessments conducted) would result in an impact of low significance for gannet due to the very extensive areas across which the species forages and the limited importance of the project area for the species.

Project	Reason for estimates being unavailable	Qualitative assessment	Final conclusion
Ormonde Wind Farm (Ecology Consulting, 2005)	Disturbance impacts considered qualitatively	Site-specific surveys included boat-based surveys undertaken monthly between May 2004 and April 2005. In addition, three aerial surveys were conducted during the summer of 2004 with four further aerial surveys in the winter of 2004/5. The peak population of gannet recorded in the wind farm plus a 2 km buffer during boat-based surveys was 199 birds. During aerial surveys the equivalent population was 15 birds. The species was primarily recorded in summer months especially May and September. The species was considered to be regionally important in the context of the assessments conducted.	The magnitude of the effect for gannet was considered to be low with a low significance.
Robin Rigg Offshore Wind Farm (Natural Power, 2002)	Disturbance impacts considered qualitatively	The project utilised site-specific boat-based surveys to characterise the baseline environment. Two surveys were completed in each month from May 2001 for one year. In addition, aerial surveys were undertaken from November 2001 on a monthly basis through winter and spring to verify the distribution and abundance of seaduck. The mean count of gannet during boat-based surveys in the wind farm was 0.4 birds with a peak of 4 birds. Gannet was considered to be of local importance based on the populations recorded in the wind farm.	The magnitude of the effect was considered to be negligible with a very low significance.
Rhyl Flats Offshore Wind Farm (Ecology Consulting, 2002)	Disturbance impacts considered qualitatively	Surveys of the project comprised aerial and boat-based surveys. Aerial surveys were undertaken between November 2001 and January 2002 and targeted common scoter, with non-target species not uniformly reported upon. Boat-based surveys were undertaken between January and March 2002 to record movements of common scoter and the flight height of birds. Gannet were only recorded in one of the aerial surveys with 52 birds recorded in November 2001.	Wind farm area not considered to be importance for seabirds and significant effects were considered unlikely

Project	Reason for estimates being unavailable	Qualitative assessment	Final conclusion
Walney 1 & 2 Offshore Wind Farms (RPS, 2006)	Disturbance impacts considered qualitatively	Site-specific surveys included boat-based surveys undertaken across an area of 512 km^2 in the vicinity of the project between May 2004 and September 2005. The project also utilised survey data collected by regional aerial surveys, undertaken across their aerial survey area between 2002 and 2006 and radar survey data collected between 1st October and 29th October 2005. The peak population of gannet recorded in the project area plus 2 km buffer during aerial surveys was 52 birds. In boat-based surveys the equivalent population was 332 birds. The proportion of flying gannets recorded above 15 m was 21.5 % across all boat-based surveys within the boat-based survey area. Gannet was deemed to be a species of medium importance due to SPA connectivity (termed sensitivity in the Walney 1&2 assessments).	It was considered that the wind farm area did not represent a favoured foraging habitat and the magnitude of any impact was considered to be low. The species was considered to be of medium sensitivity. The overall significance of impacts associated with the project was considered to be low.
West of Duddon Sands Offshore Wind Farm (RPS, 2006)	Disturbance impacts considered qualitatively	Site-specific surveys included boat-based surveys undertaken across an area of 512 km^2 in the vicinity of the project between May 2004 and September 2005. The project also utilised survey data collected by regional aerial surveys, undertaken across their aerial survey area between 2002 and 2006 and radar survey data collected between 1st October and 29th October 2005. The peak population of gannet recorded in the project area plus 2 km buffer during aerial surveys was 57 birds. In boat-based surveys the equivalent population was 431 birds. Gannet was deemed to be a species of medium importance due to SPA connectivity (termed sensitivity in the West of Duddon Sands assessments).	The magnitude of impacts was considered to be low. Gannet was considered to be of medium importance (termed sensitivity in the assessments for the project). The significance of all impacts was considered to be low.

~~5.9.2.84~~5.9.2.83 During the spring migration (pre-breeding) season the displacement from operation when using the displacement rate of 70% (range of 60 to 80%) and a mortality rate of 1% (range of 1 to 10%), results in an additional loss of ~~six (five~~three (three to ~~68~~34) individuals (Table 5.99). The regional seas UK Western Waters BDMPS population of northern gannet in the spring migration period is estimated to be 661,888 individuals (Table 5.14). Assuming an average baseline mortality rate of 0.193 (Table 5.15), background mortality during spring migration is 127,744 individuals. The addition of ~~six (five~~three (three to ~~68~~34) individual mortalities due to cumulative displacement from the presence of infrastructure would increase the mortality relative to the baseline mortality by 0.~~005~~002% (0.~~004~~002 to 0.~~053~~027%). Zero mortalities were estimated from underwater collision.

~~5.9.2.85~~5.9.2.84 During the breeding season, displacement from operation results in the loss of ~~26 (22~~ 32 (28 to ~~298~~370) individuals from the breeding population ~~(Table 5.100).~~(Table 5.100). The regional seas UK Western Waters BDMPS population of northern gannet within the breeding season is estimated to be 522,888 individuals (Table 5.14). Assuming an average baseline mortality rate of 0.193, background mortality in the breeding season is 100,917 individuals. The addition of ~~10 26 (22~~ 32 (28 to ~~298~~370) individual mortalities due to cumulative displacement from the presence of infrastructure, plus the additional 38 mortalities from underwater collision would increase the mortality relative to the baseline mortality by 0.~~056~~ 032% (0.~~049~~028 to 0.~~296%).~~367%) .

~~5.9.2.86~~5.9.2.85 During the autumn migration season (post-breeding), displacement from operation results in a loss of 18 (~~18~~16 to ~~204~~210) individuals from the migratory population (Table 5.101). The regional seas UK Western Waters BDMPS population of northern gannet during the autumn migration period is estimated to be 545,954 individuals (Table 5.14). Assuming an average baseline mortality rate of 0.193, background mortality during autumn migration is 105,369 individuals. The addition of ~~eight (~~18 (16 to ~~204~~210) individual mortalities due to cumulative displacement from the presence of infrastructure, plus the additional 8.1 mortalities from underwater collision would increase the mortality relative to the baseline mortality by 0.~~020~~025 % (0.~~015~~023 to 0.~~177~~207%).

~~5.9.2.87~~5.9.2.86 The annual estimated mortality resulting from displacement during construction is ~~47 (40~~54 (46 to ~~535~~615) individuals (Table 5.102). Using the largest UK Western Waters BDMPS population of 661,888 individuals, with an average baseline mortality rate of 0.193, the background predicted mortality would be 127,744. The addition of ~~47 (40~~54 (46 to ~~535~~615) mortalities, plus the additional 54.1 mortalities from underwater collision would increase the baseline mortality rate by 0.~~068~~084% (0.~~058~~078% to 0.~~409~~524%). The annual predicted mortality from the cumulative assessment is below the 1% threshold increase in baseline mortality.

~~5.9.2.88~~5.9.2.87 The cumulative effect is predicted to be of national spatial extent, long term duration, continuous and high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **negligible**.

Black-legged kittiwake

~~5.9.2.89~~5.9.2.88 The estimated cumulative abundance of black-legged kittiwake from the relevant projects is presented in Table 5.104. There are several projects for which there are no, or limited, data on the number of black-legged kittiwake predicted to be displaced, in particular, for some of the earlier developments which are discussed in Table.

Table 5.104: Black-legged kittiwake cumulative abundances for offshore wind projects for disturbance and displacement assessment during the operations and maintenance phase.

Project	Annual Abundance	Pre-breeding Abundance	Breeding Season Abundance	Post-breeding Abundance
Tier 1				
Awel y Môr Offshore Wind Farm	467	298	87	82
Burbo Bank Offshore Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable
Burbo Bank Extension Offshore Wind Farm	707	Unavailable	707~~Unavailable~~	Unavailable
Erebus Floating Wind Demo	2,532	2	2,022	508
Gwynt y Môr Offshore Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable
TwinHub (Wave Hub Floating Wind Farm)	249	56	4	189
Ormonde Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable
Rampion Offshore Wind Farm	2,112	831	1,059	222
Robin Rigg Offshore Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable
Rhyl Flats Offshore Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable
Walney 1 & 2 Offshore Wind Farms	Unavailable	Unavailable	Unavailable	Unavailable
Walney (3 & 4) Extension Offshore Wind Farm	2,900	1,467	319	1,114
West of Duddon Sands Offshore Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable
West of Orkney Windfarm	2,706	1,217	690	799
White Cross Offshore Windfarm	914	698	44	172
Tier 2				
Morecambe Offshore Windfarm Generation Assets	9,106	1,161	3,899	4,046

Project	Annual Abundance	Pre-breeding Abundance	Breeding Season Abundance	Post-breeding Abundance
Morgan Offshore Wind Project Generation Assets	2,724	645	460	1,619
Rampion 2 (Rampion Extension) Offshore Wind Farm	388	286	5	97
Total (minus the **Mona** Offshore Wind Project**)**	**24,805**	**6,661**	**8,5899,296**	**8,848**
Mona Offshore Wind Project	1,799860	884574	355726	560
Cumulative total (all projects)	**26,604665**	**7,545235**	**8,94410,022**	**9,408**

5.9.2.90 The following displacement matrices provide the estimated cumulative mortality of black-legged kittiwake predicted to occur due to displacement, as determined by the relevant specified rates of displacement and mortality (

5.9.2.915.9.2.89 Table 5.105Table 5.105 to Table 5.108). The approach used for the cumulative displacement assessment follows that presented in Volume 6, Annex 5.2: Offshore ornithology displacement technical report of the Environmental Statement. (Document reference F6.5.2).

Table 5.105: Operations and maintenance phase cumulative black-legged kittiwake mortality following displacement from offshore wind farms in the pre-breeding season.

Displacement level (% at risk of displacement)	Mortality level (% of displaced birds at risk of mortality)							
		1%	2%	5%	10%	25%	50%	100%
	10%	87	1514	3836	7572	189181	377362	755724
	20%	1514	3029	7572	151145	377362	755724	1,509447
	30%	2322	4543	113109	226217	566543	1,132085	2,264171
	40%	3029	6058	151145	302289	755724	1,509447	3,0182,894
	50%	3836	7572	189181	377362	943904	1,886809	3,773618
	60%	4543	9187	226217	453434	1,132085	2,264171	4,527341
	70%	5351	106101	264253	528506	1,320266	2,641532	5,282065
	80%	6058	121116	302289	604579	1,509447	3,0182,894	6,0365,788
	90%	6865	136130	340326	679651	1,698628	3,395256	6,791512
	100%	7572	151145	377362	755724	1,886809	3,773618	7,545235

Table 5.106: Operations and maintenance phase cumulative black-legged kittiwake mortality following displacement from offshore wind farms in the breeding season.

Displacement level (% at risk of displacement)	Mortality level (% of displaced birds at risk of mortality)						
	1%	2%	5%	10%	25%	50%	100%
10%	~~9~~10	~~18~~20	~~45~~50	~~89~~100	~~224~~251	~~447~~501	~~894~~1,002
20%	~~18~~20	~~36~~40	~~89~~100	~~179~~200	~~447~~501	~~894~~1,002	~~1,789~~2,004
30%	~~27~~30	~~54~~60	~~134~~150	~~268~~301	~~671~~752	1,~~342~~503	~~2,683~~3,007
40%	~~36~~40	~~72~~80	~~179~~200	~~358~~401	~~894~~1,002	~~1,789~~2,004	~~3,578~~4,009
50%	~~45~~50	~~89~~100	~~224~~251	~~447~~501	1,~~118~~253	2,~~236~~506	~~4,472~~5,011
60%	~~54~~60	~~107~~120	~~268~~301	~~537~~601	1,~~342~~503	~~2,683~~3,007	~~5,366~~6,013
70%	~~63~~70	~~125~~140	~~313~~351	~~626~~702	1,~~565~~754	3,~~130~~508	~~6,261~~7,015
80%	~~72~~80	~~143~~160	~~358~~401	~~716~~802	~~1,789~~2,004	~~3,578~~4,009	~~7,155~~8,018
90%	~~80~~90	~~161~~180	~~402~~451	~~805~~902	2,~~012~~255	4,~~025~~510	~~8,050~~9,020
100%	~~89~~100	~~179~~200	~~447~~501	~~894~~1,002	2,~~236~~506	~~4,472~~5,011	~~8,944~~10,022

Table 5.107: Operations and maintenance phase cumulative black-legged kittiwake mortality following displacement from offshore wind farms in the post-breeding season.

Displacement level (% at risk of displacement)	Mortality level (% of displaced birds at risk of mortality)						
	1%	2%	5%	10%	25%	50%	100%
10%	9	19	47	94	235	470	941
20%	19	38	94	188	470	941	1,882
30%	28	56	141	282	706	1,411	2,822
40%	38	75	188	376	941	1,882	3,763
50%	47	94	235	470	1,176	2,352	4,704
60%	56	113	282	564	1,411	2,822	5,645
70%	66	132	329	659	1,646	3,293	6,586
80%	75	151	376	753	1,882	3,763	7,526
90%	85	169	423	847	2,117	4,234	8,467
100%	94	188	470	941	2,352	4,704	9,408

Table 5.108: Operations and maintenance phase cumulative black-legged kittiwake mortality following displacement from offshore wind farms annually.

Displacement level (% at risk of displacement)	Mortality level (% of displaced birds at risk of mortality)						
	1%	2%	5%	10%	25%	50%	100%
10%	27	53	133	~~266~~267	~~665~~667	1,~~330~~333	2,~~660~~667
20%	53	~~106~~107	~~266~~267	~~532~~533	1,~~330~~333	2,~~660~~667	5,~~321~~333
30%	80	160	~~399~~400	~~798~~800	~~1,995~~2,000	~~3,991~~4,000	~~7,981~~8,000
40%	~~106~~107	213	~~532~~533	1,~~064~~067	2,~~660~~667	5,~~321~~333	10,~~642~~666
50%	133	~~266~~267	~~665~~667	1,~~330~~333	3,~~326~~333	6,~~651~~666	13,~~302~~333
60%	160	~~319~~320	~~798~~800	1,~~596~~600	~~3,991~~4,000	~~7,981~~8,000	15,~~962~~999
70%	~~186~~187	~~372~~373	~~931~~933	1,~~862~~867	4,~~656~~666	9,~~311~~333	18,~~623~~666
80%	213	~~426~~427	1,~~064~~067	2,~~128~~133	5,~~321~~333	10,~~642~~666	21,~~283~~332
90%	~~239~~240	~~479~~480	1,~~197~~200	2,~~394~~400	~~5,986~~6,000	11,~~972~~999	23,~~944~~999
100%	~~266~~267	~~532~~533	1,~~330~~333	2,~~660~~667	6,~~651~~666	13,~~302~~333	26,~~604~~665

Table 5.109: Qualitative assessment of projects considered cumulatively with the Mona Offshore Wind Project for which quantitative consideration of displacement impacts was not undertaken in project-specific documentation for black-legged kittiwake.

Project	Reason for estimates being unavailable	Qualitative assessment	Final conclusion
Tier 1			
Burbo Bank Offshore Wind Farm (Seascape Energy Ltd., 2002)	Disturbance impacts considered qualitatively	Surveys of the project comprised aerial and boat-based surveys both of which were undertaken during winter months (aerial = November to April and boat-based = December and February). Aerial surveys covered a large area encompassing the Liverpool Bay SPA with boat-based surveys covering the project area. The surveys were undertaken to provide abundance and distribution data for those species considered to be of most importance, namely common scoter and red-throated diver. Low numbers of kittiwake were recorded during boat-based surveys with relatively low numbers also recorded during aerial surveys.	Kittiwake was not considered to be a species of International or National importance in the context of the assessments undertaken. Although kittiwake was not specifically assessed due to the species being considered of limited importance, low levels of disturbance were predicted for other species with conclusions of a negligible magnitude and very low significance reached.
Gwynt y Môr Offshore Wind Farm (RWE Group and Npower Renewables, 2005)	Disturbance impacts considered qualitatively	Site-specific surveys undertaken in support of the project included boat-based surveys undertaken between February 2003 and March 2005. Surveys between February 2003 and February 2004 covered a large area along the Welsh coast incorporating the project area with surveys between March 2004 and March 2005 more focussed on the project area. The assessment also used data from aerial surveys undertaken between 2000 and 2005 which were targeted at recording common scoter. The highest populations of kittiwake were recorded between March and May.	It was considered that displacement (termed avoidance of turbines in the assessments conducted) would result in an impact of negligible to low significance for kittiwake due to the low densities of kittiwake present at the project.

Project	Reason for estimates being unavailable	Qualitative assessment	Final conclusion
Ormonde Wind Farm (Ecology Consulting, 2005)	Disturbance impacts considered qualitatively	Site-specific surveys included boat-based surveys undertaken monthly between May 2004 and April 2005. In addition, three aerial surveys were conducted during the summer of 2004 with four further aerial surveys in the winter of 2004/5. The peak population of kittiwake recorded in the wind farm plus a 2 km buffer during boat-based surveys was 60 birds. During aerial surveys the equivalent population was two birds. The species was recorded throughout the year during boat-based surveys with the highest numbers in April. Numbers in aerial surveys peaked in October with no records in the mid-winter period. The species was considered to be regionally important in the context of the assessments conducted.	The magnitude of the effect for kittiwake was considered to be negligible with a very low significance.
Rhyl Flats Offshore Wind Farm (Ecology Consulting, 2002)	Disturbance impacts considered qualitatively	Surveys of the project comprised aerial and boat-based surveys. Aerial surveys were undertaken between November 2001 and January 2002 and targeted common scoter, with non-target species not uniformly reported upon. Boat-based surveys were undertaken between January and March 2002 to record movements of common scoter and the flight height of birds. Kittiwake was recorded in all three aerial surveys with a peak count of 148 birds in November 2001.	Wind farm area not considered to be importance for seabirds and significant effects were considered unlikely.
Robin Rigg Offshore Wind Farm (Natural Power, 2002)	Disturbance impacts considered qualitatively	The project utilised site-specific boat-based surveys to characterise the baseline environment. Two surveys were completed in each month from May 2001 for one year. In addition, aerial surveys were undertaken from November 2001 on a monthly basis through winter and spring to verify the distribution and abundance of seaduck. The mean count of kittiwake during boat-based surveys in the wind farm was 4.5 birds with a peak of 46 birds. Kittiwake was considered to be of local importance based on the populations recorded in the wind farm.	The magnitude of the effect was considered to be low with a low significance.

