Liverpool Bay / Bae Lerpwl Special Protection Area

Conservation Advice Package

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Executive summary

Liverpool Bay / Bae Lerpwl Special Protection Area (SPA) was originally classified in 2010 for common scoter (*Melanitta nigra)*, red-throated diver (*Gavia stellata*) and waterbird assemblage. In 2017, the SPA was reclassified by the UK and Welsh Governments. At this time, three more bird features were added. These are non-breeding little gull (*Hydrocoloeus minutus)*, breeding little tern (*Sternula albifrons)* and breeding common tern (*Sterna hirundo).* As part of the reclassification in 2017, the boundary of the SPA was extended to the north and west to support the addition of little gull.

The Liverpool Bay / Bae Lerpwl SPA lies in both English and Welsh territorial waters and in offshore UK waters and forms part of the National Sites Network.

This advice for the Liverpool Bay / Bae Lerpwl SPA was jointly prepared by Natural England and Natural Resources Wales (NRW) and given in fulfilment of their duty under Regulation 37 of the Conservation of Habitats and Species Regulations 2017 and the Joint Nature Conservation Committee (JNCC) given in fulfilment of their duty under Regulation 21 of the Conservation of Offshore Marine Habitats and Species Regulations 2017.

Section 3 provides the background and detail of the conservation objectives for each of the features.

General site and feature information for Liverpool Bay / Bae Lerpwl SPA can be found in section 4.

The advice on operations, in relation to the site, can be found in section 5, along with information relating to each feature's seasonality.

Crynodeb Gweithredol

Dosbarthwyd Ardal Gwarchodaeth Arbennig (AGA) Bae Lerpwl / Liverpool Bay yn wreiddiol yn 2010 oherwydd ei môr-hwyaden ddu (*Melanitta nigra)*, ei throchydd gyddfgoch (*Gavia stellata*) a'i chasgliad o adar dŵr. Yn 2017, cafodd yr AGA ei hailddosbarthu gan Lywodraethau Cymru a'r DU. Yr adeg honno, ychwanegwyd tair nodwedd adar arall, sef yr wylan fechan (*Hydrocoloeus minutus)* nad yw'n bridio, y fôr-wennol fechan (*Sternula albifrons)* a'r fôr-wennol gyffredin (*Sterna hirundo) sy'n bridio.* Fel rhan o'r ailddosbarthiad yn 2017, cafodd terfyn yr AGA ei ymestyn i'r gogledd a'r gorllewin i gynnal ychwanegu'r wylan fechan.

Mae AGA Bae Lerpwl / Liverpool Bay wedi ei lleoli yn nyfroedd tiriogaethol Cymru a Lloegr ac yn nyfroedd môr mawr y DU ac mae'n ffurfio rhan o'r Rhwydwaith Safleoedd Cenedlaethol.

Cafodd y cyngor hwn ar gyfer AGA Bae Lerpwl / Liverpool Bay ei baratoi ar y cyd gan Natural England a Cyfoeth Naturiol Cymru (CNC) a'i gyflwyno wrth iddynt gyflawni eu dyletswydd dan Reoliad 37, Rheoliadau Cadwraeth Cynefinoedd a Rhywogaethau 2017 a'r Cyd-bwyllgor Cadwraeth Natur (JNCC) wrth gyflawni eu dyletswydd dan Reoliad 21, Rheoliadau Cadwraeth Cynefinoedd a Rhywogaethau Morol Alltraeth 2017.

Mae Adran 3 yn rhoi cefndir a manylion amcanion cadwraeth pob un o'r nodweddion.

Gellir dod o hyd i wybodaeth gyffredinol am safle a nodweddion AGA Bae Lerpwl / Liverpool Bay yn adran 4.

Gellir dod o hyd i gyngor ar weithrediadau, mewn perthynas â'r safle, yn adran 5, yn ogystal â gwybodaeth gysylltiedig â thymoroldeb pob nodwedd.

For further information

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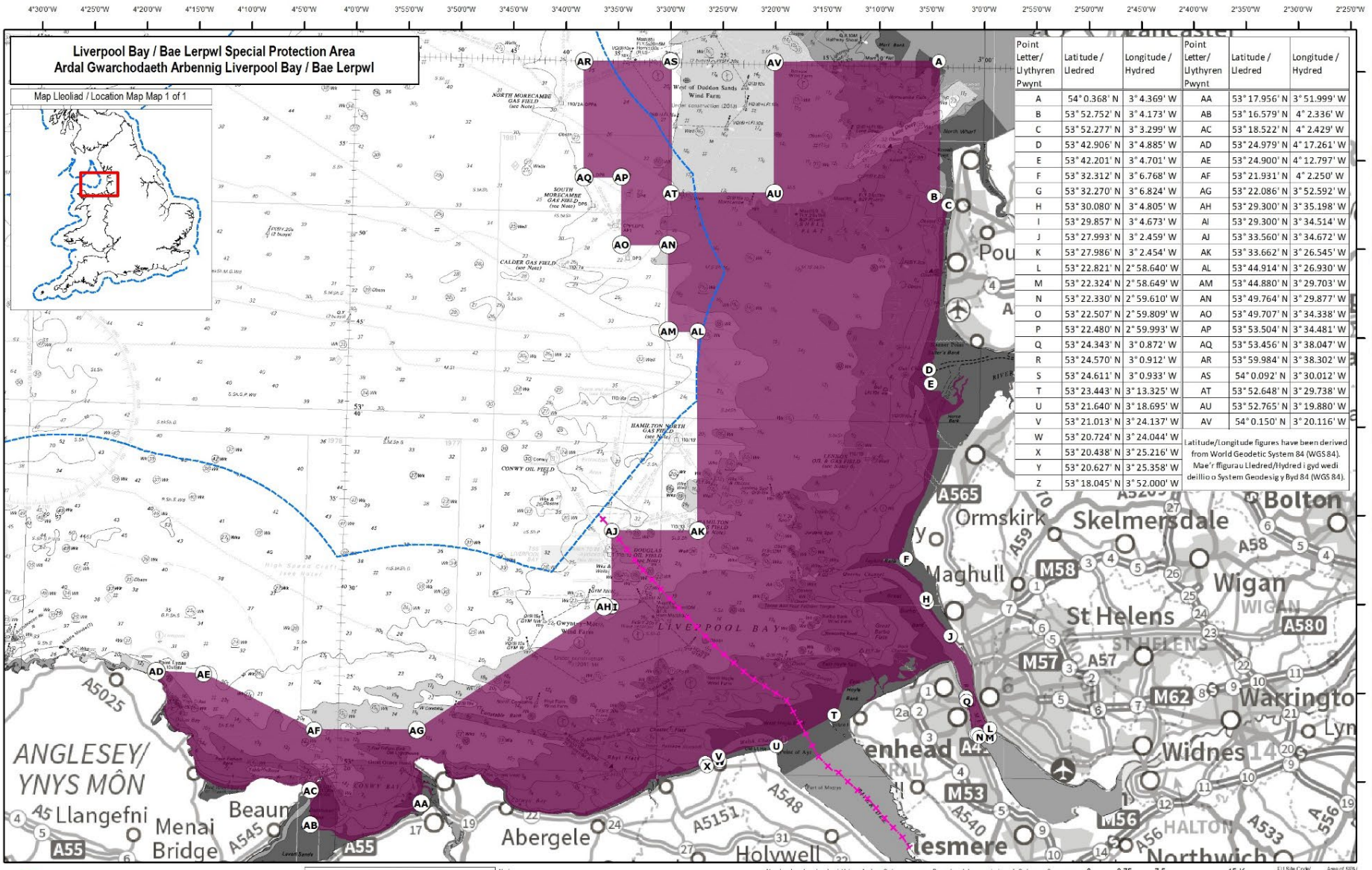
Liverpool Bay / Bae Lerpwl Special Protection Area

Advice under Regulation 37 of the Conservation of Habitats and Species Regulations 2017 & Regulation 21 of the Conservation of Offshore Marine Habitats and Species Regulations 2017

Contents

Figure 1: Map showing the site boundary of Liverpool Bay / Bae Lerpwl SPA



1. Introduction

Liverpool Bay / Bae Lerpwl Special Protection Area (SPA) was originally classified in 2010 for common scoter (*Melanitta nigra)*, red-throated diver (*Gavia stellata*) and waterbird assemblage. In 2017, the SPA was reclassified by the UK and Welsh Assembly Governments. At this time, three more bird features were added. These are non-breeding little gull (*Hydrocoloeus minutus)*, breeding little tern (*Sternula albifrons)* and breeding common tern (*Sterna hirundo).* As part of the reclassification in 2017, the boundary of the SPA was extended to the north and west to support the addition of little gull.

The Liverpool Bay / Bae Lerpwl SPA lies in both English and Welsh territorial waters and in offshore UK waters and forms part of the National Sites Network.