Project	Reason for estimates being unavailable	Qualitative assessment	Final conclusion
Walney 1 & 2 Offshore Wind Farms (RPS, 2006)	Disturbance impacts considered qualitatively	Site-specific surveys included boat-based surveys undertaken across an area of 512 km^2 in the vicinity of the project between May 2004 and September 2005. The project also utilised survey data collected by regional aerial surveys, undertaken across their aerial survey area between 2002 and 2006 and radar survey data collected between 1st October and 29th October 2005. The peak population of kittiwake recorded in the project area plus 2 km buffer during aerial surveys was 44 birds. In boat-based surveys the equivalent population was 205 birds. Kittiwake was deemed to be a species of low importance (termed sensitivity in the Walney 1&2 assessments).	It was considered that the wind farm area did not represent a favoured foraging habitat and the magnitude of any impact was considered to be negligible. The species was considered to be of low sensitivity. The overall significance of impacts associated with the project was considered to be very low.
West of Duddon Sands Offshore Wind Farm (RPS, 2006)	Disturbance impacts considered qualitatively	Site-specific surveys included boat-based surveys undertaken across an area of 512 km^2 in the vicinity of the project between May 2004 and September 2005. The project also utilised survey data collected by regional aerial surveys, undertaken across their aerial survey area between 2002 and 2006 and radar survey data collected between 1st October and 29th October 2005. The peak population of kittiwake recorded in the project area plus 2 km buffer during aerial surveys was 14 birds. In boat-based surveys the equivalent population was 454 birds. Kittiwake was deemed to be a species of low importance (termed sensitivity in the West of Duddon Sands assessments).	The magnitude of impacts was considered to be negligible. Kittiwake was considered to be of low importance (termed sensitivity in the assessments for the project). The significance of all impacts was considered to be very low.

~~5.9.2.92~~5.9.2.90 During the spring migration (pre-breeding) season the displacement from operation when using the displacement rate of 50% (range of 30 to 70%) and a mortality rate of 1% (range of 1 to 10%), results in an additional loss of ~~38 (23~~36 (22 to ~~528~~506) individuals (Table 5.105). The regional seas UK Western Waters & Channel BDMPS population of black-legged kittiwake in the spring migration period is estimated to be 691,526 individuals (Table 5.14). Assuming an average baseline mortality rate of 0.156 (Table 5.15), background mortality during spring migration is 107,878 individuals. The addition of ~~38 (23~~36 (22 to ~~528~~506) individual mortalities due to cumulative displacement from the presence of infrastructure would increase the mortality relative to the baseline mortality by 0.035 % (0.021 to 0.490%).

~~5.9.2.93~~5.9.2.91 During the breeding season the displacement from operation results in a loss of ~~45 (27~~ 50 (30 to ~~626~~702) individuals from the migratory population (Table 5.106). The regional seas UK Western Waters & Channel BDMPS population of black-legged kittiwake within the breeding season is estimated to be 245,234 individuals (Table 5.14). Assuming an average baseline mortality rate of 0.156, background mortality in the breeding season is 38,256 individuals. The addition of ~~45 (27~~ 50 (30 to ~~626~~702) individual mortalities due to cumulative displacement from the presence of infrastructure would increase the mortality relative to the baseline mortality by 0.~~117~~ 131% (0.~~070~~078 to 1.~~637~~835%). The breeding season predicted mortality from the most extreme scenario cumulative assessment (70% displacement, 10% mortality) is above the 1% threshold increase in baseline mortality.

~~5.9.2.94~~5.9.2.92 However, recent evidence suggests that 70% displacement and 10% mortality is overly cautious and that kittiwake continued to use the area around a windfarm (Leopold *et al.* 2011; Vanermen, 2013; Furness, 2013; Peschko, 2020; NatureScot, 2023). Taking a more realistic 50% displacement and considering a precautionary mortality rate of 5%, the increase in baseline mortality would be 0.~~585~~656%, which is below the 1% threshold for further investigation.

~~5.9.2.95~~5.9.2.93 During the autumn migration season (post-breeding), displacement from operation results in a loss of 47 (28 to 659) individuals from the migratory population (Table 5.107). The regional seas UK Western Waters & Channel BDMPS population of black-legged kittiwake during the autumn migration period is estimated to be 911,586 individuals (Table 5.14). Assuming an average baseline mortality rate of 0.156, background mortality during autumn migration is 142,207 individuals. The addition of 47 (28 to 659) individual mortalities due to cumulative displacement from construction activities would increase the mortality relative to the baseline mortality by 0.033 % (0.020 to 0.463%).

~~5.9.2.96~~5.9.2.94 The annual estimated mortality resulting from displacement during construction is 133 (~~80~~78 to 1,~~862~~867) individuals (Table 5.108). Using the largest UK Western Waters & Channel BDMPS population of 911,586 individuals, with an average baseline mortality rate of 0.156, the background predicted mortality would be 142,207. The addition of 133 (~~80~~78 to 1,~~862~~867) mortalities would increase the baseline mortality rate by 0.094% (0.~~056~~055% to 1.~~310~~313%). The annual predicted mortality from the cumulative assessment is above the 1% threshold increase in baseline mortality.

~~5.9.2.97~~5.9.2.95 However, recent evidence suggests that 70% displacement and 10% mortality is overly cautious and that kittiwake continued to use the area around a windfarm (MacArthur Green, 2023).Leopold *et al.* 2011; Vanermen, 2013; Furness, 2013; Peschko, 2020; NatureScot, 2023). Taking a more realistic 50% displacement and even considering a precautionary mortality rate of 5%, the increase in baseline mortality would be 0.468469%, which is below the 1% threshold for further investigation.

5.9.2.985.9.2.96 The cumulative effect is predicted to be of national spatial extent, long term duration, continuous and high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **negligible**.

Manx shearwater

5.9.2.995.9.2.97 The estimated cumulative abundance of Manx shearwater from the relevant projects is presented in Table 5.110. There are a number of projects for which there are no, or limited, data on the number of Manx shearwater predicted to be displaced. In particular this is the case for some of the earlier developments which are discussed in.

Table 5.110: Manx shearwater cumulative abundances for offshore wind projects for disturbance and displacement assessment during the operations and maintenance phase.

Project	Annual Abundance	Pre-breeding Abundance	Breeding Season Abundance	Post-breeding Abundance
Tier 1				
Awel y Môr Offshore Wind Farm	417	177	26	177214
Burbo Bank Offshore Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable
Burbo Bank Extension Offshore Wind Farm	2,937443	Unavailable	2,937443	Unavailable
Erebus Floating Wind Demo	2,115	18	1,540	557
Gwynt y Môr Offshore Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable
TwinHub (Wave Hub Floating Wind Farm)	6701,274	Unavailable1	6661,270	3
Ormonde Wind Farm	1,001Unavailable	Unavailable	Unavailable1,001	Unavailable
Rampion Offshore Wind Farm	33	0	33	0
Robin Rigg Offshore Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable
Rhyl Flats Offshore Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable
Walney 1 & 2 Offshore Wind Farms	Unavailable	Unavailable	Unavailable	Unavailable
Walney (3 & 4) Extension Offshore Wind Farm	2,617912	Unavailable183	1,417588	1,017324

Project	Annual Abundance	Pre-breeding Abundance	Breeding Season Abundance	Post-breeding Abundance
West of Duddon Sands Offshore Wind Farm	~~Unavailable~~544	Unavailable	~~Unavailable~~544	Unavailable
West of Orkney Windfarm	10	0	8	3
White Cross Offshore Windfarm	12,181	12,126	33	22
Tier 2				
Morecambe Offshore Windfarm Generation Assets	7,583	0	7,577	6
Morgan Offshore Wind Project Generation Assets	993	59	467	467
Rampion 2 (Rampion Extension) Offshore Wind Farm	0	0	0	0
TOTAL (minus the Mona Offshore Wind Project)	**~~29,556~~27,506**	**12,~~564~~380**	**~~14,704~~13,530**	**~~2,252~~1,596**
Mona Offshore Wind Project	1,~~434~~268	3	1,249	~~182~~16
TOTAL (all projects)	**~~30,990~~28,774**	**12,~~567~~383**	**~~15,953~~14,779**	**~~2,434~~1,612**

~~5.9.2.100~~5.9.2.98 The following displacement matrices provide the estimated cumulative mortality of Manx shearwater predicted to occur due to displacement, as determined by the relevant specified rates of displacement and mortality (Table 5.111 to Table 5.114). The approach used for the cumulative displacement assessment follows that presented in Volume 6, Annex 5.2: Offshore ornithology displacement assessment of the Environmental Statement~~.~~ (Document reference F6.5.2).

Table 5.111: Operations and maintenance phase cumulative Manx shearwater mortality following displacement from offshore wind farms in the pre-breeding season.

Displacement level (% at risk of displacement)	Mortality level (% of displaced birds at risk of mortality)						
	1%	2%	5%	10%	25%	50%	100%
10%	~~13~~12	25	~~63~~62	~~126~~124	~~314~~310	~~628~~619	1,~~257~~238
20%	25	50	~~126~~124	~~251~~248	~~628~~619	1,~~257~~238	2,~~513~~477
30%	~~38~~37	~~75~~74	~~189~~186	~~377~~371	~~943~~929	1,~~885~~857	3,~~770~~715
40%	50	~~101~~99	~~251~~248	~~503~~495	1,~~257~~238	2,~~513~~477	~~5,027~~4,953
50%	~~63~~62	~~126~~124	~~314~~310	~~628~~619	1,~~571~~548	3,~~142~~096	6,~~284~~192
60%	~~75~~74	~~151~~149	~~377~~371	~~754~~743	1,~~885~~857	3,~~770~~715	7,~~540~~430
70%	~~88~~87	~~176~~173	~~440~~433	~~880~~867	2,~~199~~167	4,~~398~~334	8,~~797~~668

80%	~~101~~99	~~201~~198	~~503~~495	~~1,005~~991	2,~~513~~477	~~5,027~~4,953	~~10,054~~9,906
90%	~~113~~111	~~226~~223	~~566~~557	1,~~131~~114	2,~~828~~786	5,~~655~~572	11,~~310~~145
100%	~~126~~124	~~251~~248	~~628~~619	1,~~257~~238	3,~~142~~096	6,~~284~~192	12,~~567~~383

Table 5.112: Operations and maintenance phase cumulative Manx shearwater mortality following displacement from offshore wind farms in the breeding season.

Displacement level (% at risk of displacement)	Mortality level (% of displaced birds at risk of mortality)						
	1%	2%	5%	10%	25%	50%	100%
10%	~~13~~15	~~25~~30	~~63~~74	~~126~~148	~~314~~369	~~628~~739	1,~~257~~478
20%	~~25~~30	~~50~~59	~~126~~148	~~251~~296	~~628~~739	1,~~257~~478	2,~~513~~956
30%	~~38~~44	~~75~~89	~~189~~222	~~377~~443	~~943~~1,108	~~1,885~~2,217	~~3,770~~4,434
40%	~~50~~59	~~101~~118	~~251~~296	~~503~~591	1,~~257~~478	2,~~513~~956	5,~~027~~912
50%	~~63~~74	~~126~~118	~~314~~369	~~628~~739	1,~~571~~847	3,~~142~~695	~~6,284~~7,390
60%	~~75~~89	~~151~~177	~~377~~443	~~754~~887	~~1,885~~2,217	~~3,770~~4,434	~~7,540~~8,867
70%	~~88~~103	~~176~~207	~~440~~517	~~880~~1,035	2,~~199~~586	~~4,398~~5,173	~~8,797~~10,345
80%	~~101~~118	~~201~~236	~~503~~591	1,~~005~~182	2,~~513~~956	5,~~027~~912	~~10,054~~11,823
90%	~~113~~133	~~226~~266	~~566~~665	1,~~131~~330	~~2,828~~3,325	~~5,655~~6,651	~~11,310~~13,301
100%	~~126~~148	~~251~~296	~~628~~739	1,~~257~~478	3,~~142~~695	~~6,284~~7,390	~~12,567~~14,779

Table 5.113: Operations and maintenance phase cumulative Manx shearwater mortality following displacement from offshore wind farms in the post-breeding season.

Displacement level (% at risk of displacement)	Mortality level (% of displaced birds at risk of mortality)						
	1%	2%	5%	10%	25%	50%	100%
10%	2	~~5~~3	~~12~~8	~~24~~16	~~61~~40	~~122~~81	~~243~~161
20%	~~5~~3	~~10~~6	~~24~~16	~~49~~32	~~122~~81	~~243~~161	~~487~~322
30%	~~7~~5	~~15~~10	~~37~~24	~~73~~48	~~183~~121	~~365~~242	~~730~~484
40%	~~10~~6	~~19~~13	~~49~~32	~~97~~64	~~243~~161	~~487~~322	~~973~~645
50%	~~12~~8	~~24~~16	~~61~~40	~~122~~81	~~304~~202	~~608~~403	~~1,217~~806
60%	~~15~~10	~~29~~19	~~73~~48	~~146~~97	~~365~~242	~~730~~484	~~1,460~~967
70%	~~17~~11	~~34~~23	~~85~~56	~~170~~113	~~426~~282	~~852~~564	1,~~704~~128

	80%	~~19~~13	~~39~~26	~~97~~64	~~195~~129	~~487~~322	~~973~~645	1,~~947~~290
	90%	~~22~~15	~~44~~29	~~110~~73	~~219~~145	~~548~~363	~~1,095~~725	~~2,190~~1,451
	100%	~~24~~16	~~49~~32	~~122~~81	~~243~~161	~~608~~403	~~1,217~~806	~~2,434~~1,612

Table 5.114: Operations and maintenance phase cumulative Manx shearwater mortality following displacement from offshore wind farms annually.

Displacement level (% at risk of displacement)	Mortality level (% of displaced birds at risk of mortality)							
		1%	**2%**	**5%**	**10%**	**25%**	**50%**	**100%**
	10%	~~31~~29	~~62~~58	~~155~~144	~~310~~288	~~775~~719	1,~~550~~439	~~3,099~~2,877
	20%	~~62~~58	~~124~~115	~~310~~288	~~620~~575	1,~~550~~439	~~3,099~~2,877	~~6,198~~5,755
	30%	~~93~~86	~~186~~173	~~465~~432	~~930~~863	2,~~324~~158	4,~~649~~316	~~9,297~~8,632
	40%	~~124~~115	~~248~~230	~~620~~575	1,~~240~~151	~~3,099~~2,877	~~6,198~~5,755	~~12,396~~11,510
	50%	~~155~~144	~~310~~288	~~775~~719	1,~~550~~439	3,~~874~~597	7,~~748~~194	~~15,495~~14,387
	60%	~~186~~173	~~372~~345	~~930~~863	1,~~859~~726	4,~~649~~316	~~9,297~~8,632	~~18,594~~17,264
	70%	~~217~~201	~~434~~403	1,~~085~~007	2,~~169~~014	5,~~423~~035	10,~~847~~007	~~21,693~~20,142
	80%	~~248~~230	~~496~~460	1,~~240~~151	2,~~479~~302	~~6,198~~5,755	~~12,396~~11,510	~~24,792~~23,019
	90%	~~279~~259	~~558~~518	1,~~395~~295	2,~~789~~590	6,~~973~~474	~~13,946~~12,948	~~27,891~~25,897
	100%	~~310~~288	~~620~~575	1,~~550~~439	~~3,099~~2,877	7,~~748~~194	~~15,495~~14,387	~~30,990~~28,774

Table 5.115: Qualitative assessment of projects considered cumulatively with the Mona Offshore Wind Project for which quantitative consideration of displacement impacts was not undertaken in project-specific documentation for manx shearwater

Project	Reason for estimates being unavailable	Qualitative assessment	Final conclusion
Tier 1			
Burbo Bank Offshore Wind Farm (Seascape Energy Ltd., 2002)	Disturbance impacts considered qualitatively	Surveys of the project comprised aerial and boat-based surveys both of which were undertaken during winter months (aerial = November to April and boat-based = December and February). Aerial surveys covered a large area encompassing the Liverpool Bay SPA with boat-based surveys covering the project area. The surveys were undertaken to provide abundance and distribution data for those species considered to be of most importance, namely common scoter and red-throated diver. Manx shearwater was not considered to be a species of International or National importance in the context of the assessments undertaken. It does not appear that the species was recorded during site-specific surveys, with no mention of the species in project-specific documentation.	Although Manx shearwater was not specifically assessed due to the species being considered of limited importance, low levels of disturbance were predicted for other species with conclusions of a negligible magnitude and very low significance reached.
Gwynt y Môr Offshore Wind Farm (RWE Group and Npower Renewables, 2005)	Disturbance impacts considered qualitatively	Site-specific surveys undertaken in support of the project included boat-based surveys undertaken between February 2003 and March 2005. Surveys between February 2003 and February 2004 covered a large area along the Welsh coast incorporating the project area with surveys between March 2004 and March 2005 more focussed on the project area. The assessment also used data from aerial surveys undertaken between 2000 2005 which were targeted at recording common scoter. Manx shearwaters were recorded during boat-based surveys particularly in April and May 2004. In other months only single birds or small flocks were recorded.	It was considered that displacement (termed avoidance of turbines in the assessments conducted) would result in an impact of low significance for Manx shearwater due to the very extensive areas across which the species forages and the limited importance of the project area for the species.