The SPA is subject to protection under the Conservation of Habitats and Species Regulations 2017[1] (referred to in this document as the 'Habitats Regulations') and the Conservation of Offshore Marine Habitats and Species Regulations 2017[2] (referred to in this document as the 'Offshore Habitats Regulations'). When the 'relevant Habitats Regulations' are referred to in this document it means that either the Conservation of Habitats and Species Regulations 2017 or the Conservation of Offshore Marine Habitats and Species Regulations 2017, or both, should be referred to depending on what is appropriate.

Amongst other things, both relevant Habitats Regulations place an obligation on relevant[3] and competent authorities (outlined in section 2.2) to put in place measures to protect the sites from damage or deterioration.

This advice for the Liverpool Bay / Bae Lerpwl SPA is jointly prepared by Natural England and Natural Resources Wales (NRW) and given in fulfilment of their duty under Regulation 37[4] of the Habitats Regulations and the Joint Nature Conservation Committee (JNCC) given in fulfilment of their duty under Regulation 21[5] of the Offshore Habitats Regulations.

This advice is based on the best available evidence and information at the time of writing in accordance with our evidence standards[6]. It will be kept under review by Natural England, Natural Resources Wales and the JNCC and updated with significant and appropriate new evidence and information.

The features of Liverpool Bay / Bae Lerpwl SPA are:

- Non-breeding red-throated diver (*Gavia stellata*);
- Non-breeding common scoter (*Melanitta nigra*);
- Non-breeding little gull (*Hydrocoloeus minutus*);
- Breeding common tern (*Sterna hirundo*);
- Breeding little tern (*Sternula albifrons*); and
- Non-breeding waterbird assemblage.

Liverpool Bay / Bae Lerpwl SPA qualifies under Article 4 of the Birds Directive (2009/147/EC) for the following reasons:

- Species listed in Annex I of the Birds Directive: the site regularly supports more than

[1] The Conservation of Habitats and Species Regulations 2017 (legislation.gov.uk)
[2] The Conservation of Offshore Marine Habitats and Species Regulations 2017 (legislation.gov.uk)
[3] The Conservation of Habitats and Species Regulations 2017 (legislation.gov.uk)
[4] The Conservation of Habitats and Species Regulations 2017 (legislation.gov.uk)
[5] The Conservation of Offshore Marine Habitats and Species Regulations 2017 (legislation.gov.uk)
[6] Research at Natural England - Natural England - GOV.UK (www.gov.uk)

1% of the Great Britain populations of two breeding species and one non-breeding species (Table 1). Therefore, the site qualifies for SPA classification in accordance with the UK SPA selection guidelines (stage 1.1: JNCC 1999).

- Regularly occurring migrants not listed in Annex I of the Birds Directive: the site regularly supports more than 1% of the biogeographical populations of one non-breeding species (Table 1). Therefore, the site qualifies for SPA classification in accordance with the UK SPA selection guidelines (stage 1.2: JNCC 1999).

- Assemblages: the site regularly supports an assemblage of more than 20,000 individual waterbirds. Therefore, the site qualifies for SPA classification in accordance with the UK SPA selection guidelines (stage 1.3: JNCC 1999).

- Species for which stage 1 guidelines cannot be applied: the site regularly supports one non-breeding species which is on Annex I of the Birds Directive but which cannot be selected at stage 1.1 because there is no national population estimate for comparison (Table 1). The site is identified as supporting the second largest aggregation of little gulls in the UK, and therefore qualifies for SPA classification in accordance with the UK SPA selection guidelines (stage 1.4: JNCC 1999).

2. Roles and responsibilities

2.1 Natural England's, Natural Resources Wales's and the JNCC's role

The Habitats Regulations give Natural England and Natural Resources Wales, and the Offshore Habitats Regulations give the JNCC, a statutory responsibility to advise relevant authorities as to (a) the conservation objectives for Liverpool Bay / Bae Lerpwl SPA within their respective jurisdictions and, (b) any operations which may cause deterioration of natural habitats or the habitats of species, or disturbance of species for which Liverpool Bay / Bae Lerpwl SPA has been classified.

Natural England, Natural Resources Wales and the JNCC will provide additional advice for the site to relevant authorities and competent authorities to allow them to fulfil their duties under their relevant Habitats Regulations, such as a competent authority assessing the implications of any plans or projects on the SPA. Each plan or project will be judged on its own merits, and this will determine the nature of any additional advice required.

2.2 The role of competent and relevant authorities

The term "competent authority" includes all public bodies and statutory undertakers. In relation to the marine area, all competent authorities[7] are required to exercise their functions which are relevant to nature conservation, including marine conservation, so as to secure compliance with the requirements of the Birds Directive. This includes competent authorities undertaking a Habitat Regulations Assessment, for which guidance is available[8].

Competent authorities have specific duties and powers under the relevant Habitats

[7] The Conservation of Habitats and Species Regulations 2017 (legislation.gov.uk)
[8] Habitats regulations assessments: protecting a European site - GOV.UK (www.gov.uk)

Regulations[9]. Before a competent authority decides to undertake or give any consent or permission or other authorisation for a plan or project which is: (i) likely to have a significant effect on a European Marine Site or a European offshore marine site (either alone or in combination with other plans or projects); and (ii) is not directly connected with or necessary to the management of that site, then the competent authority must carry out an appropriate assessment of the implication of the plan or project for that site in view of that site's conservation objectives. Competent authorities also have duties to review decisions that have already been made[10].

The competent authority carries out the appropriate assessment and makes a decision rather than the proponent of the plan or project or the Statutory Nature Conservation Body (SNCB i.e., Natural England, Natural Resources Wales or the JNCC). However, the competent authority must consult the SNCB under Regulation 63(3) and must have regard to any representations made by the SNCB when reaching its decision. Regulation 63(2) makes it clear that the applicant must supply the necessary information for the competent authority to make the assessment. The competent authority can require the proponent to provide sufficient information to inform the assessment. When carrying out the assessment, the competent authority **must** consult Natural England and/or Natural Resources Wales and the JNCC as appropriate, in accordance with the relevant Habitats Regulations.

The relevant authorities under Regulation 38[11] of the Habitats Regulations, and a competent authority under Regulation 22[12] of the Offshore Habitat Regulations, may draw up a management scheme for the site. If such a scheme were to be established, its purpose would be to provide a vehicle through which the relevant authority, or competent authority for offshore sites, must exercise their functions so as to secure compliance with the Directive (as defined above). Any management on this site should be guided by the advice in this package.

Relevant authorities must, within their areas of jurisdiction, have regard to both direct and indirect effects on interest features of the site. This may include consideration of issues outside the boundary of the site.

Nothing within a Regulation 37/21 package will require relevant authorities to undertake any actions or ameliorate changes in the condition of interest features if it is shown that the changes result wholly from natural causes.

Having issued Regulation 37/21 advice for this site Natural England, Natural Resources Wales and the JNCC will continue to review any new evidence or information about this site and will provide further guidance as appropriate. This does not, however, preclude relevant authorities from taking any appropriate action to prevent deterioration to the interest features and indeed such actions should be undertaken when required.

2.3 The role of conservation objectives

The conservation objectives should ensure that the obligations of the relevant Habitats Regulations are met by ensuring the integrity of the site is maintained, or where necessary restored, and that its qualifying features makes an appropriate contribution to favourable conservation status (FCS) at the national level. This includes the site's contribution to the

[9] The Conservation of Habitats and Species Regulations 2017 (legislation.gov.uk) and The Conservation of Offshore Marine Habitats and Species Regulations 2017 (legislation.gov.uk)
[10] The Conservation of Habitats and Species Regulations 2017 (legislation.gov.uk) and The Conservation of Offshore Marine Habitats and Species Regulations 2017 (legislation.gov.uk)
[11] The Conservation of Habitats and Species Regulations 2017 (legislation.gov.uk)
[12] The Conservation of Offshore Marine Habitats and Species Regulations 2017 (legislation.gov.uk)

coherence of the National Site Network.

They are the starting point from which management of the site and monitoring programmes may be developed, as they provide the basis for determining what will maintain or restore features to favourable condition. They inform the consideration of whether plans or projects are likely to have a significant effect on a site; the scope and conclusions of appropriate assessments; and the determination of whether plans or projects will adversely affect the integrity of the site.

2.4 The role of advice on operations

The advice on operations set out in Section 5 of this document provides the basis for discussion about the nature of the operations that could take place within, or close to, the site, and which have the potential to have an impact on its interest features.

Specific advice should be sought from Natural England, Natural Resources Wales or the JNCC to help identify the extent to which existing measures of control, management and forms of use are, or can be made, consistent with the conservation objectives. This should focus the attention of relevant authorities and surveillance programmes on areas that may need management measures.

2.5 When to use this advice

The aim of this advice is to enable all relevant authorities to direct and prioritise their work on the management of activities that pose the greatest potential threat to the favourable condition of interest features at Liverpool Bay / Bae Lerpwl SPA. The advice given here is without prejudice to any advice provided in relation to the consideration of plans or projects within the meaning of Part 6 of the Habitat Regulations or Regulation 28 of the Offshore Habitats Regulations.