Project	Reason for estimates being unavailable	Qualitative assessment	Final conclusion
Ormonde Wind Farm (Ecology Consulting, 2005)	Disturbance impacts considered qualitatively	Site-specific surveys included boat-based surveys undertaken monthly between May 2004 and April 2005. In addition, three aerial surveys were conducted during the summer of 2004 with four further aerial surveys in the winter of 2004/5. The peak population of Manx shearwater recorded in the wind farm plus a 2 km buffer during boat-based surveys was 1,001 birds. During aerial surveys the equivalent population was zero birds. Peak numbers were recorded in August, although the majority of birds were outside of the wind farm area in deeper waters to the west of the study area. The species was considered to be of high importance (termed sensitivity) in the context of the assessments conducted.	The magnitude of the effect for Manx shearwater was considered to be negligible with a low significance.
Robin Rigg Offshore Wind Farm (Natural Power, 2002)	Disturbance impacts considered qualitatively	The project utilised site-specific boat-based surveys to characterise the baseline environment. Two surveys were completed in each month from May 2001 for one year. In addition, aerial surveys were undertaken from November 2001 on a monthly basis through winter and spring to verify the distribution and abundance of seaduck. The mean count of Manx shearwater during boat-based surveys in the wind farm was three birds with a peak of 39 birds. Manx shearwater was considered to be present in the wind farm area in regionally important numbers.	The magnitude of the effect was considered to be negligible with a very low significance.
Rhyl Flats Offshore Wind Farm (Ecology Consulting, 2002)	Disturbance impacts considered qualitatively	Surveys of the project comprised aerial and boat-based surveys. Aerial surveys were undertaken between November 2001 and January 2002 and targeted common scoter, with non-target species not uniformly reported upon. Boat-based surveys were undertaken between January and March 2002 to record movements of common scoter and the flight height of birds. Manx shearwater are not present in UK waters during the non-breeding season and therefore were not recorded during site-specific surveys.	Wind farm area not considered to be importance for seabirds and significant effects were considered unlikely

Project	Reason for estimates being unavailable	Qualitative assessment	Final conclusion
Walney 1 & 2 Offshore Wind Farms (RPS, 2006)	Disturbance impacts considered qualitatively	Site-specific surveys included boat-based surveys undertaken across an area of 512 km^2 in the vicinity of the project between May 2004 and September 2005. The project also utilised survey data collected by regional aerial surveys, undertaken across their aerial survey area between 2002 and 2006 and radar survey data collected between 1st October and 29th October 2005. The peak population of Manx shearwater recorded in the project area plus 2 km buffer during aerial surveys was 135 birds. In boat-based surveys the equivalent population was 3,673 birds. Manx shearwater was deemed to be a species of high importance (termed sensitivity in the Walney 1&2 assessments).	With no evidence for the likely sensitivity of Manx shearwater to displacement impacts when the assessments for Walney 1+2 were undertaken the assessment assumed that Manx shearwater would avoid the wind farm area. However, although it was assumed that displacement effects would be high it was considered that this would lead to a high impact magnitude due to the short temporal period during which Manx shearwaters would be present in the wind farm area, the low importance of the wind farm area for the species and the large foraging range of the species leading to a conclusion of low magnitude. The overall significance of impacts associated with the project was considered to be low.
West of Duddon Sands Offshore Wind Farm (RPS, 2006)	Disturbance impacts considered qualitatively	Site-specific surveys included boat-based surveys undertaken across an area of 512 km^2 in the vicinity of the project between May 2004 and September 2005. The project also utilised survey data collected by regional aerial surveys, undertaken across their aerial survey area between 2002 and 2006 and radar survey data collected between 1st October and 29th October 2005. The peak population of Manx shearwater recorded in the project area plus 2 km buffer during aerial surveys was 104 birds. In boat-based surveys the equivalent population was 544 birds. Manx shearwater was deemed to be a species of high importance (termed sensitivity in the West of Duddon Sands assessments).	With no evidence for the likely sensitivity of Manx shearwater to displacement impacts when the assessments for West of Duddon Sands were undertaken the assessment assumed that Manx shearwater would avoid the wind farm area. However, although it was assumed that displacement effects would be high it was considered that this would lead to a high impact magnitude due to the short temporal period during which Manx shearwaters would be present in the wind farm area, the low importance of the wind farm area for the species and the large foraging range of the species leading to a conclusion of low magnitude. The overall significance of impacts associated with the project was considered to be low.

~~5.9.2.101~~5.9.2.99 During the spring migration (pre-breeding) season the displacement from operation when using the displacement rate of 50% (range of 30 to 70%) and a mortality rate of 1% (range of 1 to 10%), results in an additional loss of ~~63 (38~~62 (37 to ~~880~~867) individuals (Table 5.111). The regional seas UK Western Waters & Channel BDMPS population of Manx shearwater in the spring migration period is estimated to be 1,580,895 individuals (Table 5.14). Assuming an average baseline mortality rate of 0.130 (Table 5.15), background mortality during spring migration is 205,516 individuals. The addition of ~~63 (38~~62 (37 to ~~880~~867) individual mortalities due to cumulative displacement from the presence of infrastructure would increase the mortality relative to the baseline mortality by 0.~~031~~030 % (0.018 to 0.~~428~~422%).

~~5.9.2.102~~5.9.2.100 During the breeding season the displacement from operation results in a loss of ~~80 (48~~ 74 (44 to 1,~~117~~035) individuals from the migratory population (Table 5.112). The regional seas UK Western Waters & Channel BDMPS population of Manx shearwater within the breeding season is estimated to be 1,821,544 individuals (Table 5.14). Assuming an average baseline mortality rate of 0.130, background mortality in the breeding season is 236,801 individuals. The addition of ~~80 (48~~74 (44 to 1,~~117~~035) individual mortalities due to cumulative displacement from construction activities would increase the mortality relative to the baseline mortality by 0.~~034~~ 031% (0.~~020~~019 to 0.~~472~~437%).

~~5.9.2.103~~5.9.2.101 During the autumn migration season (post-breeding), displacement from operation results in a loss of ~~12 (seven~~eight (five to ~~170~~113) individuals from the migratory population (Table 5.113). The regional seas UK Western Waters & Channel BDMPS population of Manx shearwater during the autumn migration period is estimated to be 1,580,895 individuals (Table 5.14). Assuming an average baseline mortality rate of 0.130, background mortality during autumn migration is 205,516 individuals. The addition of ~~12 (seven~~eight (five to ~~170~~113) individual mortalities due to cumulative displacement from the presence of infrastructure would increase the mortality relative to the baseline mortality by 0.~~006~~004% (0.~~004~~002 to 0.~~083~~055%).

~~5.9.2.104~~5.9.2.102 The annual estimated mortality resulting from displacement during construction is ~~155 (93~~144 (86 to 2,~~169~~014) individuals (Table 5.114). Using the largest population of 1,821,544 individuals, with an average baseline mortality rate of 0.130, the background predicted mortality would be 236,801. The addition of ~~155 (93~~144 (86 to 2,~~169~~014) mortalities would increase the baseline mortality rate by 0.~~065~~061% (0.~~039~~036 to 0.~~916~~850%). The annual predicted mortality from the cumulative assessment is below the 1% threshold increase in baseline mortality.

~~5.9.2.105~~5.9.2.103 The cumulative effect is predicted to be of national spatial extent, long term duration, continuous and medium reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **negligible**.

Sensitivity of the receptor

Common guillemot

~~5.9.2.106~~5.9.2.104 Evidence of guillemot sensitivity to displacement from offshore wind farms is summarised from paragraph 5.9.2.56 onwards. Common guillemot is deemed to be of medium vulnerability, medium recoverability and medium value. Overall, based on evidence from post-construction studies and reviews, guillemot is deemed to be of medium vulnerability, medium recoverability and high value. The sensitivity of the receptor is therefore, considered to be **medium**.

Razorbill

~~5.9.2.107~~5.9.2.105 Evidence of razorbill sensitivity to displacement from offshore wind farms is summarised from paragraph 5.9.2.66 onwards. Overall, based on evidence from post-construction studies and reviews, razorbill is deemed to be of medium vulnerability, medium recoverability and medium value. The sensitivity of the receptor is therefore, considered to be **medium.**

Atlantic puffin

~~5.9.2.108~~5.9.2.106 Evidence of Atlantic puffin sensitivity to displacement from offshore wind farms is summarised from paragraph 5.9.2.75 onwards. Overall, based on evidence from post-construction studies and reviews, Atlantic puffin is deemed to be of medium vulnerability, low recoverability and high value. The sensitivity of the receptor is therefore, considered to be **high**.

Northern gannet

~~5.9.2.109~~5.9.2.107 Evidence of northern gannet sensitivity to displacement from offshore wind farms is summarised from paragraph 5.9.2.81 onwards. Based on evidence from operational wind farms demonstrating that northern gannet show a high avoidance of offshore wind farms, northern gannet is deemed to be of high vulnerability, medium recoverability and medium value. The sensitivity of the receptor is therefore, considered to be **medium.**

Black-legged kittiwake

~~5.9.2.110~~5.9.2.108 Evidence of black-legged kittiwake sensitivity to displacement from offshore wind farms is summarised from paragraph 5.9.2.88 onwards. For kittiwake, there is evidence from other operating offshore wind farm projects that displacement is not likely to occur to any significant level. However, due to low reproductive rates, black-legged kittiwake is deemed to be of low vulnerability, low recoverability and medium value. The sensitivity of the receptor is therefore, considered to be **medium.**

Manx shearwater

~~5.9.2.111~~5.9.2.109 For Manx shearwater, there is evidence from other operating offshore wind farm projects that displacement is not likely to occur to any significant level. However, due to low reproductive rates, Manx shearwater is deemed to be of low vulnerability, low recoverability and medium value. The sensitivity of the receptor is therefore, considered to be **medium**.

Significance of effect

~~5.9.2.112~~5.9.2.110 Table 5.116 summarises the significance of effect cumulative on the species susceptible to disturbance and displacement impacts. All impacts are considered non-significant in EIA terms.

Table 5.116: Table summarising the cumulative significance of effect during operation.

Species	Magnitude of impact	Sensitivity of receptor	Significance of effect
Common guillemot	Low	Medium	**Minor adverse, not significant in EIA terms**

Species	Magnitude of impact	Sensitivity of receptor	Significance of effect
Razorbill	Low	Medium	**Minor adverse, not significant in EIA terms**
Atlantic puffin	Negligible	High	**Negligible, not significant in EIA terms**
Northern gannet	Negligible	Medium	**Negligible, not significant in EIA terms**
Black-legged kittiwake	Negligible	Medium	**Negligible, not significant in EIA terms**
Manx shearwater	Negligible	Medium	**Negligible, not significant in EIA terms**

Decommissioning phase

~~5.9.2.113~~5.9.2.111 During the decommissioning phase, cumulative disturbance and displacement of red-throated divers, guillemots and razorbills would only occur if these activities occurred at the same time across offshore wind farms. Disturbance effects during the decommissioning phase are anticipated to be like construction if the decommissioning schedule of the Mona Offshore Wind Project will overlap with that for the other offshore wind farms within the CEA study area. The magnitude of impact would be negligible, with significance ranging from **negligible** to **minor** depending on the species, which is not significant in EIA terms.

5.9.3 Collision risk

Tier 1 and Tier 2

Operations and maintenance phase

5.9.3.1 The Mona Offshore Wind Project, together with other offshore wind farms in the Irish Sea, may contribute to cumulative collision risk, in the event the operations and maintenance phases of different projects overlap. Seabirds and migratory birds are highly mobile; therefore they can encounter different offshore wind farms, and be at risk of collisions, across large areas.

5.9.3.2 As stated, data used within the assessing cumulative collision risk is based on published information produced by the respective project developers. As such, the input parameters (e.g. ~~avoidance rates~~species biometrics) and the collision risk model used (e.g. deterministic) may vary from those put forward in this chapter. All of the impacts from other projects have been corrected to the latest avoidance rates (Ozsanlav-Harris *et al*., 2015) therefore Band Option 2 outputs have taken from other projects to allow this correction to occur.

5.9.3.3 The expected annual collision mortality for seabirds has been compiled from relevant offshore wind farms and is shown in Table 5.117.

5.9.3.4 The expected annual collision mortality for migratory birds has been compiled from relevant offshore wind farms and is shown in Table 5.130 to Table 5.135. Due to the number of species considered within the migratory bird section the tables are broken down as follows:

- Table 5.130 contains Bewick's swan, whooper swan, Greenland white-fronted goose, light-bellied brent goose (Canadian population), shelduck, wigeon, gadwall, teal, mallard and pintail

- Table 5.131 contains pochard, tufted duck, scaup, long-tailed duck, common scoter, goldeneye, red-breasted merganser, great northern diver and European storm petrel
- Table 5.132Table 5.132 contains Leach's storm petrel, bittern, great crested grebe, Slavonian grebe, hen harrier, osprey, merlin, corncrake and oystercatcher (breeding and non-breeding)

Table 5.133 contains ringed plover (breeding and non-breeding), dotterel, golden plover (breeding and non-breeding), grey plover, lapwing, knot, sanderling and purple sandpiper

- Table 5.134 contains dunlin, ruff, snipe, black-tailed godwit, bar-tailed godwit, whimbrel, curlew (breeding and non-breeding) and greenshank
- Table 5.135Table 5.135 contains wood sandpiper, redshank (breeding and non-breeding), turnstone, great skua, pomarine skua, long-tailed skua, black-headed gull and short-eared owl.

5.9.3.5 Any sections marked "Unavailable" in the tables from Table 5.117 to Table 5.129 are due to a lack of assessment or no available published data for the relevant species. Where this occurs, these offshore wind farms have been assessed qualitatively. Where a range of collision risks was provided, the worst-case scenario figure was used in this cumulative assessment.

Magnitude of impact

Black-legged kittiwake

5.9.3.6 The expected mean seasonal and annual collision mortality for kittiwake has been compiled for relevant offshore wind farms and is shown in Error! Reference source not found.,Table 5.117, with estimates based on the Natural Englandspecies-group advocated avoidance rate of 99.28.

Table 5.117: Expected annual collision mortality across relevant offshore wind farms for black-legged kittiwake (Avoidanceavoidance rate 99.28)

Project	Annual	Pre-breeding Season	Breeding Season	Post-breeding Season
Tier 1				
Awel y Môr Offshore Wind Farm	35.25	15.30	1211.66	8.29
Burbo Bank Offshore Wind Farm	unavailable23	unavailable	unavailable	unavailable
Burbo Bank Extension Offshore Wind Farm	23.04unavailable	unavailable	unavailable	unavailable
Erebus Floating Wind Demo	3837.65	1312.51	10.50	2524.64
Gwynt y Môr Offshore Wind Farm	unavailable	unavailable	unavailable	unavailable
TwinHub (Wave Hub Floating Wind Farm)	109.72	unavailable	unavailable	unavailable
Ormonde Wind Farm	3.27	unavailable	unavailable	unavailable

Project	Annual	Pre-breeding Season	Breeding Season	Post-breeding Season
Rampion Offshore Wind Farm	~~127~~128.16	~~42~~41.76	~~71~~70.56	~~16~~15.84
Robin Rigg Offshore Wind Farm	unavailable	unavailable	unavailable	unavailable
Rhyl Flats Offshore Wind Farm	unavailable	unavailable	unavailable	unavailable
Walney 1 & 2 Offshore Wind Farms	unavailable	unavailable	unavailable	unavailable
Walney (3 & 4) Extension Offshore Wind Farm	120.37	15.19	~~19~~18.79	86.40
West of Duddon Sands Offshore Wind Farm	unavailable	unavailable	unavailable	unavailable
West of Orkney Windfarm	~~53~~54.49	20.99	17.06	16.44
White Cross Offshore Windfarm	14.81	~~12~~9.26	~~0~~3.70	~~2~~1.85
Tier 2				
Morecambe Offshore Windfarm Generation Assets	32.00	5.34	15.03	~~12~~11.63
Morgan Offshore Wind Project Generation Assets	~~40~~39.81	13.18	5.00	~~22~~21.63
Rampion 2 (Rampion Extension) Offshore Wind Farm	28.00	17.00	1.00	10.00
Total (minus the **Mona Offshore Wind Project)**	**~~523~~526.57**	**~~153~~150.52**	**~~139~~143.3**	**196.72**
Mona Offshore Wind Project	~~33~~32.67	~~16~~8.74	~~8~~15.52	8.41
Cumulative total (all projects)	**~~556~~559.24**	**~~169~~159.26**	**~~147~~158.82**	**205.13**

5.9.3.7 There are a number of Tier 1 projects for which collision risk estimates are unavailable. This is due to various factors including species not being included in CRM or projects not having conducted CRM. To ensure these projects are considered in this assessment project-specific documents have been reviewed to provide a qualitative assessment of collision for each project. This process is summarised in Table 5.118

Table 5.118: Qualitative assessment of projects considered cumulatively with the Mona Offshore Wind Project for which quantitative consideration of collision risk was not undertaken in project-specific documentation for kittiwake.

Project	Reason for estimates being unavailable	Qualitative assessment	Final conclusion
Tier 1			
Burbo Bank Offshore Wind Farm (Seascape Energy Ltd., 2002)	Species not included in CRM	The assessment of collision risk was undertaken on a qualitative basis by investigating flight heights of birds at the project site and was undertaken for species considered to be of International or National importance in the context of the assessments undertaken for the project. Kittiwake was not considered to be a species of International or National importance. Surveys of the project comprised aerial and boat-based surveys both of which were undertaken during winter months (aerial = November to April and boat-based = December and February). Aerial surveys covered a large area encompassing the Liverpool Bay SPA with boat-based surveys covering the project area. The surveys were undertaken to provide abundance and distribution data for those species considered to be of most importance, namely common scoter and red-throated diver. Low numbers of kittiwake were recorded during boat-based surveys with relatively low numbers also recorded during aerial surveys.	No assessment was conducted for kittiwake in relation to collision risk impacts however, kittiwake was not considered to be a species of International or National importance in the context of the assessments undertaken.
Walney 1 & 2 Offshore Wind Farms (RPS, 2006)	Species not included in CRM	Site-specific surveys included boat-based surveys undertaken across an area of 512 km^2 in the vicinity of the project between May 2004 and September 2005. The project also utilised survey data collected by regional aerial surveys, undertaken across their aerial survey area between 2002 and 2006 and radar survey data collected between 1st October and 29th October 2005. Kittiwake was not included in CRM and it was considered that, due to the very low numbers of birds recorded at rotor height, that the magnitude of collision was negligible.	Very low significance

Project	Reason for estimates being unavailable	Qualitative assessment	Final conclusion
West of Duddon Sands Offshore Wind Farm (RSKENSR, 2006)	Species not included in CRM	Site-specific surveys included boat-based surveys undertaken across an area of 512 km^2 in the vicinity of the project between May 2004 and September 2005. The project also utilised survey data collected by regional aerial surveys, undertaken across their aerial survey area between 2002 and 2006 and radar survey data collected between 1st October and 29th October 2005. The peak population of kittiwake recorded in the project area plus 2 km buffer during aerial surveys was 14 birds. In boat-based surveys the equivalent population was 454 birds. The proportion of flying kittiwake recorded above 15 m was 15.5 % across all boat-based surveys within the boat-based survey area. Kittiwake was deemed to be a species of low importance (termed sensitivity in the West of Duddon Sands assessments).	Very low significance
Gwynt y Môr Offshore Wind Farm (RWE Group and Npower Renewables, 2005)	Species not included in CRM	Site-specific surveys undertaken in support of the project included boat-based surveys undertaken between February 2003 and March 2005. Surveys between February 2003 and February 2004 covered a large area along the Welsh coast incorporating the project area with surveys between March 2004 and March 2005 more focussed on the project area. The assessment also used data from aerial surveys undertaken between 2000 2005 which were targeted at recording common scoter. The highest populations of kittiwake were recorded between March and May. During boat-based surveys used to characterise the project undertaken between 2004 to 2005, covering an area considered by the project assessment to better represent the behaviour of birds than the area associated with boat-based surveys undertaken in 2003-04, 8,900 observations were obtained with only 22 flights recorded at a height of greater than 20 m. In 2004-05 surveys, 603 kittiwake were recorded in flight with only 0.2% of these flying above 20 m.	Low significance due to low proportion of flight heights recorded at collision height

Project	Reason for estimates being unavailable	Qualitative assessment	Final conclusion
Rhyl Flats Offshore Wind Farm (Ecology Consulting, 2002)	Species not included in CRM	Surveys of the project comprised aerial and boat-based surveys. Aerial surveys were undertaken between December 2001 and January 2002 and targeted common scoter, with non-target species not uniformly reported upon. Boat-based surveys were undertaken between January and March 2002 to record movements of common scoter and the flight height of birds. A qualitative assessment was undertaken for 'other seabirds' (a category that included gulls) and it was considered that collision rates would be negligible.	Very low significance
Robin Rigg Offshore Wind Farm (Natural Power, 2002)	Species not included in CRM	The project utilised site-specific boat-based surveys to characterise the baseline environment. Two surveys were completed in each month from May 2001 for one year. In addition, aerial surveys were undertaken from November 2001 on a monthly basis through winter and spring to verify the distribution and abundance of seaduck. The mean count of kittiwake during boat-based surveys in the wind farm was 4.5 birds with a peak of 46 birds. Kittiwake was considered to be of local importance based on the populations recorded in the wind farm. The proportion of kittiwake flying above 20 m during boat-based surveys across the entire study area was less than 1%. A qualitative assessment was undertaken for 'other seabirds' (a category that included gulls) and it was considered that collision rates would be low/negligible.	Low/Very low significance

5.9.3.8 The estimated cumulative collision mortality of black-legged kittiwake from the relevant projects with available data is ~~556~~559.24 per year (Table 5.117). Using the largest population of 911,586 individuals (during the post-breeding/autumn migration), with an average baseline mortality rate of 0.156 (Table 5.15), the background predicted mortality would be 142,207. The addition of ~~556~~559.24 mortalities would increase the baseline mortality rate by 0.~~391~~393%. The annual predicted mortality from the cumulative collision risk assessment is below the 1% threshold increase in baseline mortality.

5.9.3.9 The cumulative effect is predicted to be of national spatial extent, long term duration, continuous and high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **low**.

Great black-backed gull

5.9.3.10 The expected mean seasonal and annual collision mortality for great black-backed gull has been compiled for relevant offshore wind farms and is shown in~~**Error! Reference source not found.**~~ Table 5.119 using the ~~Natural England advocated~~species-group avoidance rate of 99.39. Additionally, within Table 5.120 avoidance rates have been corrected to account for the species-specific avoidance rate of 99.91 calculated by Ozsanlav-Harris *et al.* (2023) which is considered more appropriate for this species, with species-specific estimates based on sufficient sample size.

Table 5.119: Expected annual collision mortality across relevant offshore wind farms for great black-backed gull (~~Avoidance~~avoidance rate 99.39)

Project	Annual	Breeding Season	Non-breeding Season
Tier 1			
Awel y Môr Offshore Wind Farm	~~2.89~~5.94	~~2.37~~5.32	0.~~52~~62
Burbo Bank Offshore Wind Farm	unavailable	unavailable	unavailable
Burbo Bank Extension Offshore Wind Farm	unavailable	unavailable	unavailable
Erebus Floating Wind Demo	0.~~67~~82	0.00	0.~~67~~82
Gwynt y Môr Offshore Wind Farm	unavailable	unavailable	unavailable
TwinHub (Wave Hub Floating Wind Farm)	~~13.00~~15.74	unavailable	unavailable
Ormonde Wind Farm	0.~~24~~29	unavailable	unavailable

Project	Annual	Breeding Season	Non-breeding Season
Rampion Offshore Wind Farm	31.2038.06	3.904.76	27.333.31
Robin Rigg Offshore Wind Farm	unavailable	unavailable	unavailable
Rhyl Flats Offshore Wind Farm	unavailable	unavailable	unavailable
Walney 1 & 2 Offshore Wind Farms	unavailable	unavailable	unavailable
Walney (3 & 4) Extension Offshore Wind Farm	25.96unavailable	5.89unavailable	20.07unavailable
West of Duddon Sands Offshore Wind Farm	unavailable21.20	unavailable4.80	unavailable16.4
West of Orkney Windfarm	13.18unavailable	unavailable	unavailable
White Cross Offshore Windfarm	6.100.93	0.1093	60
Tier 2			
Morecambe Offshore Windfarm Generation Assets	0.98	0.53	0.45
Morgan Offshore Wind Project Generation Assets	2.81	2.10	0.71
Rampion 2 (Rampion Extension) Offshore Wind Farm	20.0019.84	6.25	1413.59

Project	Annual	Breeding Season	Non-breeding Season
Total (minus the **Mona** Offshore Wind Project**)**	**~~99.78~~124.53**	**~~20.75~~25.77**	**~~62~~69.56**
Mona Offshore Wind Project	4.~~82~~83	1.~~64~~67	3.~~18~~16
Cumulative total (all projects)	**~~104.60~~129.36**	**~~22.39~~27.44**	**~~66~~72.72**

Table 5.120: Expected annual collision mortality across relevant offshore wind farms for great black-backed gull (~~Avoidance~~avoidance rate 99.91)

Project	Annual	Breeding Season	Non-breeding Season
Tier 1			
Awel y Môr Offshore Wind Farm	0.~~52~~87	0.~~43~~78	0.09
Burbo Bank Offshore Wind Farm	unavailable	unavailable	unavailable
Burbo Bank Extension Offshore Wind Farm	unavailable	unavailable	unavailable
Erebus Floating Wind Demo	0.12	0.00	0.12
Gwynt y Môr Offshore Wind Farm	unavailable	unavailable	unavailable
TwinHub (Wave Hub Floating Wind Farm)	~~1.06~~2.32	unavailable	unavailable
Ormonde Wind Farm	0.04	unavailable	unavailable
Rampion Offshore Wind Farm	5.62	0.70	4.91
Robin Rigg Offshore Wind Farm	unavailable	unavailable	unavailable
Rhyl Flats Offshore Wind Farm	unavailable	unavailable	unavailable
Walney 1 & 2 Offshore Wind Farm	unavailable	unavailable	unavailable
Walney (3 & 4) Extension Offshore Wind Farm	unavailable	unavailable	unavailable
West of Duddon Sands Offshore Wind Farm	3.~~82~~83	0.~~86~~87	2.~~95~~96
West of Orkney Windfarm	1.94~~unavailable~~	unavailable	unavailable
White Cross Offshore Windfarm	0.~~90~~14	0.~~01~~14	0.~~89~~00
Tier 2			
Morecambe Offshore Windfarm Generation Assets	0.14	0.08	0.07

Project	Annual	Breeding Season	Non-breeding Season
Morgan Offshore Wind Project Generation Assets	0.41	0.31	0.10
Rampion 2 (Rampion Extension) Offshore Wind Farm	2.~~95~~93	0.92	2.01
Total (minus the **Mona** Offshore Wind Project**)**	**~~15.71~~18.37**	**3.~~44~~80**	**~~11.14~~10.26**
Mona Offshore Wind Project	0.~~71~~72	0.~~24~~25	0.47
Cumulative total (all projects)	**~~16.43~~19.09**	**~~3.69~~4.05**	**~~11.61~~10.73**

5.9.3.11 There are a number of projects for which collision risk estimates are unavailable. This is due to various factors including species not being included in CRM or projects not having conducted CRM. To ensure these projects are considered in this assessment project-specific documents have been reviewed to provide a qualitative assessment of collision for each project. This process is summarised in Table 5.121.

Table 5.121: Qualitative assessment of projects considered cumulatively with the Mona Offshore Wind Project for which quantitative consideration of collision risk was not undertaken in project-specific documentation for great black-backed gull.

Project	Reason for estimates being unavailable	Qualitative assessment	Final conclusion
Tier 1			
Burbo Bank Offshore Wind Farm (Seascape Energy Ltd., 2002)	Species not included in CRM	The assessment of collision risk was undertaken on a qualitative basis by investigating flight heights of birds at the project site and was undertaken for species considered to be of International or National importance in the context of the assessments undertaken for the project. Great black-backed gull was not considered to be a species of International or National importance. Surveys of the project comprised aerial and boat-based surveys both of which were undertaken during winter months (aerial = November to April and boat-based = December and February). Aerial surveys covered a large area encompassing the Liverpool Bay SPA with boat-based surveys covering the project area. The surveys were undertaken to provide abundance and distribution data for those species considered to be of most importance, namely common scoter and red-throated diver. Great black-backed gull was not recorded during boat-based surveys with relatively low numbers recorded during aerial surveys.	No assessment was conducted for great black-backed gull in relation to collision risk impacts however, for great black-backed gull was not considered to be a species of International or National importance in the context of the assessments undertaken.

Project	Reason for estimates being unavailable	Qualitative assessment	Final conclusion
Burbo Bank Extension Offshore Wind Farm (DONG Energy, 2013)	Species not included in CRM	CRM was undertaken however great black-backed gull was not included. Site-specific data consisted of six boat-based surveys undertaken between April and September 2011 and six aerial surveys undertaken between November 2010 and April 2011. The peak population of great black-backed gull recorded during boat-based surveys was 18 bids with an average of eight birds. During aerial surveys, great black-backed gulls were recorded in all but one but in small numbers (peak population of 90 birds). The species was considered to be of regional/local importance in the context of the assessment for the project.	No assessment was conducted for great black-backed gull in relation to collision risk impacts.
Walney 1 & 2 Offshore Wind Farms (RPS, 2006)	Species not included in CRM	Site-specific surveys included boat-based surveys undertaken across an area of 512 km^2 in the vicinity of the project between May 2004 and September 2005. The project also utilised survey data collected by regional aerial surveys, undertaken across their aerial survey area between 2002 and 2006 and radar survey data collected between 1st October and 29th October 2005. The peak population of great black-backed gull recorded in the project area plus 2 km buffer during aerial surveys was 43 birds. In boat-based surveys the equivalent population was 65 birds. The proportion of flying great black-backed gulls recorded above 15 m was 28.7 % across all boat-based surveys, although the total number of flying birds was low (108 records). Great black-backed gull was deemed to be a species of medium importance (termed sensitivity in the Walney 1&2 assessments). Great black-backed gull was not included in CRM, and it was considered that, due to the very low numbers of birds recorded at rotor height, that the magnitude of collision was negligible.	Very low significance.

Project	Reason for estimates being unavailable	Qualitative assessment	Final conclusion
West of Duddon Sands Offshore Wind Farm (RSKENSR, 2006)	Species not included in CRM	Site-specific surveys included boat-based surveys undertaken across an area of 512 km^2 in the vicinity of the project between May 2004 and September 2005. The project also utilised survey data collected by regional aerial surveys, undertaken across their aerial survey area between 2002 and 2006 and radar survey data collected between 1st October and 29th October 2005. The peak population of great black-backed gull recorded in the project area plus 2 km buffer during aerial surveys was 2 birds. In boat-based surveys the equivalent population was 661 birds. The proportion of flying great black-backed gulls recorded above 15 m was 28.7 % across all boat-based surveys, although the total number of flying birds was low (108 records). Great black-backed gull was deemed to be a species of medium importance (termed sensitivity in the West of Duddon Sands assessments).	Very low significance.
Gwynt y Môr Offshore Wind Farm (RWE Group and Npower Renewables, 2005)	Species not included in CRM	Site-specific surveys undertaken in support of the project included boat-based surveys undertaken between February 2003 and March 2005. Surveys between February 2003 and February 2004 covered a large area along the Welsh coast incorporating the project area with surveys between March 2004 and March 2005 more focussed on the project area. The assessment also used data from aerial surveys undertaken between 2000 2005 which were targeted at recording common scoter. During boat-based surveys used to characterise the project undertaken between 2004 to 2005, covering an area considered by the project assessment to better represent the behaviour of birds than in 2003-04, 8,900 observations were obtained with only 22 flights recorded at a height of greater than 20 m. In 2004-05 surveys, 70 great black-backed gull were recorded in flight with only 2.9% of these flying above 20 m.	Low significance due to low proportion of flight heights recorded at collision height.

Project	Reason for estimates being unavailable	Qualitative assessment	Final conclusion
Rhyl Flats Offshore Wind Farm (Ecology Consulting, 2002)	Species not included in CRM	Surveys of the project comprised aerial and boat-based surveys. Aerial surveys were undertaken between December 2001 and January 2002 and targeted common scoter, with non-target species not uniformly reported upon. Boat-based surveys were undertaken between January and March 2002 to record movements of common scoter and the flight height of birds. A qualitative assessment was undertaken for 'other seabirds' (a category that included gulls) and it was considered that collision rates would be negligible.	Very low significance.
Robin Rigg Offshore Wind Farm (Natural Power, 2002)	Species not included in CRM	The project utilised site-specific boat-based surveys to characterise the baseline environment. Two surveys were completed in each month from May 2001 for one year. In addition, aerial surveys were undertaken from November 2001 on a monthly basis through winter and spring to verify the distribution and abundance of seaduck. The mean count of great black-backed gull during boat-based surveys in the wind farm was 0.1 birds with a peak of one bird. Great black-backed gull was not assigned an importance rating. The proportion of great black-backed gull flying above 20 m during boat-based surveys across the entire study area was 16%. A qualitative assessment was undertaken for 'other seabirds' (a category that included gulls) and it was considered that collision rates would be low/negligible.	Low/Very low significance.

5.9.3.12 The estimated annual cumulative collision mortality of great black-backed gull from the relevant projects with available data, using species-specific (0.9991) and ~~Natural England-advised~~ species-group~~-specific~~ (0.9939) avoidance rates used in the CRM for cumulative projects is ~~16.43~~19.09 per year and ~~104.60~~129.36 per year, respectively (Table 5.117).

~~5.9.3.12~~5.9.3.13 Using the largest population (during the breeding season) of 44,753 individuals, with an average baseline mortality rate of 0.095 (Table 5.15), the background predicted mortality would be 4,251. The addition of these mortalities to the baseline mortality rate results in an increase of 0.~~39~~419% and 2.~~46~~842% for avoidance rates of 0.9991 and 0.9939, respectively.

~~5.9.3.13 In the non-breeding/winter season, with a population of 17,742 individuals, and an average baseline mortality rate of 0.095 (Table 5.15), the background predicted mortality would be 1,685. The estimated cumulative collision mortality during the non-breeding/winter season for great black-backed gull for species-specific and group-specific avoidance rates is 11.67 and 66.00, respectively. The addition of these mortalities to the baseline mortality rate results in an increase of 0.689% and 3.894% for avoidance rates of 0.9991 and 0.9939.~~

5.9.3.14 As the predicted increase in baseline mortality of the population for great black-backed gull exceeds an increase of 1% when considering an avoidance rate of ~~99.28~~0.9939 in the non-breeding season and annually, as a first step to understand if further mitigation is required, impacts were assessed in Volume 6, Annex 5.6: Offshore ornithology population viability analysis technical report of the Environmental Statement~~.~~ (Document reference F6.5.6).

5.9.3.15 The PVA revealed that the addition of great black-backed gull collision impacts from cumulative offshore wind farms would ~~reduce the growth rate of the non-breeding/wintering population by 0.0008 for avoidance rate of 0.9991 and 0.0045 for avoidance rate of 0.9939. The model predicts a positive rate of growth for the population based on growth rates of 1.122 to 1.127 per annum at the range of scenarios from unimpacted baseline to 0.9991 and 0.9939 avoidance rate.~~result in the population being 1.6% to 10.1% smaller under the two impact scenarios (species-group avoidance rate (0.9939) or species-specific avoidance rate (0.9991)) after 35 years (in 2065), than a non-impacted population. The predicted growth rate under the two impact scenarios and the unimpacted baseline scenario would continue to be positive, including when considering the lower and upper 95% confidence intervals. The counterfactural of growth rate is 1.000 (i.e. no change) when considering the species-specific avoidance rate (0.9991) or 0.997 when considering the species-group avoidance rate (0.9939).