This information should be used with case-specific advice issued by Natural England, Natural Resources Wales and the JNCC when developing, proposing or assessing an activity, plan or project that may affect the site.

Any proposals or operations which may affect the site, or its features should be designed so they do not hinder the achievement of the conservation objectives as this would amount to an adverse effect on the integrity of the site.

3. Conservation objectives

The conservation objectives present attributes for each of the classified species within the site. These attributes are ecological characteristics, and ecological requirements, of the classified species within a site. Taken together, the attributes of all the features describe the site's ecological integrity. The sites conservation objectives will be met when all attributes meet their targets.

The integrity of a site is defined as the coherence of its ecological structure and function, across its whole area, that enables it to sustain the habitat, complex of habitats and/or the levels of populations of the species for which it was designated. Feature attributes allow a feature's condition to be measured which in turn can be used to see if site integrity is being maintained. Unfavourable condition, or failure of an attribute, means that site integrity is not being maintained.

The conservation objectives outline attributes for:

- Species abundance;
- Species distribution;
- Disturbance caused by human activity
- Supporting habitat (food availability)
- Supporting habitat (extent, distribution and availability)
- Connectivity with supporting habitats (little gull, common tern and little tern only)
- Assemblage of species: diversity (waterbird assemblage only)

The attributes relating to supporting habitats and processes should allow birds to distribute themselves optimally within (and sometimes outside) the SPA boundary. This is perhaps particularly relevant for food availability; extent and distribution of supporting habitat; quality of supporting habitat; predation; and disturbance caused by human activity.

Conservation objective attributes have a target which is either quantified or qualified depending on the available evidence. The target identifies, as far as possible, the desired state to be achieved for the attribute. In many cases, the attribute targets show if the current objective is to either 'maintain' or 'restore' the attribute. **The targets given for each attribute do not represent thresholds to assess the significance of any given impact in Habitats Regulation Assessments.** This will need to be assessed on a case-by-case basis using the most current information available.

Some, but not all, of these conservation objective attributes can also be used for regular monitoring of the condition of the classified features. The attributes selected for monitoring the features, and the standards used to assess their condition, are listed in separate monitoring documents, which are available from Natural England, Natural Resources Wales and the JNCC. As condition assessment information becomes available this conservation advice package will be reviewed accordingly.

3.2 Liverpool Bay / Bae Lerpwl SPA conservation objectives

The conservation objectives for Liverpool Bay / Bae Lerpwl SPA are set out in the sections below. As noted in section 1 above, Natural England, Natural Resources Wales and the JNCC may, in future, refine these as understanding of the features improves and further information, such as survey work, becomes available.

The conservation objectives should ensure that the obligations of the relevant Habitats Regulations are met by ensuring the integrity of the site is maintained, or where necessary restored, and that its qualifying features, when in favourable condition, makes an appropriate contribution to favourable conservation status (FCS) for those species at the national level. This includes the site's contribution to the coherence of the National Site Network.

The conservation objectives are the starting point from which management of the site and monitoring programmes may be developed as they provide the basis for determining what will maintain or restore features to favourable condition. They inform the consideration of whether plans or projects are likely to have a significant effect on a site; the scope and conclusions of appropriate assessments; and the determination of whether plans or projects will adversely affect the integrity of the site.

The map at the beginning of this document shows the Liverpool Bay/Bae Lerpwl SPA site boundary. It should be noted that activities outside the site may also affect the features of the site. Reference should also be made to the relevant Habitats Regulations.

Each feature's conservation objective section provides:

1. A clear statement of the conservation objective for the feature

2. A table summarising the attributes, and the targets for those attributes

3. A description of the favourable condition for that feature and

4. A summary of evidence that underpins the selection of the feature, its attributes and targets.

3.3 The conservation objectives for Liverpool Bay / Bae Lerpwl SPA Interest feature 1: Internationally important non-breeding population of red-throated diver (*Gavia stellata*)

Subject to natural change[13], maintain[14] or restore[15] the red-throated diver population, distribution and its supporting habitats in favourable condition.

Table 1: Conservation objectives (attributes and targets) for the Liverpool Bay / Bae Lerpwl SPA interest feature red-throated diver.

Feature	Attribute	Target
Red-throated diver	Non-breeding population: abundance	Maintain the size of the non-breeding population at a level which is at or above 1800 individuals (mean peak, 2015, 2018, 2019 & 2020).
	Non-breeding population: distribution	Restore[16] the distribution of the feature; preventing further deterioration, and where possible, reduce any existing anthropogenic influences impacting feature distribution.
	Disturbance caused by human activity	Minimise the frequency, duration and/or intensity of disturbance affecting the feature so that the population, its distribution within the site, or its use of the habitat is not significantly affected.
	Supporting habitat: Food availability and quality of prey	Maintain the distribution, abundance and availability of key food and prey items (e.g. fish) to maintain the population.
	Supporting habitat: extent, distribution and quality of supporting habitat for the non-breeding season	Restore the extent, distribution and availability of suitable habitat which supports the feature; preventing further deterioration, and where possible, reduce any existing anthropogenic influences impacting the extent and quality (including water quality).

[13] "Natural change" means changes in the species or habitat which are not a result of human influences. Human influence on the red-throated diver population is acceptable provided that it is proved to be/can be established to be compatible with the achievement of the conditions set out under the definition of favourable condition. A failure to meet these conditions which is entirely a result of natural process will not constitute unfavourable condition but may trigger a review of the definition of favourable condition.

[14] "Maintain" is used here because existing evidence suggests the feature to be in favourable condition for each attribute with a maintain target, and the objective is for it to remain so. Existing activities are deemed to be compatible with the conservation objectives if current practices are continued at current levels and in the absence of evidence that current activities are significantly affecting the red-throated diver population or its habitat. However, it must be borne in mind that gradually damaging activities can take time to show their effects. If evidence later shows an activity to be undermining the achievement of the conservation objectives, then the red-throated diver population will be deemed to be in unfavourable condition.

[15] "Restore" means to prevent further deterioration without inhibiting potential for future restoration.

[16] "Restore" is used here because existing evidence shows the feature to have been displaced from previously used areas of the site. Therefore, we have set the target to prevent further displacement, while recognising current impacts to the feature, and where possible existing influences should be addressed.

3.3.1 Favourable condition for red-throated diver

The interest feature red-throated diver will be considered to be in favourable condition only when each of the following three conditions are met:

(i) The red-throated diver population shows only non-significant fluctuation around the mean population at the time of classification of the SPA, with due consideration to the potential for natural change.

(ii) Red-throated diver distribution and ability to use the site does not significantly change (subject to natural fluctuations and variation).

(iii) The extent and distribution of the supporting habitat available to the red throated diver population within the site, including its structure, function and supporting processes, is maintained.

Digital aerial surveys of the original SPA boundary[17] took place over several successive winters (2015, 2018, 2019 & 2020) and this data was used as the basis for deriving the SPA population. There is therefore a reasonable estimate of the magnitude of inter-annual natural variation in population size within the boundary of the SPA. This knowledge of natural fluctuation will be used to inform future assessments of favourable condition.

Changes in extent will need to take account of the dynamic nature of the supporting habitats. However, a trend of reduction in extent may indicate long-term changes in the physical conditions influencing the feature, whether it be natural processes or anthropogenically driven.

3.3.2 Explanatory information for the red-throated diver conservation objectives

3.3.2.1 Key supporting habitats, distribution, and disturbance of red-throated diver

Wintering red-throated divers occur throughout Liverpool Bay / Bae Lerpwl SPA with highest recorded densities off the Ribble Estuary, North Wales and the North Wirral Foreshore (Webb and others, 2006). Red-throated divers use the SPA in wintering numbers of European importance which was 922 individuals at the time of classification in 2010 (5.4% of the GB population, 2001/02 – 2006/07). The most recent four-year peak mean population estimate for red-throated diver in Liverpool Bay / Bae Lerpwl SPA is 1800 individuals based on recent digital aerial surveys (HiDef, in prep.).

Supporting habitats may have a functional role (as nursery, spawning or feeding grounds or in providing shelter) in supporting their prey species. Loss or damage to supporting habitats may cause a loss of foraging sites and therefore lead to a reduction in food resources. When Liverpool Bay/Bae Lerpwl SPA was first classified in 2010, red-throated divers had an estimated area of 170,293 ha. This baseline area included windfarms that were present at the time of classification. Post construction monitoring between 2017 and 2020 has indicated that there are detectable displacement effects from the Burbo Bank extension windfarm in Liverpool Bay/Bae Lerpwl SPA (HiDef, 2020). As a result of wind farm development, red-

[17] A 4-year mean peak of the population size was estimated for red-throated diver using the original SPA boundary rather than the most recent boundary. Due to the difference in area being small and containing a low red-throated diver density, no appreciable difference is expected.

throated divers in Liverpool Bay SPA have experienced a reduction in available supporting habitat. Although the physical supporting habitat may still be present, disturbance and displacement from wind farms has meant that some areas are no longer accessible for red-throated divers.