~~5.9.3.16 It is assumed that despite any additional mortality, the population is still expected to continue to grow and will be larger after 35 years than that what is currently recorded. The reduced growth rate of 1.126 (lower confidence interval 1.119, upper confidence interval 1.132) for avoidance rate of 0.9991 and of 1.122 (lower confidence interval 1.116, upper confidence interval 1.128) would not trigger a risk of population decline and would only result in a slight reduction in the growth rate currently seen in the BDMPS population.~~

~~5.9.3.17~~5.9.3.16 Due to the minimal level of change to baseline conditions, the cumulative effect is predicted to be of national spatial extent, long term duration, continuous and high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **low**.

Herring gull

5.9.3.185.9.3.17 The expected mean seasonal and annual collision mortality for herring gull has been compiled for relevant offshore wind farms and is shown in Table 5.122**Error! Reference source not found.** using the Natural England advocatedspecies-group avoidance rate of 99.39. Additionally, within Table 5.120 avoidance rates have been corrected to account for the species-specific avoidance rate of 99.52 calculated by Ozsanlav-Harris *et al.* (2023) which are considered more appropriate for this species, with species-specific estimates based on sufficient sample size.

Table 5.122: Expected annual collision mortality across relevant offshore wind farms for herring gull (Avoidanceavoidance rate 99.39)

Project	Annual	Breeding Season	Non-breeding Season
Tier 1			
Awel y Môr Offshore Wind Farm	1.493.61	0.842.03	0.651.59
Burbo Bank Offshore Wind Farm	unavailable	unavailable	unavailable
Burbo Bank Extension Offshore Wind Farm	23.7513.17	unavailable	unavailable
Erebus Floating Wind Demo	0.674.60	0.002.83	0.671.77
Gwynt y Môr Offshore Wind Farm	unavailable	unavailable	unavailable
TwinHub (Wave Hub Floating Wind Farm)	23.0033.55	unavailable	unavailable
Ormonde Wind Farm	0.3644	unavailable	unavailable
Robin Rigg Offshore Wind Farm	unavailable	unavailable	unavailable
Rhyl Flats Offshore Wind Farm	unavailable	unavailable	unavailable
Walney 1 & 2 Offshore Wind Farms	unavailable	unavailable	unavailable
Walney (3 & 4) Extension Offshore Wind Farm	62.0075.64	38.0046.36	2429.28
West of Duddon Sands Offshore Wind Farm	unavailable	unavailable	unavailable
West of Orkney Windfarm	6.100	0.10	60
White Cross Offshore Windfarm	0.7030	0.7030	0
Tier 2			

Project	Annual	Breeding Season	Non-breeding Season
Morecambe Offshore Windfarm Generation Assets	~~0.98~~3.42	0.~~53~~93	~~0.45~~2.49
Morgan Offshore Wind Project Generation Assets	~~2.81~~11.82	2.~~10~~57	~~0.71~~9.25
Total (minus the Mona Offshore Wind Project)	**~~121.85~~ 146.56**	**~~42.27~~ 55.02**	**~~29~~ 44.38**
Mona Offshore Wind Project	~~4.82~~1.51	~~1.64~~0.03	~~3.18~~1.48
Cumulative total (all projects)	**~~126.67~~ 148.07**	**~~43.91~~ 55.05**	**~~32~~ 45.86**

Table 5.123: Expected annual collision mortality across relevant offshore wind farms for herring gull (~~Avoidance~~avoidance rate 99.52)

Project	Annual	Breeding Season	Non-breeding Season
Tier 1			
Awel y Môr Offshore Wind Farm	~~1.43~~2.84	~~0.81~~1.59	~~0.62~~1.25
Burbo Bank Offshore Wind Farm	~~-~~unavailable	unavailable	unavailable
Burbo Bank Extension Offshore Wind Farm	10.36	unavailable	unavailable
Erebus Floating Wind Demo	~~0.64~~ 3.62	~~0.00~~ 2.23	~~0.64~~ 1.39
Gwynt y Môr Offshore Wind Farm	unavailable	unavailable	unavailable
TwinHub (Wave Hub Floating Wind Farm)	~~10.04~~26.40	unavailable	unavailable
Ormonde Wind Farm	0.35	unavailable	unavailable
Robin Rigg Offshore Wind Farm	unavailable	unavailable	unavailable
Rhyl Flats Offshore Wind Farm	unavailable	unavailable	unavailable
Walney 1 & 2 Offshore Wind Farms	unavailable	unavailable	unavailable
Walney (3 & 4) Extension Offshore Wind Farm	59.52	36.48	23.04
West of Duddon Sands Offshore Wind Farm	unavailable	unavailable	unavailable

Project	Annual	Breeding Season	Non-breeding Season
West of Orkney Windfarm	~~4.88~~0	0~~.08~~	~~4.80~~0
White Cross Offshore Windfarm	0.~~67~~24	0.~~67~~24	0.00
Tier 2			
Morecambe Offshore Windfarm Generation Assets	~~0.78~~2.69	0.~~42~~73	~~0.36~~1.96
Morgan Offshore Wind Project Generation Assets	~~2.25~~9.30	~~1.68~~2.02	~~0.57~~7.28
Total (minus the **Mona Offshore Wind Project)**	**~~91~~115.32**	**~~40~~ 43.29**	**~~30.03~~ 34.92**
Mona Offshore Wind Project	~~3.86~~1.19	~~1.31~~0.02	~~2.54~~1.16
Cumulative total (all projects)	**~~94.77~~ 116.51**	**~~41.45~~ 43.31**	**~~32.58~~ 36.08**

~~5.9.3.19~~5.9.3.18 There are a number of projects for which collision risk estimates are unavailable. This is due to various factors including species not being included in CRM or projects not having conducted CRM. To ensure these projects are considered in this assessment project-specific documents have been reviewed to provide a qualitative assessment of collision for each project. This process is summarised in Table 5.124.

Table 5.124: Qualitative assessment of projects considered cumulatively with the Mona Offshore Wind Project for which quantitative consideration of collision risk was not undertaken in project-specific documentation for herring gull

Project	Reason for estimates being unavailable	Qualitative assessment	Final conclusion
Tier 1			
Burbo Bank Offshore Wind Farm (Seascape Energy Ltd., 2002)	Species not included in CRM	The assessment of collision risk was undertaken on a qualitative basis by investigating flight heights of birds at the project site and was undertaken for species considered to be of International or National importance in the context of the assessments undertaken for the project. Herring gull was not considered to be a species of International or National importance. Surveys of the project comprised aerial and boat-based surveys both of which were undertaken during winter months (aerial = November to April and boat-based = December and February). Aerial surveys covered a large area encompassing the Liverpool Bay SPA with boat-based surveys covering the project area. The surveys were undertaken to provide abundance and distribution data for those species considered to be of most importance, namely common scoter and red-throated diver. Herring gull was not recorded during boat-based surveys with relatively low numbers recorded during aerial surveys.	No assessment was conducted for herring gull in relation to collision risk impacts however, for herring gull was not considered to be a species of International or National importance in the context of the assessments undertaken.

Project	Reason for estimates being unavailable	Qualitative assessment	Final conclusion
Walney 1 & 2 Offshore Wind Farms (RPS, 2006)	Species not included in CRM	Site-specific surveys included boat-based surveys undertaken across an area of 512 km^2 in the vicinity of the project between May 2004 and September 2005. The project also utilised survey data collected by regional aerial surveys, undertaken across their aerial survey area between 2002 and 2006 and radar survey data collected between 1st October and 29th October 2005. The peak population of herring gull recorded in the project area plus 2 km buffer during aerial surveys was 47 birds. In boat-based surveys the equivalent population was 78 birds. The proportion of flying herring gulls recorded above 15 m was 21.1 % across all boat-based surveys, although the total number of flying birds was low (90 records). Herring gull was deemed to be a species of very high importance due to SPA connectivity (termed sensitivity in the Walney 1&2 assessments). Herring gull was not included in CRM, and it was considered that, due to the very low numbers of birds recorded at rotor height, that the magnitude of collision was negligible.	Low significance.

Project	Reason for estimates being unavailable	Qualitative assessment	Final conclusion
West of Duddon Sands Offshore Wind Farm (RSKENSR, 2006)	Species not included in CRM	Site-specific surveys included boat-based surveys undertaken across an area of 512 km^2 in the vicinity of the project between May 2004 and September 2005. The project also utilised survey data collected by regional aerial surveys, undertaken across their aerial survey area between 2002 and 2006 and radar survey data collected between 1st October and 29th October 2005. The peak population of herring gull recorded in the project area plus 2 km buffer during aerial surveys was 6 birds. In boat-based surveys the equivalent population was 1,562 birds. The proportion of flying herring gulls recorded above 15 m was 21.1 % across all boat-based surveys, although the total number of flying birds was low (90 records). Herring gull was deemed to be a species of very high importance due to SPA connectivity (termed sensitivity in the West of Duddon Sands assessments). Herring gull was not included in CRM, and it was considered that, due to the very low numbers of birds recorded at rotor height, that the magnitude of collision was negligible.	Low significance.

Project	Reason for estimates being unavailable	Qualitative assessment	Final conclusion
Gwynt y Môr Offshore Wind Farm (RWE Group and Npower Renewables, 2005)	Species not included in CRM	Site-specific surveys undertaken in support of the project included boat-based surveys undertaken between February 2003 and March 2005. Surveys between February 2003 and February 2004 covered a large area along the Welsh coast incorporating the project area with surveys between March2004 and March 2005 more focussed on the project area. The assessment also used data from aerial surveys undertaken between 2000 2005 which were targeted at recording common scoter. During boat-based surveys used to characterise the project undertaken between 2004-05, covering an area considered by the project assessment to better represent the behaviour of birds than in 2003-04, 8,900 observations were obtained with only 22 flights recorded at a height of greater than 20 m. In 2004-05 surveys, 225 herring gulls were recorded in flight with only 1.3% of these flying above 20 m.	Low significance due to low proportion of flight heights recorded at collision height.
Rhyl Flats Offshore Wind Farm (Ecology Consulting, 2002)	Species not included in CRM	Surveys of the project comprised aerial and boat-based surveys. Aerial surveys were undertaken between December 2001 and January 2002 and targeted common scoter, with non-target species not uniformly reported upon. Boat-based surveys were undertaken between January and March 2002 to record movements of common scoter and the flight height of birds. A qualitative assessment was undertaken for 'other seabirds' (a category that included gulls) and it was considered that collision rates would be negligible.	Very low significance.

Project	Reason for estimates being unavailable	Qualitative assessment	Final conclusion
Robin Rigg Offshore Wind Farm (Natural Power, 2002)	Species not included in CRM	The project utilised site-specific boat-based surveys to characterise the baseline environment. Two surveys were completed in each month from May 2001 for one year. In addition, aerial surveys were undertaken from November 2001 on a monthly basis through winter and spring to verify the distribution and abundance of seaduck. The mean count of herring gull during boat-based surveys in the wind farm was 0.9 birds with a peak of three birds. Herring gull was considered to be of local importance based on the populations recorded in the wind farm. The proportion of herring gull flying above 20 m during boat-based surveys across the entire study area was 8%. A qualitative assessment was undertaken for 'other seabirds' (a category that included gulls) and it was considered that collision rates would be low/negligible.	Low/Very low significance

5.9.3.205.9.3.19 The estimated annual cumulative collision mortality of herring gull from the relevant projects with available data, using species-specific (0.9952) and Natural England-advised species-group-specific (0.9939) avoidance rates used in the CRM for cumulative projects is 94.77 116.51 per year and 126.67 148.07 per year, respectively.

5.9.3.215.9.3.20 Using the largest population (during the breeding season) of 217,167 individuals, with an average baseline mortality rate of 0.171 (Table 5.15), the background predicted mortality would be 37,136. The addition of 94.77 116.51 mortalities per year and 126.67when considering the species-specific avoidance rate (0.9952) or 148.07 mortalities per year mortalities when considering the species-group avoidance rate (0.9939) would increase the baseline mortality rate by 0.255% and314% or 0.341%399%, respectively. The annual predicted mortality from the cumulative collision risk assessment is below the 1% threshold increase in baseline mortality.

5.9.3.225.9.3.21 The cumulative effect is predicted to be of national spatial extent, long term duration, continuous and high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **low.**

Lesser black-backed gull

5.9.3.235.9.3.22 The expected mean seasonal and annual collision mortality for lesser black-backed gull has been compiled for relevant offshore wind farms and is shown in Table 5.125, using the Natural England advocatedspecies-group avoidance rate of 99.39. Additionally, within Table 5.120 avoidance rates have been corrected to account for the species-specific avoidance rate of 99.54 calculated by Ozsanlav-Harris *et al.* (2023) which are considered more appropriate for this species, with species-specific estimates based on sufficient sample size.

Table 5.125: Expected annual collision mortality across relevant offshore wind farms for lesser black-backed gull (Avoidanceavoidance rate 99.39)

Project	Annual	Pre-breeding season	Breeding season	Post-breeding season	Non-breeding Season
Tier 1					
Awel y Môr Offshore Wind Farm	0.00	0.00	0.00	0.00	unavailable
Burbo Bank Offshore Wind Farm	unavailable	unavailable	unavailable	unavailable	unavailable
Burbo Bank Extension Offshore Wind Farm	44.0053.68	unavailable	unavailable	unavailable	unavailable
Erebus Floating Wind Demo	6.738.21	0.00	6.247.61	0.4960	Grouped as post-breeding
Gwynt y Môr Offshore Wind Farm	5.00	unavailable	unavailable	unavailable	unavailable
TwinHub (Wave Hub Floating Wind Farm)	6.003.77	unavailable	unavailable	unavailable	unavailable

Project	Annual	Pre-breeding season	Breeding season	Post-breeding season	Non-breeding Season
Ormonde Wind Farm	~~22.10~~26.96	unavailable	unavailable	unavailable	unavailable
Robin Rigg Offshore Wind Farm	unavailable	unavailable	unavailable	unavailable	unavailable
Rhyl Flats Offshore Wind Farm	1.00	unavailable	unavailable	unavailable	unavailable
Walney 1 & 2 Offshore Wind Farms	~~57.20~~69.78	unavailable	unavailable	unavailable	unavailable
Walney (3 & 4) Extension Offshore Wind Farm	~~29.30~~35.75	~~2.60~~3.17	~~7.30~~8.91	~~6.20~~7.56	~~13.20~~16.10
West of Duddon Sands Offshore Wind Farm	~~52.40~~63.93	unavailable	unavailable	unavailable	unavailable
West of Orkney Windfarm	unavailable	unavailable	unavailable	unavailable	unavailable
White Cross Offshore Windfarm	0.~~30~~41	0.00	0.~~30~~41	0.00	0.00
Tier 2					
Morecambe Offshore Windfarm Generation Assets	4.36	0.00	2.00	2.03	0.33
Morgan Offshore Wind Project Generation Assets	0.99	0.00	0.00	0.55	Grouped as post-breeding
Total (minus the **Mona** Offshore Wind Project**)**	**~~229.38~~273.84**	**~~2.60~~3.17**	**~~15.84~~18.93**	**~~9.27~~10.74**	**~~13.52~~16.43**
Mona Offshore Wind Project	1.92	0.83	0.33	0.00	0.~~01~~76
Cumulative total (all projects)	**~~231.30~~275.76**	**~~3.43~~4.00**	**~~16.17~~19.26**	**~~9.27~~10.74**	**~~13.53~~17.19**

Table 5.126: Expected annual collision mortality across relevant offshore wind farms for lesser black-backed gull (~~Avoidance~~avoidance rate 99.54)

Project	Annual	Pre-breeding season	Breeding Season	Post-breeding season	Non-breeding Season
Tier 1					
Awel y Môr Offshore Wind Farm	0.00	0.00	0.00	0.00	unavailable
Burbo Bank Offshore Wind Farm	unavailable	unavailable	unavailable	unavailable	unavailable
Burbo Bank Extension Offshore Wind Farm	40.48	unavailable	unavailable	unavailable	unavailable
Erebus Floating Wind Demo	6.19	0.00	5.74	0.45	0.00
Gwynt y Môr Offshore Wind Farm	4.60	unavailable	unavailable	unavailable	unavailable
TwinHub (Wave Hub Floating Wind Farm)	2.~~51~~84	unavailable	unavailable	unavailable	unavailable
Ormonde Wind Farm	20.33	unavailable	unavailable	unavailable	unavailable
Robin Rigg Offshore Wind Farm	unavailable	unavailable	unavailable	unavailable	unavailable
Rhyl Flats Offshore Wind Farm	0.92	unavailable	unavailable	unavailable	unavailable
Walney 1 & 2 Offshore Wind Farms	52.62	unavailable	unavailable	unavailable	unavailable
Walney (3 & 4) Extension Offshore Wind Farm	26.96	2.39	6.72	5.70	12.14
West of Duddon Sands Offshore Wind Farm	48.21	unavailable	unavailable	unavailable	unavailable
West of Orkney Windfarm	Species not assessed due to low numbers recorded	Species not assessed due to low numbers recorded	Species not assessed due to low numbers recorded	Species not assessed due to low numbers recorded	Species not assessed due to low numbers recorded

Project	Annual	Pre-breeding season	Breeding Season	Post-breeding season	Non-breeding Season
White Cross Offshore Windfarm	0.~~27~~31	0.00	0.~~27~~31	0.00	0.00
Tier 2					
Morecambe Offshore Windfarm Generation Assets	3.~~34~~29	0.00	1.~~53~~51	1.~~56~~53	0.25
Morgan Offshore Wind Project Generation Assets	0.~~76~~75	0.00	0.00	0.~~42~~41	0.00
Total (minus the Mona Offshore Wind Project)	**207.~~20~~50**	**2.39**	**14.~~26~~28**	**8.~~14~~09**	**12.39**
Mona Offshore Wind Project	1.47	0.64	0.~~25~~26	0.00	0.~~01~~58
Cumulative total (all projects)	**208.~~67~~97**	**3.~~03~~02**	**14.~~52~~54**	**8.~~14~~09**	**12.~~40~~97**

~~5.9.3.24~~5.9.3.23 There are a number of projects for which collision risk estimates are unavailable. This is due to various factors including species not being included in CRM or projects not having conducted CRM. To ensure these projects are considered in this assessment project-specific documents have been reviewed to provide a qualitative assessment of collision for each project. This process is summarised in Table 5.127.