Red-throated diver are wholly marine in the non-breeding season and can be found rafting and fishing in the shallow coastal waters throughout Liverpool Bay (Natural England and JNCC, 2010; Natural England and JNCC, 2013; Dierschke and others, 2017). In the UK, wintering red-throated divers show a preference for shallow inshore waters up to depths of 20m but may also use waters up to approximately 30m deep. Red-throated diver are highly mobile around the UK, and within the SPA over the winter, and may move between sandy bays, sandbanks and the mouths of estuaries, where water of different salinity mixes (Natural England and JNCC, 2013; McGovern, Goddarn and Rehfisch, 2016; Dierschke and others, 2017; Skov and others, 1995; Stone and others, 1995).

Red-throated diver will primarily use the water column for foraging, but they may also use benthic habitats (e.g., Duckworth and others, 2021). Supporting habitats may have a functional role (as nursery, spawning or feeding grounds or in providing shelter) in supporting their prey species.

Red-throated diver are highly sensitive to vessel movements and have been shown to have a strong stress response to disturbance (Dierschke and others, 2017). In a review of the sensitivity of 26 species of “seabird" to the development of offshore wind- farms, Garthe and Huppop (2004) found that red-throated divers had the second highest species sensitivity index score. Recent evidence shows that displacement from large infrastructure such as offshore windfarms can extend to 10km and beyond based on monitoring in the Outer Thames Estuary (APEM, 2021). A report on Burbo Bank wind farm extension shows that red-throated divers may have been displaced from up to 12km from the array when post-construction and pre-construction data was compared (HiDef, 2020). The displacement distance from this study was similar to those distances found by Mendel and others, (2019; 20km) and Petersen, Nielsen and Mackenzie (2014; 13km).

Similar results have been reported from the German Bight. Using digital aerial surveys and satellite telemetry, Heinänen and others, (2020) found that divers were strongly displaced from wind farms in suitable habitat, and a significant effect could be detected up to 10-15 km away. Approaching ships and smaller vessels have been shown to cause displacement, even when several kilometres away (Dierschke and others, 2017; Schwemmer and others, 2011, Fliessbach and others, 2019). Here, ships regularly cross the Liverpool Bay / Bae Lerpwl SPA to enter or leave the port of Liverpool, one of the busiest ports in the UK, or service the wind farms and other marine industries in the area. Burt and others, (2022) processed shipping and other anthropogenic activity data and combined it with aerial survey data to model the distribution of wintering red-throated diver in Liverpool Bay / Bae Lerpwl SPA. Amongst other findings, the model results suggest that a displacement buffer of 2km for shipping may be appropriate, with predicted numbers increasing as the distance increased from 0 to 2km.

Commercial and recreational fishing causes disturbance to red-throated diver as the birds usually avoid boats which can result in displacement and the forced use of sub-optimal foraging habitats (Natural England and JNCC, 2010). Disturbance can cause birds to reduce or cease feeding in a given area or to fly away from an area (i.e., be displaced). Either response could decrease their energy intake rate at their present (disturbed) feeding site or alternative feeding site, which may be less favoured. The latter response would also increase energy expenditure during flight and perhaps during subsequent foraging in less favourable habitat (or favourable habitat with greater intra-specific competition). Both

disturbance and displacement can affect the energy budgets and possibly survival of birds (Dierschke and others, 2017). Disturbance and displacement to red-throated diver needs to be managed and limited as far as possible to avoid significantly impacting this species.

At the time Liverpool Bay was originally classified, red-throated divers were already exposed to some level of boat activity (including commercial freight and passenger services, recreational boating, dredging activity, and fishing vessels) and existing wind farms. Disturbance from dredging and shipping activities is expected to be confined to existing shipping channels which are already known to be avoided by divers.

The red-throated diver is a long-lived species with low breeding productivity and populations are vulnerable to increased adult mortality. As shown by studies on fishing practices in the Baltic Sea, entanglement in various types of static fishing gear, netting and marine litter is one of the most frequently identified causes of death for red-throated diver (Okill, 2002, Erdmann and others, 2005, Weston and Caldow 2010). The extent of this impact in Liverpool Bay is not known. Fishing activity within Liverpool Bay includes trawling, dredging, long-lining, potting and angling. Removal of fish species and larger molluscs can have significant impacts on the structure and functioning of benthic communities over and above the physical effects of fishing methods on the seabed, particularly as some fish species fill upper roles in the trophic web.

Red-throated divers are thought to be vulnerable to pollution at any time of the year (Webb and others, 2016). Red-throated divers moult their flight feathers during September and October when they may become flightless for a short period and are thought to be particularly vulnerable to oil pollution and disturbance at this time.

Further detail on local environmental conditions and supporting habitats may be found in section 4.

3.3.2.2 Key food

Red-throated diver are opportunistic feeders, diving below the surface to catch small fish at shallow depths (McGovern, Goddarn and Rehfisch, 2016; Guse, Garthe and Schirmeister 2009) and forage on the seabed in some environments (Duckworth and others, 2021). Evidence also suggests that red-throated divers prey on several different fish species including members of the gadoid family, various flatfish, herring, gobies, sand eels and sprat (Guse, Garthe and Schirmeister, 2009; Natural England and JNCC, 2013). However, there is currently a lack of evidence for the diet of red-throated diver in Liverpool Bay.

The sandbanks of Liverpool Bay are important foraging grounds, as they provide suitable hunting depths and support many of the prey species and their nursery grounds (Natural England and JNCC, 2013).

As an active fish-feeder (Guse, Garthe and Schirmeister, 2009 and references therein), the distribution and concentrations of red-throated divers will at least partly be determined by the presence, abundance, and availability of their prey species.

Certain types of fishing have the potential to directly remove divers' prey species. Thus, the mechanisms for these pressures to impact on red-throated divers may be a direct or indirect reduction in food availability for the overwintering population.

For many of the red-throated diver's prey species, Liverpool Bay provides important nursery and spawning areas (Campanella and van der Kooij, 2021). Impacts on the prey species from dredging and dumping activities could be detrimental although this requires more

research to determine the scale of impact. As a pursuit predator of fish, red-throated divers are particularly sensitive to elevated levels of turbidity which may reduce their foraging success. Marine industries, such as dredging and aggregates extraction, may cause increased turbidity. This could reduce prey availability for this species if prey are displaced from an area. It is also important to consider the variability in natural background turbidity levels of the site which may affect the contribution of marine industry activity to the turbidity of the water at a specific location (van Kruchten and van der Hammen, 2011).

Commercial extraction of the red-throated diver's main fish prey, as either target and/or by-catch species, could impact the birds, but the extent of this in Liverpool Bay/Bae Lerpwl SPA is not well understood.

3.4 The conservation objectives for Liverpool Bay / Bae Lerpwl SPA Interest feature 2: Internationally important non-breeding population of common scoter (*Melanitta nigra*)

Subject to natural change[18], maintain[19] or restore[20] the common scoter population, distribution and its supporting habitats in favourable condition.

Table 2: Conservation objectives (attributes and targets) for the Liverpool Bay / Bae Lerpwl SPA interest feature common scoter.

Feature	Attribute	Target
Common scoter	Non-breeding population: abundance	Maintain the size of the non-breeding population at a level which is at or above 141,801 individuals (mean peak 2015, 2018, 2019 & 2020).
	Non-breeding population: distribution	Maintain the distribution of the feature; the extent should not be reduced by anthropogenic factors.
	Disturbance caused by human activity	Minimise the frequency, duration and/or intensity of disturbance affecting the feature so that the population, its distribution within the site, or its use of the habitat is not significantly affected.
	Supporting habitat: Food availability	Maintain the distribution, abundance and availability of key food and prey items (e.g. molluscs and bivalves) to maintain the population.
	Supporting habitat: extent, distribution, and quality of supporting habitat for the non-breeding season	Maintain the extent, distribution and availability of suitable habitat which supports the feature; the quality and extent should not deteriorate by anthropogenic factors (including water quality).

[18] "Natural change" means changes in the species or habitat which are not a result of human influences. Human influence on the common scoter population is acceptable provided that it is proved to be/can be established to be compatible with the achievement of the conditions set out under the definition of favourable condition. A failure to meet these conditions which is entirely a result of natural process will not constitute unfavourable condition but may trigger a review of the definition of favourable condition.

[19] "Maintain" is used here because existing evidence suggests the feature to be in favourable condition for each attribute with a maintain target, and the objective is for it to remain so. Existing activities are deemed to be compatible with the conservation objectives if current practices are continued at current levels and in the absence of evidence that current activities are significantly affecting the common scoter population or its habitat. However, it must be borne in mind that gradually damaging activities can take time to show their effects. If evidence later shows an activity to be undermining the achievement of the conservation objectives, then the common scoter population will be deemed to be in unfavourable condition.

[20] "Restore" means to prevent further deterioration without inhibiting potential for future restoration.

3.4.1 Favourable condition for common scoter

Common scoter will be considered to be in favourable condition only when each of the following three conditions is met:

(i) The common scoter population shows only non-significant fluctuation around the mean population at the time of classification of the SPA, with due consideration to the potential for natural change.

(ii) Common scoter distribution and ability to use the site does not significantly change (subject to natural fluctuations and variation).

(iii) The extent and distribution of the supporting habitat available to the common scoter population within the site, including its structure, function and supporting processes, is maintained.

Digital aerial surveys of the original SPA boundary took place over several successive winters (2015, 2018, 2019 & 2020) and this data was used as the basis for deriving the SPA population. There is therefore a reasonable estimate of the magnitude of inter-annual natural variation in population size within the boundary of the SPA. This knowledge of natural fluctuation will be used to inform future assessments of favourable condition.

Changes in extent will need to take account of the dynamic nature of the supporting habitats, but a trend of reduction in extent may indicate long-term changes in the physical conditions influencing the feature, whether it be natural processes or anthropogenically driven.

3.4.2 Explanatory information for the common scoter conservation objectives

3.4.2.1 Key supporting habitats, distribution, and disturbance of common scoter

Common scoters have a clustered distribution within Liverpool Bay with the highest concentrations recorded from three broad areas (Webb and others, 2006): Red Wharf Bay/ Traeth Coch (Anglesey) and Conwy Bay/Bae Colwyn; Great Orme Head/Pen y Gogarth to the North Wirral Foreshore; Formby Point to Shell Flat (off Blackpool). At the time of first classification in 2010, common scoters used the SPA in winter in numbers of European importance (54,675 individuals, 3.4% of the *nigra* subspecies, 2001/02 – 2006/07). The most recent four-year peak mean population estimate of common scoter in the Liverpool Bay / Bae Lerpwl SPA is 141,801 individuals based on recent digital aerial surveys (HiDef, in prep.).

Over-wintering common scoters in Liverpool Bay tend to aggregate on a water depth range of 2-20m and a mean depth of 10-12m (Kaiser and others, 2006). The most important areas of Liverpool Bay for the common scoter are Shell Flat to Formby (off Blackpool), Colwyn Bay/Bae Colwyn and Conwy Bay/Bae Conwy (CCW, 2006).

Common scoters are present in Liverpool Bay from July to May, with the most significant numbers present during August to March. The observed distribution of common scoters is strongly associated with the distribution of its benthic prey species (Kaiser and others, 2006).

Common scoter will primarily use the subtidal and intertidal sandy sediments for foraging. The relatively high abundance of common scoter within Liverpool Bay/Bae Lerpwl SPA may

be attributed to the presence of suitable supporting habitat (HiDef, in prep.; Kaiser, 2002; Natural England, 2010). Supporting habitats may have a functional role in supporting their prey species. Further detail on local environmental conditions and supporting habitats may be found in section 4.

Common scoter is an extremely shy species. In a review of the sensitivity of 26 species of “seabird" to the development of offshore wind-farms, common scoter had the highest vulnerability score in relation to disturbance by ship and helicopter traffic (Garthe and Huppop, 2004). Kaiser and others (2006) noted that large flocks of the birds were observed being put to flight at a distance of 2km from a 35m vessel, though smaller flocks were less sensitive and put to flight at a distance of 1km (Kaiser and others, 2006). Burt and others (2022) processed shipping and other anthropogenic activity data and combined it with aerial survey data to model the distribution of wintering common scoter in Liverpool Bay / Bae Lerpwl SPA (Burt and others 2022). Amongst other findings, the model results show that the greater the size of the ship the more negative the impact on the estimated number of birds in the vicinity, with larger vessels being expected to have an even greater disturbance distance (Kaiser and others, 2006).

Common scoter may be equally sensitive to other sources of non-physical disturbance, especially those creating noise and/or movement. Disturbance can cause birds to reduce or cease feeding in a given area or to fly away from a given area i.e., be displaced. Kaiser and others (2006) have shown that common scoters were observed in lowest numbers or were absent from areas of Liverpool Bay in which anthropogenic disturbance (shipping activity) was relatively intense, even when these areas held a high prey biomass.

Although evidence shows that common scoters are sensitive to disturbance, especially from ships, it is not clear the extent common scoter are experiencing this pressure within the site. Most shipping activity, including recreational boating, commercial freight and passenger services, marine aggregates and fishing, is confined to existing shipping channels in and out of the Mersey, whilst the main common scoter aggregations are located at Shell Flat near Blackpool, or near the North Wales coastline. Kaiser and others (2006) showed that while common scoters were observed in lowest numbers or were absent from areas of Liverpool Bay in which anthropogenic disturbance (shipping activity) was relatively intense, such areas could hold a high prey biomass. Disturbance to common scoter needs to be monitored and managed to limit disturbance as far as possible to avoid impacting this species.

Studies at Danish wind-farms (Petersen and others*,* 2006) have provided some evidence of displacement of common scoter from wind-farms and areas around them, although the evidence is less clear than in the case of red-throated divers. At least at one site apparent displacement may be related to temporal variation in the distribution of profitable patches of food resources rather than an effect of the wind-farm (Petersen and others*,* 2006). Studies in Denmark have suggested evidence of a degree of habituation by common scoters to offshore wind-farms (Petersen and Fox, 2007). Impacts to common scoter may result from collision with wind turbines if they fly at a height above 20m. It has been observed, however, that common scoters generally fly below the height at which they would be at risk of colliding with rotating turbine blades (Garthe and Huppop 2004). In addition, exposure to collision risks may be lowered by apparent displacement of common scoter from wind-farm footprints due to non-physical disturbance (Petersen and others, 2006), although such an effect may only be short-lived (Petersen and Fox 2007). Any habituation of common scoter to offshore wind-farms (Petersen and Fox 2007) or further expansion of such developments may alter the likelihood of collision risks.

Common scoter are frequently listed amongst those species of seabird and waterfowl that are found entangled in various types of static fishing gear and netting in NW European waters (Erdmann and others*,* 2005). However, as this type of fishing does not currently

occur in Liverpool Bay, there is no direct site-specific evidence for this being a source of mortality for common scoter in Liverpool Bay. Common scoter populations are sensitive to increased adult mortality as it is a long-lived species with relatively low annual adult mortality (Krementz, Barker and Nichols, 1997; Fox, Petersen and Frederiksen, 2003) and low breeding productivity.

3.4.2.2 Key food

Common scoters feed by diving, usually synchronously in flocks, and feed on cockles, clams, other bivalves, and a variety of other molluscs, crustaceans, and worms. Kaiser and others (2002) conducted a review of the literature concerning the diet of common scoter. This revealed that in each of eight quantitative studies, the percentage value for the occurrence of molluscs in their diet exceeded 90%, and that for bivalves exceeded 88%. The distribution of common scoter in Liverpool Bay / Bae Lerpwl SPA is strongly associated with the distribution of its benthic prey species. As benthic feeders, common scoters are closely associated with the availability and condition of their shallow seabed habitat. The subtidal sandbanks of Shell Flat (also protected within Shell Flat and Lune Deep SAC) support many bivalves that in turn support the common scoter population of Liverpool Bay / Bae Lerpwl SPA. Benthic sampling undertaken to date has found three main bivalve species within the site as a whole; *Abra alba, Pharus legumen* and *Donax vittatus* (Kaiser and others, 2006). They are, however, opportunistic in their diet and will often exploit whatever mollusc happens to be the most locally abundant, suitable prey resource.

Fishing activity within Liverpool Bay includes trawling, dredging, long-lining, potting and angling. Removal of fish species and larger molluscs can have significant impacts on the structure and functioning of benthic communities over and above the physical effects of fishing methods on the seabed, particularly as some fish species fill upper roles in the trophic web. In addition, certain types of fishing have the potential to directly remove common scoter's prey species. Thus, the mechanisms for these pressures to impact on common scoters may be a direct or indirect reduction in food availability for the overwintering population. Common scoters are highly sensitive to selective extraction of their prey species, as although they are known to take a broad range of shellfish species, their diet is composed predominantly of sedentary benthic bivalves (Kaiser, 2002). The exposure to selective extraction of prey species by fishing (the amount of their prey species taken by fishing vessels as target or by-catch) is not clearly understood.

Dredging for bivalves has been shown to have significant negative effects on their benthic habitat and could directly affect both the food source and feeding grounds used by common scoters. Extensive harvesting of benthic bivalves has been implicated in mass mortalities of other benthic bivalve feeding ducks notably common eider in the Dutch Wadden Sea (Piersma and Camphuysen 2001).