Table 5.127 Qualitative assessment of projects considered cumulatively with the Mona Offshore Wind Project for which quantitative consideration of collision risk was not undertaken in project-specific documentation for lesser black-backed gull.

Project	Reason for estimates being unavailable	Qualitative assessment	Final conclusion
Tier 1			
Robin Rigg Offshore Wind Farm (Natural Power, 2002)	CRM was not undertaken	The project utilised site-specific boat-based surveys to characterise the baseline environment. Two surveys were completed in each month from May 2001 for one year. In addition, aerial surveys were undertaken from November 2001 on a monthly basis through winter and spring to verify the distribution and abundance of seaduck. The mean count of lesser black-backed gull during boat-based surveys in the wind farm was 0.2 birds with a peak of 3 birds. Lesser black-backed gull was considered to be of local importance based on the populations recorded in the wind farm. The proportion of lesser black-backed gull flying above 20 m during boat-based surveys across the entire study area was 24% A qualitative assessment was undertaken for 'other seabirds' (a category that included gulls) and it was considered that collision rates would be low/negligible.	Low/very low significance
Awel-y-Môr Offshore Wind Farm (RWE Renewables UK, 2022)	Species not included in CRM	Project -specific surveys comprised 24 months of DAS undertaken between March 2019 and February 2021. Lesser black-backed gulls were recorded in only one of the baseline aerial surveys. Eight birds were recorded in July 2020.	Project concluded: *"Recorded in negligible numbers, therefore the level of potential impact would be indistinguishable from natural fluctuations in* [BDMPS] *baseline mortality"*

~~5.9.3.25~~5.9.3.24 The estimated cumulative collision mortality of lesser black-backed gull from the relevant projects with available data is ~~231.30~~275.76 per year using ~~Natural England advocated~~species-group avoidance rate of 99.39% and 208.~~67~~97 per year using species-specific rates of 99.54%.

~~5.9.3.26~~5.9.3.25 Using the largest population of 240,750 individuals, with an average baseline mortality rate of 0.121 (Table 5.15), the background predicted mortality would be 29,131 The addition of ~~231.30~~275.76 and 208.~~67~~97 mortalities would increase the baseline mortality rate by 0.~~794%~~947% and 0.~~716%~~717% respectively. The annual predicted mortality from the cumulative collision risk assessment is below the 1% threshold increase in baseline mortality.

~~5.9.3.27~~5.9.3.26 The cumulative effect is predicted to be of national spatial extent, long term duration, continuous and high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **low**.

Northern gannet

~~5.9.3.28~~5.9.3.27 The expected mean seasonal and annual collision mortality for ~~lesser black-backed gull~~northern gannet has been compiled for relevant offshore wind farms and is shown in Table 5.128, using the ~~Natural England advocated~~species-group avoidance rate of 99.28.

Table 5.128: Expected annual collision mortality across relevant offshore wind farms for northern gannet (~~Avoidance~~avoidance rate 99.28)

Project	Annual	Pre-breeding season	Breeding season	Post-breeding season
Tier 1				
Awel y Môr Offshore Wind Farm	13.41	0.00	~~9.43~~10.88	~~3.99~~2.53
Burbo Bank Offshore Wind Farm	unavailable~~12.24~~	unavailable	unavailable	unavailable
Burbo Bank Extension Offshore Wind Farm	12.44~~unavailable~~	unavailable	unavailable	unavailable
Erebus Floating Wind Demo	4.59	0.61	3.37	0.61
Gwynt y Môr Offshore Wind Farm	unavailable	unavailable	unavailable	unavailable
TwinHub (Wave Hub Floating Wind Farm)	26.~~18~~12	unavailable	unavailable	unavailable
Ormonde Wind Farm	6.72	unavailable	unavailable	unavailable
Robin Rigg Offshore Wind Farm	unavailable	unavailable	unavailable	unavailable
Rhyl Flats Offshore Wind Farm	unavailable	unavailable	unavailable	unavailable
Walney 1 & 2 Offshore Wind Farms	unavailable	unavailable	unavailable	unavailable

Project	Annual	Pre-breeding season	Breeding season	Post-breeding season
Walney (3 & 4) Extension Offshore Wind Farm	33.77unavailable	0.92unavailable	unavailable16.30	16.56unavailable
West of Duddon Sands Offshore Wind Farm	unavailable33.77	unavailable0.92	unavailable16.30	unavailable16.56
West of Orkney Windfarm	48.83	2.10	33.80	12.92
White Cross Offshore Windfarm	6.11611	0	4.42342	1.69369
Tier 2				
Morecambe Offshore Windfarm Generation Assets	0.08	0.00	0.08	0.00
Morgan Offshore Wind Project Generation Assets	2.15	0.22	1.68	0.25
Total (minus the Mona Offshore Wind Project)	**150.18154.22**	**3.85**	**66.2570.53**	**34.9456**
Mona Offshore Wind Project	65.65	0.6241	3.864.73	1.160.51
Cumulative total (all projects)	**156.82159.87**	**4.4726**	**70.1175.26**	**36.1035.07**

5.9.3.295.9.3.28 There are a number of projects for which collision risk estimates are unavailable. This is due to various factors including species not being included in CRM or projects not having conducted CRM. To ensure these projects are considered in this assessment project-specific documents have been reviewed to provide a qualitative assessment of collision for each project. This process is summarised in Table 5.129.

Table 5.129 Qualitative assessment of projects considered cumulatively with the Mona Offshore Wind Proejct for which quantitative consideration of collision risk was not undertaken in project-specific documentation for northern gannet

Project	Reason for estimates being unavailable	Qualitative assessment	Final conclusion
Tier 1			
Burbo Bank Offshore Wind Farm (Seascape Energy Ltd., 2002)	Species not included in CRM	The assessment of collision risk was undertaken on a qualitative basis by investigating flight heights of birds at the project site and was undertaken for species considered to be of International or National importance in the context of the assessments undertaken for the project. Gannet was not considered to be a species of International or National importance. Surveys of the project comprised aerial and boat-based surveys both of which were undertaken during winter months (aerial = November to April and boat-based = December and February). Aerial surveys covered a large area encompassing the Liverpool Bay SPA with boat-based surveys covering the project area. The surveys were undertaken to provide abundance and distribution data for those species considered to be of most importance, namely common scoter and red-throated diver. Gannet was not recorded during boat-based surveys with relatively low numbers recorded during aerial surveys.	No assessment was conducted for gannet in relation to collision risk impacts however, for gannet was not considered to be a species of International or National importance in the context of the assessments undertaken.
Walney 1 & 2 Offshore Wind Farms (RPS, 2006)	Species not included in CRM	Site-specific surveys included boat-based surveys undertaken across an area of 512 km^2 in the vicinity of the project between May 2004 and September 2005. The project also utilised survey data collected by regional aerial surveys, undertaken across their aerial survey area between 2002 and 2006 and radar survey data collected between 1st October and 29th October 2005. The peak population of gannet recorded in the project area plus 2 km buffer during aerial surveys was 52 birds. In boat-based surveys the equivalent population was 332 birds. The proportion of flying gannets recorded above 15 m was 21.5 % across all boat-based surveys within the boat-based survey area. Gannet was deemed to be a species of medium importance due to SPA connectivity (termed sensitivity in the Walney 1&2 assessments). Gannet was not included in CRM and it was considered that many gannet would avoid the wind farm area due to alternative foraging	Low significance.

Project	Reason for estimates being unavailable	Qualitative assessment	Final conclusion
		habitats being available to this species. It was concluded that there was a low magnitude impact for this species associated with collision.	
West of Duddon Sands Offshore Wind Farm (RSKENSR, 2006)	Species not included in CRM	Site-specific surveys included boat-based surveys undertaken across an area of 512 km^2 in the vicinity of the project between May 2004 and September 2005. The project also utilised survey data collected by regional aerial surveys, undertaken across their aerial survey area between 2002 and 2006 and radar survey data collected between 1st October and 29th October 2005. The peak population of gannet recorded in the project area plus 2 km buffer during aerial surveys was 57 birds. In boat-based surveys the equivalent population was 431 birds. The proportion of flying gannets recorded above 15 m was 21.5 % across all boat-based surveys within the boat-based survey area. Gannet was deemed to be a species of medium importance due to SPA connectivity (termed sensitivity in the West of Duddon Sands assessments). Gannet was not included in CRM and it was considered that many gannet would avoid the wind farm area due to alternative foraging habitats being available to this species. It was concluded that there was a low magnitude impact for this species associated with collision.	Low significance.
Gwynt y Môr Offshore Wind Farm (RWE Group and Npower Renewables, 2005)	Species not included in CRM	Site-specific surveys undertaken in support of the project included boat-based surveys undertaken between February 2003 and March 2005. Surveys between February 2003 and February 2004 covered a large area along the Welsh coast incorporating the project area with surveys between March 2004 and March 2005 more focussed on the project area. The assessment also used data from aerial surveys undertaken between 2000 and 2005 which were targeted at recording common scoter. Very few gannet were recorded during boat-based surveys between October and March. More birds were present in summer months with a large proportion on the sea surface. During boat-based surveys used to characterise the project undertaken between 2004-05, covering an area considered by the project	Low significance due to low proportion of flight heights recorded at collision height.

Project	Reason for estimates being unavailable	Qualitative assessment	Final conclusion
		assessment to better represent the behaviour of birds than in 2003-04, 8,900 observations were obtained with only 22 flights recorded at a height of greater than 20 m. In 2004-05 surveys, 583 gannets were recorded in flight with only 0.7% of these flying above 20 m.	
Rhyl Flats Offshore Wind Farm (Ecology Consulting, 2002)	Species not included in CRM	Surveys of the project comprised aerial and boat-based surveys. Aerial surveys were undertaken between November 2001 and January 2002 and targeted common scoter, with non-target species not uniformly reported upon. Boat-based surveys were undertaken between January and March 2002 to record movements of common scoter and the flight height of birds. Gannet were only recorded in one of the aerial surveys with 52 birds recorded in November 2001. Gannet was not considered to be an ‘other seabird’ species that would occur in sufficient numbers to be at risk of collision impacts.	Very low significance.
Robin Rigg Offshore Wind Farm (Natural Power, 2002)	Species not included in CRM	The project utilised site-specific boat-based surveys to characterise the baseline environment. Two surveys were completed in each month from May 2001 for one year. In addition, aerial surveys were undertaken from November 2001 on a monthly basis through winter and spring to verify the distribution and abundance of seaduck. The mean count of gannet during boat-based surveys in the wind farm was 0.4 birds with a peak of four birds. Gannet was considered to be of local importance based on the populations recorded in the wind farm. The proportion of gannet flying above 20 m during boat-based surveys across the entire study area was 3% Gannet was not considered to be an ‘other seabird’ species that would occur in sufficient numbers to be at risk of collision impacts.	Low/Very low significance.

~~5.9.3.30~~5.9.3.29 The estimated cumulative collision mortality of northern gannet from the relevant projects with available data is ~~156.54~~159.87 per year.

~~5.9.3.31~~5.9.3.30 Using the largest population of 661,888 individuals, with an average baseline mortality rate of 0.193 (Table 5.15), the background predicted mortality would be 127,744. The addition of ~~156.54~~159.87 mortalities would increase the baseline mortality rate by 0.~~123~~125%. The annual predicted mortality from the cumulative collision risk assessment is well below the 1% threshold increase in baseline mortality.

~~5.9.3.32~~5.9.3.31 The cumulative effect is predicted to be of national spatial extent, long term duration, continuous and high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **low.**

Migratory birds

~~5.9.3.33~~5.9.3.32 A total of ~~15~~16 migratory species are estimated to experience a cumulative collision mortality greater than one per year. This includes nine wader species, five duck species and one gull.

~~5.9.3.34~~5.9.3.33 Due to their very large biogeographic population size and migration routes through the Irish sea, wader species were at the greatest risk of collision. Despite this, no increase in annual mortality due to a combined collision risk is anticipated to be greater than 0.09% (dunlin, sub-species *alpina*) for any wader species.

~~5.9.3.35~~5.9.3.34 The annual predicted mortality from the cumulative collision risk assessment is below the 1% threshold increase in baseline mortality for all assessed migratory bird species.

~~5.9.3.36~~5.9.3.35 Due to the minimal level of change to baseline mortality across the migratory bird species, the cumulative effect is predicted to be of national spatial extent, medium to long term duration, continuous and high reversibility. It is predicted that the impact will affect the receptor group directly. The magnitude is therefore, considered to be **low.**

Table 5.130: Expected annual collision mortality across relevant offshore wind farms for all migratory bird species assessed for collision risk.

Project	Species									
	Bewick’ s swan	Whooper swan	White-fronted goose	Light-bellied brent goose	Shelduck	Wigeon	Gadwall	Teal	Mallard	Pintail
Tier 1										
Barrow Offshore Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Burbo Bank Offshore Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Burbo Bank Extension Offshore Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	0.00	Unavailable	Unavailable	0.00	Unavailable	0.00
North Hoyle Offshore Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Ormonde Wind Farm	Unavailable	0.12	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Walney 1 & 2 Offshore Wind Farms	Unavailable	N/A	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Walney (3 & 4) Extension Offshore Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	1.00	2.00	Unavailable	1.00	Unavailable	0.00
West of Duddon Sands Offshore Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Gwynt y Môr Offshore Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Rhyl Flats Offshore Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Robin Rigg Offshore Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Arklow Bank Wind Park Phase 1	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Awel y Môr Offshore Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Erebus Floating Wind Demo	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable

Project	Species									
	Bewick's swan	Whooper swan	White-fronted goose	Light-bellied brent goose	Shelduck	Wigeon	Gadwall	Teal	Mallard	Pintail
Tier 2										
Morgan Generation Assets	0.02	0.13	0.06	0.21	0.04	0.18	0.00	0.09	0.09	0.00
Morecambe Offshore Windfarm Generation Assets	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
North Irish Sea Array	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Codling Wind Park	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Dublin Array Offshore Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Oriel Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Arklow Bank Wind Park Phase 2	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Shelmalere Offshore Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Llyr 1 Floating Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Llyr 2 Floating Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
White Cross Offshore Windfarm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Inis Eagla Marine Energy Park	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Total (minus Mona Offshore Wind Project)	**0.00**	**0.12**	**0.00**	**0.00**	**1.00**	**2.00**	**0.00**	**1.00**	**0.00**	**0.00**
Mona Offshore Wind Project	0.01	0.40	0.15	0.01	0.22	1.78	0.14	1.60	2.89	0.08
Cumulative total	**0.01**	**0.52**	**0.15**	**0.01**	**1.22**	**3.78**	**0.14**	**2.6**	**2.89**	**0.08**
Increase in baseline mortality (%)	**0.02**	**0.13**	**0.06**	**0.21**	**0.04**	**0.18**	**0.00**	**0.09**	**0.09**	**0.00**

Table 5.131: Expected annual collision mortality across relevant offshore wind farms for all migratory bird species assessed for collision risk.

Project	Species									
	Shoveler	Pochard	Tufted duck	Scaup	Long-tailed duck	Common scoter	Goldeneye	Red-breasted merganser	Great northern diver	European storm petrel
Tier 1										
Barrow Offshore Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Burbo Bank Offshore Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Burbo Bank Extension Offshore Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	2.00	Unavailable	Unavailable	Unavailable	Unavailable
North Hoyle Offshore Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Ormonde Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	0.85	Unavailable	Unavailable	Unavailable	Unavailable
Walney 1 & 2 Offshore Wind Farms	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Walney (3 & 4) Extension Offshore Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
West of Duddon Sands Offshore Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Gwynt y Môr Offshore Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Rhyl Flats Offshore Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Robin Rigg Offshore Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Arklow Bank Wind Park Phase 1	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Awel y Môr Offshore Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	0.04	Unavailable	Unavailable
Erebus Floating Wind Demo	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	0.00

Project	Species									
	Shoveler	Pochard	Tufted duck	Scaup	Long-tailed duck	Common scoter	Goldeneye	Red-breasted merganser	Great northern diver	European storm petrel
Tier 2										
Morgan Generation Assets	0.01	0.09	0.08	0.01	0.01	0.00	0.02	0.01	Unavailable	Unavailable
Morecambe Offshore Windfarm Generation Assets	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
North Irish Sea Array	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Codling Wind Park	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Dublin Array Offshore Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Oriel Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Arklow Bank Wind Park Phase 2	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Shelmalere Offshore Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Llyr 1 Floating Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Llyr 2 Floating Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
White Cross Offshore Windfarm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Inis Eagla Marine Energy Park	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Total (minus Mona Offshore Wind Project)	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**2.85**	**0.00**	**0.04**	**0.00**	**0.00**
Mona Offshore Wind Project	0.08	0.12	0.54	0.03	0.05	0.04	0.08	0.04	0.02	0.30
Cumulative total	**0.08**	**0.12**	**0.54**	**0.03**	**0.05**	**2.89**	**0.08**	**0.08**	**0.02**	**0.30**
Increase in baseline mortality (%)	**0.001**	**0.001**	**0.001**	**0.001**	**0.001**	**0.010**	**0.002**	**0.004**	**0.006**	**0.008**

Table 5.132: Expected annual collision mortality across relevant offshore wind farms for all migratory bird species assessed for collision risk.