3.5 The conservation objectives for Liverpool Bay / Bae Lerpwl SPA Interest feature 3: Internationally important non-breeding population of little gull (*Hydrocoloeus minutus*)

Subject to natural change[21], maintain[22] or restore[23] the little gull population, distribution and itssupporting habitats in favourable condition.

Table 3: Conservation objectives (attributes and targets) for the Liverpool Bay / Bae Lerpwl SPA interest feature little gull.

Feature	Attribute	Target
Little gull	Non-breeding population: abundance	Maintain the size of the non-breeding population at a level which is at or above 319 individuals (mean peak 2004/5 - 2010/11).
	Non-breeding population: distribution	Maintain the distribution of the feature; the extent should not be reduced by anthropogenic factors.
	Disturbance caused by human activity	Minimise the frequency, duration and/or intensity of disturbance affecting the feature so that the population, its distribution within the site, or its use of the habitat is not significantly affected.
	Supporting habitat: Food availability	Maintain the distribution, abundance and availability of key food and prey items (e.g., fish) to maintain the population.
	Connectivity with supporting habitats	Maintain safe passage of birds moving between roosting and feeding areas.
	Supporting habitat: extent, distribution and quality of supporting habitat for the non-breeding season	Maintain the extent, distribution and availability of suitable habitat which supports the feature; the quality and extent should not deteriorate by anthropogenic factors (including water quality).

[21] "Natural change" means changes in the species or habitat which are not a result of human influences. Human influence on the little gull population is acceptable provided that it is proved to be/can be established to be compatible with the achievement of the conditions set out under the definition of favourable condition. A failure to meet these conditions which is entirely a result of natural process will not constitute unfavourable condition but may trigger a review of the definition of favourable condition.

[22] "Maintain" is used here because existing evidence suggests the feature to be in favourable condition for each attribute with a maintain target, and the objective is for it to remain so. Existing activities are deemed to be compatible with the conservation objectives if current practices are continued at current levels and in the absence of evidence that current activities are significantly affecting the little gull population or its habitat. However, it must be borne in mind that gradually damaging activities can take time to show their effects. If evidence later shows an activity to be undermining the achievement of the conservation objectives, then the little gull population will be deemed to be in unfavourable condition.

[23] "Restore" means to prevent further deterioration without inhibiting potential for future restoration.

3.5.1 Favourable condition for little gull

Little gull will be considered to be in favourable condition only when each of the following three conditions is met:

(i) The little gull population shows only non-significant fluctuation around the mean population at the time of classification of the SPA, with due consideration to the potential for natural change.

(ii) Little gull distribution and ability to use the site does not significantly change (subject to natural fluctuations and variation).

(iii) The extent and distribution of the supporting habitat available to the little gull population within the site, including its structure, function and supporting processes, is maintained.

Survey data from multiple winter seasons was used as the basis for deriving the SPA population. There is therefore a reasonable estimate of the magnitude of inter-annual natural variation in population size within the boundary of the SPA. This knowledge of natural fluctuation will be used to inform future assessments of favourable condition.

Changes in extent will need to take account of the dynamic nature of the supporting habitats, but a trend of reduction in extent may indicate long-term changes in the physical conditions influencing the feature, whether it be natural processes or anthropogenically driven.

3.5.2 Explanatory information for the little gull conservation objectives

3.5.2.1 Key supporting habitats, distribution, and disturbance of little gull

From the available data for Liverpool Bay / Bae Lerpwl SPA, Lawson and others (2016) demonstrated a mean peak of 319 individuals (2004/05 – 2010/11), in clearly defined hotspots. Surveys from 2006/07 and 2007/08 did not inform the estimate of little gull abundance because of incomplete spatial coverage, or because of unreliable population estimates. The mean of peak thus uses data from 2004/05, 2005/06 and 2010/11. Although there is no national estimate of little gull abundance, the value of 319 comfortably exceeds the ‘minimum 50’ guideline nominally used to assess SPA qualification (Stroud and others, 2001). Furthermore, JNCC’s national programme of data analysis has established that Liverpool Bay / Bae Lerpwl SPA holds more little gulls than anywhere else in the UK, except for the Greater Wash SPA.

Little gull roost at sea within Liverpool Bay / Bae Lerpwl SPA and are known to travel to Seaforth Nature Reserve within the adjacent Mersey Narrows and North Wirral Foreshore SPA, where they feed and possibly shelter during periods of harsh weather (Allcock, O’brien and Parsons, 2013). Allcock, O’brien and Parsons (2013) found that the highest densities of little gull were consistently located offshore of Blackpool and the Ribble Estuary, close to the 12 nautical mile line.

The impact of marine industries upon little gull connectivity should be monitored, and connectivity between roosting and feeding sites maintained as safe and successful movement between these areas is critical to adult fitness and survival. This target will apply within the site boundary and where birds regularly move to and from off-site habitat where this is relevant. The target has been set to better understand the impact of anthropogenic

activities on little gull. Inappropriate management and direct or indirect impacts which may affect the extent and distribution of habitats may adversely affect the population and alter the distribution of birds. This may also apply to supporting habitat that lies outside of the Liverpool Bay / Bae Lerpwl SPA boundary.

3.5.2.2 Key food

We currently have a very limited understanding of the diet of little gulls. Samples collected in the vicinity of feeding little gulls included but was not limited to insects, crustaceans, comb jellies and molluscs, which suggest these might form at least part of their diet (Schwemmer and Garthe, 2006).

Lawson and others (2016) describe in detail the assessment of important areas for little gulls within Liverpool Bay. Supporting habitats may have a functional role (as nursery, spawning or feeding grounds or in providing shelter) in supporting their prey species. Physical loss or damage to supporting habitats may cause a loss of foraging sites and therefore lead to a reduction in food resources.

Physical loss by removal or by smothering of any of the habitats on which little gull depend may result in the loss of foraging sites and therefore the reduction of the food resource for the overwintering population. This would consequently be detrimental to the favourable condition of the interest feature. At the time of the original designation, there was a low level of ships anchoring and marine aggregate extraction. Further detail on local environmental conditions and supporting habitats may be found in section 4.

Fishing activity within Liverpool Bay includes trawling, dredging, long-lining, potting and angling. Removal of fish species and larger molluscs can have significant impacts on the structure and functioning of benthic communities over and above the physical effects of fishing methods on the seabed, particularly as some fish species fill upper roles in the trophic web. Thus, the mechanisms for these pressures to impact on little gulls may be a direct or indirect reduction in food availability for the overwintering population.

3.6 The conservation objectives for Liverpool Bay / Bae Lerpwl SPA Interest feature 4: Internationally important breeding population of common tern (*Sterna hirundo*)

Subject to natural change[24], maintain[25] or restore[26] the common tern population, distribution and its supporting habitats in favourable condition.

Table 4: Conservation objectives (attributes and targets) for the Liverpool Bay / Bae Lerpwl SPA interest feature common tern.

Feature	Attribute	Target
Common tern	Breeding population: abundance	Maintain the size of the breeding population at a level which is at or above 180 pairs (2011 – 2015).
	Breeding population: distribution	Maintain the distribution of the feature; the extent should not be reduced by anthropogenic factors.
	Disturbance caused by human activity	Minimise the frequency, duration and/or intensity of disturbance affecting the feature so that the population, its distribution within the site, or its use of the habitat is not significantly affected.
	Supporting habitat: Food availability	Maintain the distribution, abundance and availability of key food and prey items (e.g., fish) to maintain the population.
	Connectivity with supporting habitats	Maintain safe passage of birds moving between nesting and feeding areas.
	Supporting habitat: extent, distribution and quality of supporting habitat for the breeding season	Maintain the extent, distribution and availability of suitable habitat which supports the feature; the quality and extent should not deteriorate by anthropogenic factors (including water quality).

[24] "Natural change" means changes in the species or habitat which are not a result of human influences. Human influence on the common tern population is acceptable provided that it is proved to be/can be established to be compatible with the achievement of the conditions set out under the definition of favourable condition. A failure to meet these conditions which is entirely a result of natural process will not constitute unfavourable condition but may trigger a review of the definition of favourable condition.

[25] "Maintain" is used here because existing evidence suggests the feature to be in favourable condition for each attribute with a maintain target, and the objective is for it to remain so. Existing activities are deemed to be compatible with the conservation objectives if current practices are continued at current levels and in the absence of evidence that current activities are significantly affecting the common tern population or its habitat. However, it must be borne in mind that gradually damaging activities can take time to show their effects. If evidence later shows an activity to be undermining the achievement of the conservation objectives, then the common tern population will be deemed to be in unfavourable condition.

[26] "Restore" means to prevent further deterioration without inhibiting potential for future restoration.

3.6.1 Favourable condition for the common tern

Common tern will be considered to be in favourable condition only when each of the following three conditions is met:

(i) The common tern population shows only non-significantfluctuation around the mean population at the time of classification of the SPA, with due consideration to the potential for natural change.

(ii) Common tern distribution and ability to use the site does not significantly change (subject to natural fluctuations and variation).