Project	Species									
	Leach's storm petrel	Bittern	Great crested grebe	Slavonian grebe	Hen harrier	Osprey	Merlin	Corncrake	Oystercatcher (breeding)	Oystercatcher (non-breeding)
Tier 1										
Barrow Offshore Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Burbo Bank Offshore Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Burbo Bank Extension Offshore Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	0.00	0.00
North Hoyle Offshore Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Ormonde Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Walney 1 & 2 Offshore Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Walney (3 & 4) Extension Offshore Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	4.00	4.00
West of Duddon Sands Offshore Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Gwynt y Môr Offshore Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Rhyl Flats Offshore Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Robin Rigg Offshore Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Arklow Bank Wind Park Phase 1	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Awel y Môr Offshore Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	1.11	1.11
Erebus Floating Wind Demo	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable

Project	Species									
	Leach's storm petrel	Bittern	Great crested grebe	Slavonian grebe	Hen harrier	Osprey	Merlin	Corncrake	Oystercatcher (breeding)	Oystercatcher (non-breeding)
Tier 2										
Morgan Generation Assets	Unavailable	0.01	0.01	0.00	0.00	0.00	0.14	0.01	0.19	0.23
Morecambe Offshore Windfarm Generation Assets	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
North Irish Sea Array	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Codling Wind Park	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Dublin Array Offshore Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Oriel Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Arklow Bank Wind Park Phase 2	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Shelmalere Offshore Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Llyr 1 Floating Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Llyr 2 Floating Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
White Cross Offshore Windfarm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Inis Eagla Marine Energy Park	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Total (minus Mona Offshore Wind Project)	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**5.11**	**5.11**
Mona Offshore Wind Project	0.75	0.03	0.06	0.00	0.01	0.01	0.01	0.01	0.57	1.82
Cumulative total	**0.75**	**0.03**	**0.06**	**0.00**	**0.01**	**0.01**	**0.01**	**0.01**	**5.68**	**6.93**
Increase in baseline mortality (%)	**0.012**	**0.013**	**0.002**	**0.000**	**0.010**	**0.028**	**0.002**	**0.001**	**0.050**	**0.019**

Table 5.133: Expected annual collision mortality across relevant offshore wind farms for all migratory bird species assessed for collision risk.

Project	Species									
	Ringed plover (breeding)	Ringed plover (non-breeding)	Dotterel	Golden plover (breeding)	Golden plover (non-breeding)	Grey plover	Lapwing	Knot	Sanderling	Purple sandpiper
Tier 1										
Barrow Offshore Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Burbo Bank Offshore Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Burbo Bank Extension	0.00	0.00	Unavailable	0.00	0.00	0.00	Unavailable	0.00	Unavailable	Unavailable
North Hoyle Offshore Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Ormonde Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Walney 1 & 2 Offshore Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Walney (3 & 4) Extension Offshore Wind Farm	0.00	0.00	Unavailable	0.00	0.00	0.00	Unavailable	4.00	Unavailable	Unavailable
West of Duddon Sands Offshore Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Gwynt y Môr Offshore Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Rhyl Flats Offshore Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Robin Rigg Offshore Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Arklow Bank Wind Park Phase 1	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Awel y Môr Offshore Wind Farm	0.04	0.14	Unavailable	0.87	0.87	Unavailable	Unavailable	0.57	0.09	Unavailable

Project	Species									
	Ringed plover (breeding)	Ringed plover (non-breeding)	Dotterel	Golden plover (breeding)	Golden plover (non-breeding)	Grey plover	Lapwing	Knot	Sanderling	Purple sandpiper
Erebus Floating Wind Demo	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Tier 2										
Morgan Generation Assets	0.02	0.23	0.00	1.20	0.50	0.02	0.62	0.06	0.02	0.01
Morecambe Offshore Windfarm Generation Assets	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
North Irish Sea Array	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Codling Wind Park	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Dublin Array Offshore Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Oriel Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Arklow Bank Wind Park Phase 2	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Shelmalere Offshore Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Llyr 1 Floating Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Llyr 2 Floating Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
White Cross Offshore Windfarm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Inis Eagla Marine Energy Park	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Total (minus Mona Offshore Wind Project)	**0.04**	**0.14**	**0.00**	**0.87**	**0.87**	**0.00**	**0.00**	**4.57**	**0.09**	**0.00**

Project	Ringed plover (breeding)	Ringed plover (non-breeding)	Dotterel	Golden plover (breeding)	Golden plover (non-breeding)	Grey plover	Lapwing	Knot	Sanderling	Purple sandpiper
Mona Offshore Wind Project	0.03	0.24	0.00	0.27	2.22	0.20	3.40	1.55	0.11	0.05
Cumulative total	**0.07**	**0.38**	**0.00**	**1.14**	**3.09**	**0.20**	**3.40**	**6.12**	**0.20**	**0.05**
Increase in baseline mortality (%)	0.006	0.004	0.000	0.008	0.003	0.004	0.002	0.015	0.006	0.002

Table 5.134: Expected annual collision mortality across relevant offshore wind farms for all migratory bird species assessed for collision risk.

Project	Species									
	Dunlin (sub-species schinzii and arctica)	Dunlin (sub-species alpina)	Ruff	Snipe	Black-tailed godwit (Icelandic race)	Bar-tailed godwit	Whimbrel	Curlew (breeding)	Curlew (non-breeding)	Greenshank
Tier 1										
Barrow Offshore Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Burbo Bank Offshore Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Burbo Bank Extension	0.00	0.00	Unavailable	Unavailable	0.00	0.00	Unavailable	0.00	0.00	Unavailable

Project	Species									
	Dunlin (sub-species schinzii and arctica)	Dunlin (sub-species alpina)	Ruff	Snipe	Black-tailed godwit (Icelandic race)	Bar-tailed godwit	Whimbrel	Curlew (breeding)	Curlew (non-breeding)	Greenshank
North Hoyle Offshore Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Ormonde Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Walney 1 & 2 Offshore Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Walney (3 & 4) Extension Offshore Wind Farm	8.00	8.00	Unavailable	Unavailable	0.00	1.00	Unavailable	1.00	1.00	Unavailable
West of Duddon Sands Offshore Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Gwynt y Môr Offshore Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Rhyl Flats Offshore Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Robin Rigg Offshore Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Arklow Bank Wind Park Phase 1	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Awel y Môr Offshore Wind Farm	0.05	0.05	Unavailable	Unavailable	0.28	Unavailable	Unavailable	0.47	0.47	0.01
Erebus Floating Wind Demo	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Tier 2										
Morgan Generation Assets	2.79	0.32	0.01	3.11	0.05	0.07	0.01	0.40	0.20	0.00
Morecambe Offshore Windfarm Generation Assets	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
North Irish Sea Array	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Codling Wind Park	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable

Project	Species									
	Dunlin (sub-species schinzii and arctica)	Dunlin (sub-species alpina)	Ruff	Snipe	Black-tailed godwit (Icelandic race)	Bar-tailed godwit	Whimbrel	Curlew (breeding)	Curlew (non-breeding)	Greenshank
Dublin Array Offshore Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Oriel Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Arklow Bank Wind Park Phase 2	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Shelmalere Offshore Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Llyr 1 Floating Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Llyr 2 Floating Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
White Cross Offshore Windfarm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Inis Eagla Marine Energy Park	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Total (minus Mona Offshore Wind Project)	**8.05**	**8.05**	**0.00**	**0.00**	**0.28**	**1.00**	**0.00**	**1.47**	**1.47**	**0.01**
Mona Offshore Wind Project	1.77	0.24	0.01	6.16	0.26	0.40	0.00	1.13	0.58	0.01
Cumulative total	**9.82**	**8.29**	**0.01**	**6.16**	**0.54**	**1.40**	**0.00**	**2.60**	**2.05**	**0.02**
Increase in baseline mortality (%)	**0.011**	**0.091**	**0.003**	**0.001**	**0.022**	**0.009**	**0.000**	**0.044**	**0.016**	**0.027**

Table 5.135: Expected annual collision mortality across relevant offshore wind farms for all migratory bird species assessed for collision risk.

Project	Species								
	Wood sandpiper	Redshank (breeding)	Redshank (non-breeding)	Turnstone	Great skua	Pomarine skua	Long-tailed skua	Black-headed gull	Short-eared owl
Tier 1									
Barrow Offshore Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Burbo Bank Offshore Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Burbo Bank Extension Offshore Wind Farm	Unavailable	0.00	0.00	Unavailable	0.00	Unavailable	Unavailable	1.00	Unavailable
North Hoyle Offshore Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Ormonde Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Walney 1 & 2 Offshore Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Walney (3 & 4) Extension Offshore Wind Farm	Unavailable	1.00	1.00	0.00	0.00	Unavailable	Unavailable	1.00	Unavailable
West of Duddon Sands Offshore Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Gwynt y Môr Offshore Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Rhyl Flats Offshore Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Robin Rigg Offshore Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Arklow Bank Wind Park Phase 1	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Awel y Môr Offshore Wind Farm	Unavailable	0.16	1.53	0.11	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Erebus Floating Wind Demo	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Tier 2									
Morgan Generation Assets	0.00	0.11	1.15	0.03	Unavailable	Unavailable	Unavailable	Unavailable	0.05

Project	Species								
	Wood sandpiper	Redshank (breeding)	Redshank (non-breeding)	Turnstone	Great skua	Pomarine skua	Long-tailed skua	Black-headed gull	Short-eared owl
Morecambe Offshore Windfarm Generation Assets	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
North Irish Sea Array	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Codling Wind Park	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Dublin Array Offshore Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Oriel Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Arklow Bank Wind Park Phase 2	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Shelmalere Offshore Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Llyr 1 Floating Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Llyr 2 Floating Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
White Cross Offshore Windfarm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Inis Eagla Marine Energy Park	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Total (minus Mona Offshore Wind Project)	**0.00**	**1.16**	**2.53**	**0.11**	**0.00**	**0.00**	**0.00**	**2**	**0.00**
Mona Offshore Wind Project	0.00	0.32	3.26	0.10	0.22	0.03	0.01	0.83	0.03
Cumulative total	**0.00**	**1.48**	**5.79**	**0.21**	**0.22**	**0.03**	**0.01**	**2.83**	**0.03**
Increase in baseline mortality (%)	**0.000**	**0.026**	**0.022**	**0.003**	**0.020**	**0.013**	**0.009**	**0.008**	**0.004**

Sensitivity of the receptor

Black-legged kittiwake

~~5.9.3.37~~5.9.3.36 Black-legged kittiwake was rated as relatively highly vulnerable to collision impacts by Wade *et al*. (2016), due to the proportion of flights likely to occur at potential risk height and percentage of time in flight.

~~5.9.3.38~~5.9.3.37 Despite a higher reproductive success (i.e. laying two eggs and breeding until four years old) than most seabird species (Robinson, 2005), the species is deemed to have a low recoverability given the continuing decline in abundance observed between 1986 and 2018 in the UK (JNCC, 2020). During this period, breeding productivity has declined as the result of food shortage, although it has stabilised in recent years (JNCC, 2020).

~~5.9.3.39~~5.9.3.38 Black-legged kittiwake is a qualifying interest for several SPAs likely to be connected to the Mona Array Area (within the mean-max + SD foraging range), with several non-SPA colonies within range and so the species is considered to be of medium value.

~~5.9.3.40~~5.9.3.39 Black-legged kittiwake is deemed to be of high vulnerability, low recoverability and medium value. The sensitivity of the receptor is therefore, considered to be **high**.

Great black-backed gull

~~5.9.3.41~~5.9.3.40 Great black-backed gull was rated as one of the most vulnerable seabird species to collision impacts by Wade *et al.* (2016), due to the proportion of flights likely to occur at potential risk height and percentage of time in flight.

~~5.9.3.42~~5.9.3.41 The abundance of breeding great black-backed gull in the UK has changed relatively little between census (JNCC, 2020). The species is deemed to have a medium recoverability due to a low reproductive success and the stable trend in breeding abundance.

~~5.9.3.43~~5.9.3.42 As great black-backed gull is a qualifying feature of interest for several SPAs likely to be connected to the Mona Array Area (within the mean-max + SD foraging range), with a non-SPA colony within range, the species is considered to be of medium value.

~~5.9.3.44~~5.9.3.43 Great black-backed gull is deemed to be of high vulnerability, medium recoverability and medium value. The sensitivity of the receptor is therefore, considered to be **medium.**

European herring gull

~~5.9.3.45~~5.9.3.44 European herring gull was rated as one of the most vulnerable seabird species to collision impacts by Wade *et al*. (2016), due to the proportion of flights likely to occur at potential risk height and percentage of time in flight.

~~5.9.3.46~~5.9.3.45 As European herring gull is a qualifying interest for several SPAs likely to be connected to the Mona Array Area (within the mean-max + SD foraging range) with multiple non-SPA colonies within range, the species is considered to be of medium value.

~~5.9.3.47~~5.9.3.46 Although European herring gull have a relatively high reproductive success, breeding abundance is declining in the coastal natural nesting population, and this may be indicative of decline in the entire UK breeding population (JNCC, 2020). There is evidence that the urban nesting gull population has increased in recent years, but census of these sites is lacking to derive a UK wide trend that includes both the urban and natural populations. The species is therefore deemed to be of medium recoverability.

~~5.9.3.48~~5.9.3.47 European herring gull is deemed to be of high vulnerability, medium recoverability and medium value. The sensitivity of the receptor is therefore, considered to be **medium.**

Lesser black-backed gull

~~5.9.3.49~~5.9.3.48 Lesser black-backed gull was rated as one of the most vulnerable seabird species to collision impacts by Wade *et al*. (2016), due to the proportion of flights likely to occur at potential risk height and percentage of time in flight.

~~5.9.3.50~~5.9.3.49 As lesser black-backed gull is a qualifying interest for several SPAs likely to be connected to the Mona Array Area (within the mean-max + SD foraging range), with multiple non-SPA colonies within range, the species is considered to be of medium value.

~~5.9.3.51~~5.9.3.50 Although lesser black-backed gull has a relatively high reproductive success, the species breeding abundance has exhibited a downward trend over the last 15-20 years in the UK (JNCC, 2020). It must be noted that this trend excludes urban nesting gulls from the sample and, therefore, may not be representative of trends in the entire UK population. The species is deemed to be of medium recoverability.

~~5.9.3.52~~5.9.3.51 Lesser black-backed gull is deemed to be of high vulnerability, medium recoverability and medium value. The sensitivity of the receptor is therefore, considered to be **medium**.

Northern gannet

~~5.9.3.53~~5.9.3.52 Although the latest scientific guidance showed the species to display a high level of macro-avoidance (Peschko *et al*., 2021), the species is rated as relatively vulnerable to collision impacts by Wade *et al*. (2016).

~~5.9.3.54~~5.9.3.53 Northern gannet is a qualifying interest for several SPAs likely to be connected to the Mona Array Area (within the mean-max + SD foraging range), with a large non-SPA colony within close proximity (Monreith Cliffs and Scar Rocks), the species is therefore considered to be of medium value.

~~5.9.3.55~~5.9.3.54 Although northern gannet has a low reproductive success, the species is deemed to have a medium recoverability given the consistent increasing trend in abundance since the 1990s (JNCC, 2020). It is of note that the species has suffered from the outbreak of avian flu during the 2022 breeding season. The species is deemed to be of medium recoverability.

~~5.9.3.56~~5.9.3.55 Northern gannet is deemed to be of high vulnerability, medium recoverability and medium value. The sensitivity of the receptor is therefore, considered to be **medium**.

Migratory birds

~~5.9.3.57~~5.9.3.56 Although migratory bird species have not been significantly studied in the offshore environment, vulnerability to collisions is likely to be generally low, since most migration will occur on a broad front and likely above rotor height, although during periods of poor weather this risk may increase.

~~5.9.3.58~~5.9.3.57 Recoverability of populations of migrants may vary considerably, with smaller wader species with a relatively favourable conservation status (e.g. dunlin) faring better than larger species with lower reproductive rates (e.g. Eurasian curlew).

~~5.9.3.59~~5.9.3.58 Of the assessed migratory species, nine are qualifying features of SPAs, as noted in Table 5.10. These species are Bewick's swan, shelduck, wigeon, grey plover, lapwing, ruff, bar-tailed godwit, whimbrel and turnstone. Therefore, on a precautionary basis and for the purposes of this assessment, migratory birds as a collective group have been assumed to have **medium** sensitivity to a cumulative collision risk.

Significance of the effect

~~5.9.3.60~~5.9.3.59 Overall, the magnitude of the cumulative impact is low for all seabird and migratory species (Table 5.136). Although sensitivity of the receptor varies from medium to high, the effect is expected to be of **minor** adverse significance for all species, which is not significant in EIA terms. For black-legged kittiwake, minor was selected from the minor to moderate range due to the impact not exceeding a 1% increase in baseline mortality and hence, was not regarded as a moderate significance of effect.

Table 5.136: Table summarising the significance of effect of collision from cumulative impacts during the operations and maintenance phase.

Species	Magnitude of impact	Sensitivity of receptor	Significance of effect
Black-legged kittiwake	Low	High	**Minor, not significant in EIA terms**
Great black-backed gull	Low	Medium	**Minor, not significant in EIA terms**
European herring gull	Low	Medium	**Minor, not significant in EIA terms**
Lesser black-backed gull	Low	Medium	**Minor, not significant in EIA terms**
Northern gannet	Low	Medium	**Minor, not significant in EIA terms**
Migratory birds	Low	Medium	**Minor, not significant in EIA terms**

5.9.4 Combined displacement and collision risk

Tier 1 and Tier 2

Operations and maintenance phase

Magnitude of impact

5.9.4.1 For species such as black-legged kittiwake and northern gannet that are both adversely affected by displacement and collision during the operations and maintenance phase, impacts must be combined in order for the true magnitude of impact to be understood.