(iii) The extent and distribution of the supporting habitat available to the common tern population within the site, including its structure, function and supporting processes, is maintained.

Aerial surveys were not used to set the target population for this species. The target population is based on the same population estimate from counts at the colony that were used to set the conservation objective for this feature in the Mersey Narrows, or North Wirral Foreshore depending on where they come from. There is therefore a reasonable estimate of the magnitude of inter-annual natural variation in population size within the boundary of the SPA. This knowledge of natural fluctuation will be used to inform future assessments of favourable condition.

Changes in extent will need to take account of the dynamic nature of the supporting habitats, but a trend of reduction in extent may indicate long-term changes in the physical conditions influencing the feature, whether it be natural processes or anthropogenically driven.

3.6.2 Explanatory information for the common tern conservation objectives

3.6.2.1 Key supporting habitats, distribution, and disturbance of common tern

Within Liverpool Bay / Bae Lerpwl SPA, common terns use intertidal habitats when inundated, as well as the deeper water column for foraging. Key foraging areas within the SPA include shallow subtidal waters, generally within 18km of breeding colonies, and especially in areas of high velocity water flow (Woodward and others, 2019; Eglington and Perrow, 2014; Thaxter and others, 2012). Woodward and others (2019) found that for foraging common terns, the mean distance was 6.4(±4.5) km, the mean maximum was 18.09(±8.9) km, and the maximum recorded distance was 30km. The coastal waters of the SPA are also used for a wide range of maintenance activities such as bathing and preening. Common tern foraging in the site are also known to use supporting habitat within the Mersey Narrows and North Wirral Foreshore SPA and the Ribble and Alt Estuaries SPA (Natural England, Natural Resources Wales and JNCC, Departmental Brief 2016).

Supporting habitats may have a functional role (as nursery, spawning or feeding grounds or in providing shelter) in supporting their prey species. Physical loss or damage to supporting habitats could cause a loss of foraging sites and therefore lead to a reduction in food resources. Further detail on local environmental conditions and supporting habitats may be found in section 4.

Important foraging areas for common terns around the Seaforth colony were identified from models of common tern foraging behaviour (Wilson and others, 2014) and confirmed by verification surveys carried out in the Mersey (Perrow, Harwood and Caldow, 2015). Within Mersey Narrows and North Wirral Foreshore SPA there has been recent establishment of a

small breeding colony at Birkenhead (Monteith, 2018) and in the past common tern have also nested at Langton Dock (Banks, 2018 personal communications). These populations may be reliant on Liverpool Bay SPA for foraging. For common tern nesting within Mersey Narrows and North Wirral Foreshore SPA at Seaforth, the predicted marine foraging area extends northwards approximately to Formby, west along most of the Wirral foreshore, and into the mouth of the Mersey Estuary approximately to Rock Ferry (Natural England, Natural Resources Wales and JNCC, Departmental Brief 2016) although greater foraging distances cannot be ruled out. The Seaforth colony will also travel to foraging waters within the Ribble and Alt Estuaries.

There may be a 'functional linkage' (meaning a shared use of bird supporting habitats in different locations) across the suite of SPAs adjacent to Liverpool Bay (and elsewhere along the Irish Sea coast). This includes Ribble and Alt Estuaries SPA, Mersey Narrows and North Wirral Foreshore SPA, The Dee Estuary SPA and Anglesey Terns/Morwenoliaid SPA. As a result, the population of common terns should be regarded as dynamic and may utilise other (protected and non-protected) sites within the Liverpool Bay area. Where common terns are using habitat outside of designated sites this should be regarded as functionally linked supporting habitat for SPA birds and therefore should be considered within any Habitats Regulations Assessment. When last assessed in 2018, numbers within the meta-population appear to be stable (JNCC SMP, 2018).

The impact of marine industries upon common tern connectivity should be monitored, and connectivity between feeding and nesting sites maintained.

3.6.2.2 Key Food

Small fish and invertebrates constitute the majority of the diet for common tern, with sprat (*Sprattus sprattus*), herring (*Clupea harengus*) and sand eels (*Ammodytes* spp.) being particularly important. However, common terns have a broad range of potential prey species and foraging methods, demonstrating a strong foraging plasticity and adaptability (Eglington and Perrow, 2014). They may also feed on crustaceans and terrestrial insects.

Fishing activity within Liverpool Bay includes trawling, dredging, long-lining, potting and angling. Removal of fish species and larger molluscs may have significant impacts on the structure and functioning of benthic communities over and above the physical effects of fishing methods on the seabed, particularly as some fish species fill upper roles in the trophic web. In addition, certain types of fishing have the potential to directly remove common tern prey species. Thus, the mechanisms for these pressures to impact on common tern may be a direct or indirect reduction in food availability for the breeding population.

Physical loss by removal or by smothering of any of the habitats on which common tern depend may result in the loss of foraging sites and therefore the reduction of the food resource for the breeding population. This would consequently be detrimental to the favourable condition of the interest feature. At the time of the original classification, there was a low level of ships anchoring and marine aggregate extraction.

Common tern prey species, such as herring, are particularly sensitive to noise disturbance and excess siltation when spawning can smother eggs. Long term monitoring is required to fully assess any impacts on prey availability due to disturbance and offshore development. There is evidence to suggest that tern foraging success may be higher in areas of greater turbidity (Eglington and Perrow 2014). However, excessive turbidity, such as arising from marine dredging or aggregates extraction, construction, and some types of fishing activity, may also displace prey species and reduce prey availability. Turbidity within key foraging areas should be maintained at natural levels.

3.7 The conservation objectives for Liverpool Bay / Bae Lerpwl SPA Interest feature 5: Internationally important breeding population of little tern (*Sternula albifrons*)

Subject to natural change[27], maintain[28] or restore[29] the little tern population, distribution and its supporting habitats in favourable condition.

Table 5: Conservation objectives (attributes and targets) for the Liverpool Bay / Bae Lerpwl SPA interest feature little tern.

Feature	Attribute	Target
Little tern	Breeding population: abundance	Maintain the size of the breeding population, at a level which is at or above 69 pairs (1995-1999).
	Breeding population: distribution	Maintain the distribution of the feature; the extent should not be reduced by anthropogenic factors.
	Disturbance caused by human activity	Minimise the frequency, duration and/or intensity of disturbance affecting the feature so that the population, its distribution within the site, or its use of the habitat is not significantly affected.
	Supporting habitat: Food availability	Maintain the distribution, abundance and availability of key food and prey items (e.g., fish) to maintain the population.
	Connectivity with supporting habitats	Maintain safe passage of birds moving between nesting and feeding areas.
	Supporting habitat: extent, distribution and quality of supporting habitat for the breeding season	Maintain the extent, distribution and availability of suitable habitat which supports the feature; the quality and extent should not deteriorate by anthropogenic factors (including water quality).

[27] "Natural change" means changes in the species or habitat which are not a result of human influences. Human influence on the little tern population is acceptable provided that it is proved to be/can be established to be compatible with the achievement of the conditions set out under the definition of favourable condition. A failure to meet these conditions which is entirely a result of natural process will not constitute unfavourable condition but may trigger a review of the definition of favourable condition.

[28] "Maintain" is used here because existing evidence suggests the feature to be in favourable condition for each attribute with a maintain target, and the objective is for it to remain so. Existing activities are deemed to be compatible with the conservation objectives if current practices are continued at current levels and in the absence of evidence that current activities are significantly affecting the little tern population or its habitat. However, it must be borne in mind that gradually damaging activities can take time to show their effects. If evidence later shows an activity to be undermining the achievement of the conservation objectives, then the little tern population will be deemed to be in unfavourable condition.

[29] "Restore" means to prevent further deterioration without inhibiting potential for future restoration.

3.7.1 Favourable condition for little tern

Little tern will be considered to be in favourable condition only when each of the following three conditions is met:

(i) The little tern population shows only non-significant fluctuation around the mean population at the time of classification of the SPA, with due consideration to the potential for natural change.

(ii) Little tern distribution and ability to use the site does not significantly change (subject to natural fluctuations and variation).

(iii) The extent and distribution of the supporting habitat available to the little tern population within the site, including its structure, function and supporting processes, is maintained.

Aerial surveys were not used to set the target population for this species. Rather, this is based on the same population estimate from counts at the colony at Gronant that were used to set the conservation objective for this feature in the Dee SPA. There is therefore a reasonable estimate of the magnitude of inter-annual natural variation in population size within the boundary of the SPA. This knowledge of natural fluctuation will be used to inform future assessments of favourable condition.

Changes in extent will need to take account of the dynamic nature of the supporting habitats, but a trend of reduction in extent may indicate long-term changes in the physical conditions influencing the feature, whether it be natural processes or anthropogenically driven.