5.9.4.2 It is recognised that assessing these two potential impacts together could amount to double counting, as birds that are subject to displacement would not be subject to potential collision risk as they are already assumed to have not entered the array area. Equally, birds estimated to be subject to collision risk mortality would not be able to be subjected to displacement consequent mortality as well. As a more refined method to consider displacement and collision together whilst reducing any double counting of impacts is not agreed with SNCBs the precautionary and highly unlikely approach is presented in this assessment.

Black-legged kittiwake

5.9.4.3 Outputs from the combined impact from displacement and collision from the Mona Offshore Wind Project, together with other offshore wind farms in the Irish Sea are tabulated and presented in Table 5.137~~**Error! Reference source not found.**~~.

Table 5.137: Black-legged kittiwake combined displacement and collision cumulative impacts.

Impact	Pre-breeding/Spring Migration	Breeding	Post-breeding/Autumn Migration	Annual
Predicted displacement impact when considering 50% displacement and 1% mortality	36	47	47	133
~~50%~~Range of predicted displacement~~,~~ impact when considering between 30% displacement and 1% mortality and 70% displacement and 10% mortality	~~38~~22 to 506	~~45~~28 to 652	~~47~~28 to 659	~~133~~80 to 1,867
Collisions (avoidance rate 99.28)	~~169~~160	~~147~~159	205	~~556~~559
~~Total impact~~Predicted combined impact (considering 50% displacement and 1% mortality)	~~207~~196	~~192~~206	252	~~689~~692
Range of combined impacts (considering between 30% displacement and 1% mortality and 70% displacement and 10% mortality)	182 to 666	187 to 811	233 to 864	639 to 2,426
~~Increase~~**Predicted increase in baseline mortality (%)** ~~uncorrected~~**(considering 50% displacement and 1% mortality)**	**0.~~192~~138%**	**0.~~501~~538%**	**0.177%**	**0.~~485~~487%**

5.9.4.4 The combined mortality for black-legged kittiwake from displacement and collision for the relevant projects with available data is ~~689~~692 individuals per annum when considering a displacement scenario of 50% displacement and 1% mortality.

5.9.4.5 Using the largest UK Western Waters BDMPS population of 911,586 individuals, with an average baseline mortality rate of 0.~~157~~156, the background predicted mortality would be 142,207. The addition of ~~689~~692 mortalities would increase the baseline mortality rate by 0.~~485~~487% The annual predicted mortality from the combined cumulative displacement and collision risk assessment is below the 1% threshold increase in baseline mortality.

5.9.4.6 The combined cumulative effect is predicted to be of national spatial extent, long term duration, continuous and high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **low.**

Northern gannet

5.9.4.7 Outputs from the combined impact from displacement and collision from the Mona Offshore Wind Project, together with other offshore wind farms in the Irish Sea are tabulated and presented in ~~Table 5.137~~**~~Error! Reference source not found.~~**~~.~~Table 5.138.

Table 5.138: Northern gannet combined displacement and collision cumulative impacts.

Impact	Pre-breeding/Spring Migration	Breeding	Post-breeding/Autumn Migration	Annual
Predicted displacement impact when considering 70% displacement and 1% mortality	3	31	18	54
70%Range of predicted displacement, impact when considering between 60% displacement and 1% mortality and 80% displacement and 10% mortality.	63 to 34	2627 to 354	1816 to 210	4746 to 615
Collisions (avoidance rate 99.28)	4	7075	3635	157160
Total impactPredicted combined impact (considering 70% displacement and 1% mortlaity)	107	96106	5453	204214
Range of combined impacts (considering between 60% displacement and 1% mortality and 80% displacement and 10% mortality)	7 to 38	102 to 429	51 to 245	206 to 775
IncreasePredicted increase **in baseline mortality (%)** uncorrected**(considering 70% displacement and 1% mortality)**	**0.008005%**	**0.095105%**	**0.051050%**	**0.159168%**

5.9.4.8 The combined mortality for northern gannet from displacement and collision for the relevant projects with available data is 204214 individuals per annum.

5.9.4.9 Using the largest UK Western Waters BDMPS population of 661,888 individuals, with an average baseline mortality rate of 0.193 the background predicted mortality would be 127,774. The addition of 204214 mortalities would increase the baseline mortality rate by 0.159168%. The annual predicted mortality from the cumulative collision risk assessment is below the 1% threshold increase in baseline mortality.

5.9.4.10 The cumulative effect is predicted to be of national spatial extent, long term duration, continuous and high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **low.**

Sensitivity of the receptor

Black-legged kittiwake

5.9.4.11 As seen in displacement and collision, black-legged kittiwake is deemed to be of overall medium vulnerability, low recoverability and medium value. The sensitivity of the receptor is therefore, considered to be **medium**.

Northern gannet

5.9.4.12 As seen in displacement and collision, northern gannet is deemed to be overall of medium vulnerability, medium recoverability and medium value. The sensitivity of the receptor is therefore, considered to be **medium**.

Significance of the effect

Black-legged kittiwake

5.9.4.13 Overall, the magnitude of the combined displacement and collision cumulative impact is low, and the sensitivity of the receptor is medium. The effect will, therefore, be of **minor** adverse significance, which is not significant in EIA terms.

Northern gannet

5.9.4.14 Overall, the magnitude of the combined displacement and collision cumulative impact is low, and the sensitivity of the receptor is considered to be medium. The effect will, therefore, be of **minor** adverse significance, which is not significant in EIA terms.

5.10 Transboundary effects

5.10.1.1 A screening of transboundary impacts has been carried out and any potential for significant transboundary effects with regard to offshore ornithology from the Mona Offshore Wind Project upon the interests of other states has been assessed as part of the EIA. The potential transboundary impacts assessed within sections 5.8 and 5.9 of this technical report are summarised below:

- Disturbance and displacement (including impacts on species which may have connectivity to UK SPAs) during the construction, operations and maintenance, and decommissioning phases. Overall, the effect will be of negligible adverse to minor adverse significance, which is not significant in EIA terms
- Indirect disturbance and displacement resulting from changes to prey and habitats (including impacts on species which may have connectivity to UK SPAs) during the construction, operations and maintenance, and decommissioning phases. Overall, the effect will be of minor adverse significance, which is not significant in EIA terms
- Collision risk (including impacts on species which may have connectivity to UK SPAs) during the construction, operations and maintenance, and decommissioning phases. Overall, the effect will be of negligible to minor adverse significance, which is not significant in EIA terms
- Barrier effect (including impacts on species which may have connectivity to UK SPAs) during the construction, operations and maintenance, and decommissioning phases. Overall, the effect will be of negligible adverse significance, which is not significant in EIA terms
- No significant transboundary effects have been identified during the screening process.

5.11 Inter-related effects

5.11.1.1 Inter-relationships are considered to be the impacts and associated effects of different aspects of the proposal on the same receptor. These are considered to be:

- Project lifetime effects: Assessment of the scope for effects that occur throughout more than one phase of the Mona Offshore Wind Project (construction, operations and maintenance, and decommissioning), to interact to potentially create a more significant effect on a receptor than if just assessed in isolation in these three phases (e.g. subsea noise effects from piling, operational turbines, vessels and decommissioning)
- Receptor-led effects: Assessment of the scope for all effects to interact, spatially and temporally, to create inter-related effects on a receptor. As an example, all effects on offshore ornithology, such as displacement/disturbance, collision and increased SSCs, may interact to produce a different, or greater effect on this receptor than when the effects are considered in isolation. Receptor-led effects may be short term, temporary or transient effects, or incorporate longer term effects.

5.11.1.2 A description of the likely interactive effects arising from the Mona Offshore Wind Project on offshore ornithology is provided in Volume 2, Chapter 11: Inter-related effects - offshore of the Environmental Statement. (Document reference F2.11).

5.12 Summary of impacts, mitigation measures and monitoring

5.12.1.1 Information on offshore ornithology within the Offshore Ornithology study areas, as defined in section 5.3.4.1, was collected through review of available literature, other offshore wind farm assessments, UK statutory guidance, detailed analysis of the data collected during the site-specific aerial surveys and intertidal surveys, and consultation with relevant stakeholders.

- Table 5.139 presents a summary of the potential impacts, measures adopted as part of the project and residual effects in respect to offshore ornithology. The impacts assessed include disturbance and displacement from airborne noise, underwater sound, and presence of vessels and infrastructure, indirect impacts from underwater sound affecting prey species, temporary habitat loss/disturbance and increased SSCs, collision risk and barrier to movement. Overall, it is concluded that there will be **no significant effects** arising from the Mona Offshore Wind Project during the construction, operations and maintenance, or decommissioning phases
- Table 5.140 presents a summary of the potential cumulative impacts, mitigation measures and residual effects. The cumulative impacts assessed include disturbance and displacement from airborne noise, underwater sound and presence of vessels and infrastructure and collision risk. Overall, it is concluded that there are **no significant cumulative effects** to any species from the Mona Offshore Wind Project alongside other projects/plans.

5.12.1.2 Potential transboundary impacts have been identified in relation to offshore ornithology. Overall, it is concluded that there will be **no significant transboundary effects** arising from the Mona Offshore Wind Project.

Table 5.139: Summary of potential environmental effects, mitigation and monitoring.

[a] C=construction, O=operations and maintenance, D=decommissioning

Description of impact	Phase[a] C	O	D	Measures adopted as part of the project	Magnitude of impact	Sensitivity of the receptor	Significance of effect	Further mitigation	Residual effect	Proposed monitoring
Disturbance and displacement from airborne noise, underwater sound, and presence of vessels and infrastructure	✓	✓	✓	Offshore EMP that will include measures to minimise disturbance to rafting birds from transiting vessels.	Common guillemot C: Negligible O: low D: Negligible Razorbill C: Negligible O: Negligible D: Negligible Atlantic puffin C: Negligible O: Negligible D: Negligible Northern gannet C: Negligible O: Negligible D: Negligible Black-legged kittiwake C: Negligible O: Negligible D: Negligible Manx shearwater C: Negligible O: Negligible D: Negligible	Common guillemot C: Medium O: Medium D: Medium Razorbill C: Medium O: Medium D: Medium Atlantic puffin C: High O: High D: High Northern gannet C: Medium O: Medium D: Medium Black-legged kittiwake C: Medium O: Medium D: Medium Manx shearwater C: Medium	Common guillemot C: Negligible adverse O: Minor adverse D: Negligible adverse Razorbill C: Negligible adverse O: Negligible adverse D: Negligible adverse Atlantic puffin C: Minor adverse O: Negligible adverse D: Minor adverse Northern gannet C: Negligible adverse O: Negligible adverse	None	Common guillemot C: Negligible adverse O: Minor adverse D: Negligible adverse Razorbill C: Negligible adverse O: Negligible adverse D: Negligible adverse Atlantic puffin C: Minor adverse O: Negligible adverse D: Minor adverse Northern gannet C: Negligible adverse O: Negligible adverse	None

Description of impact	Phase[a] C	O	D	Measures adopted as part of the project	Magnitude of impact	Sensitivity of the receptor	Significance of effect	Further mitigation	Residual effect	Proposed monitoring
					Common scoter C: Negligible O: Negligible D: Negligible Red-throated diver C: Negligible O: Negligible D: Negligible	O: Medium D: Medium Common scoter C: High O: High D: High Red-throated diver C: High O: High D: High	D: Negligible adverse Black-legged kittiwake C: Negligible adverse O: Negligible adverse D: Negligible adverse Manx shearwater C: Negligible adverse O: Negligible adverse D: Negligible adverse Common scoter C: Minor adverse O: Negligible adverse D: Minor adverse Red-throated diver C: Minor adverse O: Negligible adverse		D: Negligible adverse Black-legged kittiwake C: Negligible adverse O: Negligible adverse D: Negligible adverse Manx shearwater C: Negligible adverse O: Negligible adverse D: Negligible adverse Common scoter C: Minor adverse O: Negligible adverse D: Minor adverse Red-throated diver C: Minor adverse O: Negligible adverse	

Description of impact	Phase[a] C	O	D	Measures adopted as part of the project	Magnitude of impact	Sensitivity of the receptor	Significance of effect	Further mitigation	Residual effect	Proposed monitoring
							D: Minor adverse		D: Minor adverse	
Indirect impacts from underwater sound affecting prey species	✓	✓	×	None	Auk species C: Low D: Low	Auk species C: Medium D: Medium	Auk species C: Minor adverse D: Minor adverse	None	Auk species C: Minor adverse D: Minor adverse	None
Temporary habitat loss/disturbance and increased SSCs	✓	✓	✓	None	All receptors C: Negligible O: Negligible D: Negligible	All receptors C: Medium O: Medium D: Medium	All receptors C: Minor adverse O: Minor adverse D: Minor adverse	None	All receptors C: Minor adverse O: Minor adverse D: Minor adverse	None
Collision risk	×	✓	×	Increasing 'minimum air draught to 34 over LAT to reduce bird collision	Black-legged kittiwake O: Negligible Great black-backed gull O: Low European herring gull O: Negligible Lesser black-backed gull	Black-legged kittiwake O: High Great black-backed gull O: Medium European herring gull O: Medium Lesser black-backed gull	Black-legged kittiwake O: Negligible adverse Great black-backed gull O: Minor adverse European herring gull	None	Black-legged kittiwake O: Negligible adverse Great black-backed gull O: Minor adverse European herring gull	None

Description of impact	Phase[a] C	O	D	Measures adopted as part of the project	Magnitude of impact	Sensitivity of the receptor	Significance of effect	Further mitigation	Residual effect	Proposed monitoring
					O: Negligible Northern gannet O: Negligible Northern fulmar O: Negligible Manx shearwater O: No change Migratory birds (non-seabirds) O: Negligible	O: Medium Northern gannet O: Medium Northern fulmar O: Low Manx shearwater O: Medium Migratory birds (non-seabirds) O: Medium	O: Negligible adverse Lesser black-backed gull O: Negligible adverse Northern gannet O: Negligible adverse Northern fulmar O: Negligible adverse Manx shearwater O: No change Migratory birds (non-seabirds) O: Negligible adverse		O: Negligible adverse Lesser black-backed gull O: Negligible adverse Northern gannet O: Negligible adverse Northern fulmar O: Negligible adverse Manx shearwater O: No change Migratory birds (non-seabirds) O: Negligible adverse	
Barrier to movement	×	✓	×	Offshore EMP that will include measures to minimise disturbance to rafting birds from transiting vessels	All receptors O: Negligible	All receptors O: Medium	All receptors O: Negligible adverse	None	All receptors O: Negligible adverse	None

Table 5.140: Summary of potential cumulative environmental effects, mitigation and monitoring.

[a] C=construction, O=operations and maintenance, D=decommissioning

Description of effect	Phase[a] C	O	D	Measures adopted as part of the project	Magnitude of impact	Sensitivity of the receptor	Significance of effect	Further mitigation	Significant residual effect	Proposed monitoring
Tier 1 and Tier 2										
Disturbance and displacement from airborne noise, underwater sound, and presence of vessels and infrastructure	✓	✓	✓	Offshore EMP that will include measures to minimise disturbance to rafting birds from transiting vessels	Common guillemot C: Negligible O: Low D: Negligible Razorbill C: Negligible O: Negligible D: Negligible Atlantic puffin C: Negligible O: Low D: Negligible Northern gannet C: Negligible O: Negligible D: Negligible Black-legged kittiwake C: Negligible O: Negligible D: Negligible	Common guillemot C: Medium O: Medium D: Medium Razorbill C: Medium O: Medium D: Medium Atlantic puffin C: High O: High D: High Northern gannet C: Medium O: Medium D: Medium Black-legged kittiwake C: Medium O: Medium D: Medium	Common guillemot C: Negligible adverse O: Minor adverse D: Negligible adverse Razorbill C: Negligible adverse O: Negligible adverse D: Negligible adverse Atlantic puffin C: Minor adverse O: Minor adverse D: Minor adverse Northern gannet C: Negligible adverse O: Negligible adverse D: Negligible adverse Black-legged kittiwake C: Negligible adverse O: Negligible adverse D: Negligible adverse	None	Common guillemot C: Negligible adverse O: Minor adverse D: Negligible adverse Razorbill C: Negligible adverse O: Negligible adverse D: Negligible adverse Atlantic puffin C: Minor adverse O: Minor adverse D: Minor adverse Northern gannet C: Negligible adverse O: Negligible adverse D: Negligible adverse Black-legged kittiwake C: Negligible adverse O: Negligible adverse D: Negligible adverse	None

Description of effect	Phase[a] C	O	D	Measures adopted as part of the project	Magnitude of impact	Sensitivity of the receptor	Significance of effect	Further mitigation	Significant residual effect	Proposed monitoring
Collision Risk	×	✓	×	Increasing minimum air draught to 34 over LAT to reduce bird collision	Black-legged kittiwake O: Low Great black-backed gull O: Medium European herring gull O: Low Lesser black-backed gull O: Low Northern gannet O: Low	Black-legged kittiwake O: High Great black-backed gull O: Medium European herring gull O: Medium Lesser black-backed gull O: Medium Northern gannet O: Medium	Black-legged kittiwake O: Minor adverse Great black-backed gull O: Minor adverse European herring gull O: Minor adverse Lesser black-backed gull O: Minor adverse Northern gannet O: Minor adverse	None	Black-legged kittiwake O: Minor adverse Great black-backed gull O: Minor adverse European herring gull O: Minor adverse Lesser black-backed gull O: Minor adverse Northern gannet O: Minor adverse	None
Combined collision risk and disturbance and displacement from airborne noise, underwater sound, and presence of vessels and infrastructure	×	✓	×	Increasing minimum air draught to 34 over LAT air draught to reduce bird collision	Black-legged kittiwake O: Low Northern gannet O: Low	Black-legged kittiwake O: Medium Northern gannet O: Medium	Black-legged kittiwake O: Minor adverse Northern gannet O: Minor adverse	None	Black-legged kittiwake O: Minor adverse Northern gannet O: Minor adverse	None

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