3.7.2 Explanatory information for the little tern conservation objectives

3.7.2.1 Key supporting habitats, distribution, and disturbance of little tern

The little tern is the smallest of five species of tern breeding around the British coast. It usually nests on beaches and lagoon islands of shingle, sand, or shells sometimes only metres from the high tide mark. This makes them susceptible to predation, human disturbance, and tidal inundation.

The little tern's nesting strategy makes them vulnerable because they breed in small, single species colonies that are abandoned when predation becomes too great; food becomes scarce; or more recently, when human disturbance becomes too great. The nest is an unlined scrape in which 1-3 camouflaged eggs are laid. Incubation is around 18-22 days, and the chicks fledge in 19-20 days. Little terns feed on small fish and crustaceans caught inshore, and occasionally from coastal freshwater bodies.

The nature, scale, timing, and duration of some human activities can result in bird disturbance (defined as any human-induced activity sufficient to disrupt normal behaviours and / or distribution of birds in the absence of the activity) at a level that may substantially affect their behaviour, and consequently affect the long-term viability of the population. Such disturbing effects can, for example, result in changes to feeding or roosting behaviour, increases in energy expenditure due to increased flight, abandonment of nest sites and desertion of supporting habitat (both within and outside the designated site boundary where appropriate). This may undermine successful nesting, rearing, feeding and/or roosting, and/or may reduce the availability of suitable habitat as birds are displaced and their

distribution within the site contracts. Disturbance associated with human activity may take a variety of forms including noise, light, sound, vibration, trampling, presence of people, animals and structures.

Little tern foraging ranges are highly limited, and key areas are generally within 5km of breeding colonies (Woodward and others, 2019). Woodward and others (2019) found that, for foraging, the mean range is 3.5km, mean of recorded maxima is 5km and the maximum recorded is 5km. Research carried out by the JNCC and the Statutory Nature Conservation Bodies (SNCBs) on the little tern colony at Gronant, found the mean of the maximum seaward foraging extents to be 1.87km (Parsons and others, 2015). Eglington (2013), in a literature review of foraging ecology of terns, concluded that most studies, including those citing anecdotal information, reported a foraging radius less than 4km from the colony. As a result, the little tern relies on abundant food supplies of fish in waters close to the colony. The breeding colony of little tern that forage in Liverpool Bay are located at Gronant, which is located within the Dee Estuary SPA. Significant variation in foraging range occurs between colonies and between years (Eglington, 2013). Within colonies, ranges have been found to be significantly greater during incubation (April-May ~1.6 – 2 km) than during chick rearing (June-July ~1 - 1.2 km) when foraging ranges would have been constrained by chick feeding duties (Paiva and others 2008). Diet may also change according to chick age, with smaller individuals of the same prey species being brought to younger chicks (Davies, 1981; Bogliani and others 1994; Phalan, 2000; Paiva and others 2006).

The coastal waters of the SPA are also used for a wide range of maintenance activities such as bathing and preening. Little tern foraging within the site are also known to use supporting habitat within The Dee Estuary SPA (Natural England, Natural Resources Wales and JNCC, Departmental Brief 2016). Important foraging areas for little tern nesting at Gronant were identified from shore and boat-based surveys (2009, 2010, 2011) in Liverpool Bay / Bae Lerpwl SPA (Parsons and others, 2015). Maintaining the connectivity between the nesting site and foraging areas is therefore crucial.

Population decline has been attributed to reductions in breeding success rather than to emigration or changes in adult survival (Pickerell, 2004). Human disturbance, primarily as an unintentional result of recreational activity, is thought to have been a major cause of reduced breeding success in the past. Now most colonies have a warden and are cordoned off, greatly reducing such disturbance. A more significant threat is predation from foxes, kestrels, carrion crows and magpies, which are widely reported to cause colony failure or at least severe reduction to breeding success. Although fox control in particular has been effective, control of aerial predators remains a challenge (Pickerell, 2004). Natural erosion and encroachment of vegetation have in many places reduced the area of suitable nesting habitat. Because little terns habitually nest very close to the high-water mark, tidal inundation during storm surges is a frequent cause of nest loss; given predictions of future sea level rise and increase in storminess, these threats would be expected to become increasingly prevalent (Pickerell, 2004).

Physical loss by removal or by smothering of any of the habitats on which little tern depend may result in the loss of foraging sites and therefore the reduction of the food resource for the breeding population. This would consequently be detrimental to the favourable condition of the interest feature. At the time of the original classification, there was a low level of ships anchoring and marine aggregate extraction.

Further detail on local environmental conditions and supporting habitats may be found in section 4.

3.7.2.2 Key Food

Little terns are plunge divers, foraging for small fish within the shallow subtidal waters of the site and may fish over sandbanks out to sea if conditions/prey availability dictate (Allcorn and others, 2003). There is evidence to suggest that shallow waters with strong currents may increase prey availability for this species. An EU LIFE study has mapped availability of prey species for terns around the British Isles (Green, 2017). Key little tern prey items include sand eels (*Ammodytes* spp.), sprat (*Sprattus sprattus*), young herring (*Clupea harengus*) and invertebrates (Taylor and Roe, 2004; Bertolero and others, 2005, Paiva and others, 2008). The impact of changes in food availability geographically and seasonally is not yet understood. It may be a limiting factor determining where and when colonies are established and abandoned.

The availability of an abundant food supply is critically important for successful breeding, adult fitness and survival and the overall sustainability of the population. As a result, inappropriate management and direct or indirect impacts which may affect the distribution, abundance and availability of prey may adversely affect the population and alter the distribution of birds. Main food sources can be found within coastal and offshore waters (Cramp, Bourne and Saunders, 1974; del Hoyo, Elliot and Sargatal, 1996; Perrow and others, 2006).

Supporting habitats may have a functional role (as nursery, spawning or feeding grounds or in providing shelter) in supporting little tern prey species. Physical loss or damage to supporting habitats may cause a loss of foraging sites and therefore lead to a reduction in food resources. Tern prey species, such as herring, are particularly sensitive to noise disturbance which can result from offshore developments. Fishing activity may have an impact on the availability of key prey species. Long term monitoring is required to fully assess any impacts on prey availability for this species.

Fishing activity within Liverpool Bay includes trawling, dredging, long-lining, potting and angling. Removal of fish species and larger molluscs may have significant impacts on the structure and functioning of benthic communities over and above the physical effects of fishing methods on the seabed, particularly as some fish species fill upper roles in the trophic web. In addition, certain types of fishing have the potential to directly remove little tern prey species. Thus, the mechanisms for these pressures to impact on little tern may be a direct or indirect reduction in food availability for the breeding population.

3.8 The conservation objectives for Liverpool Bay / Bae Lerpwl SPA Interest feature 6: non-breeding assemblage of over 20,000 waterbirds

Subject to natural change[30], maintain[31] or restore[32] the waterbird assemblage population, distribution and its supporting habitats in favourable condition.

Table 6: Conservation objectives (attributes and targets) for the Liverpool Bay / Bae Lerpwl SPA interest feature waterbird assemblage.

Feature	Attribute	Target
Waterbird assemblage	Assemblage of species: abundance	Maintain the size of the non-breeding population of component species at a level which is at or above 157,952 individuals (mean peak 2015, 2018, 2019 & 2020).
	Assemblage of species: diversity	Maintain the species diversity of the bird assemblage which should include common scoter, red-throated diver, little gull, red-breasted merganser and great cormorant.
	Assemblage of species: distribution	Maintain the distribution of the feature; the extent should not be reduced by anthropogenic factors.
	Disturbance caused by human activity	Minimise the frequency, duration and/or intensity of disturbance affecting the feature so that the population, its distribution within the site, or its use of the habitat is not significantly affected.
	Supporting habitat: extent, distribution, and quality of supporting habitat for the non-breeding season	Maintain the extent, distribution and availability of suitable habitat which supports the feature; the quality and extent should not deteriorate by anthropogenic factors (including water quality).

[30] "Natural change" means changes in the species or habitat which are not a result of human influences. Human influence on the waterbird assemblage population is acceptable provided that it is proved to be/can be established to be compatible with the achievement of the conditions set out under the definition of favourable condition. A failure to meet these conditions which is entirely a result of natural processes will not constitute unfavourable condition but may trigger a review of the definition of favourable condition.

[31] "Maintain" is used here because existing evidence suggests the feature to be in favourable condition for each attribute with a maintain target, and the objective is for it to remain so. Existing activities are deemed to be compatible with the conservation objectives if current practices are continued at current levels and in the absence of evidence that current activities are significantly affecting the waterbird assemblage population or its habitat. However, it must be borne in mind that gradually damaging activities can take time to show their effects. If evidence later shows an activity to be undermining the achievement of the conservation objectives, then the waterbird assemblage population will be deemed to be in unfavourable condition.

[32] "Restore" means to prevent further deterioration without inhibiting potential for future restoration.

3.8.1 Favourable condition for waterbird assemblage

The waterbird assemblage will be considered to be in favourable condition only when each of the following three conditions is met:

(i) The waterbird assemblage population shows only non-significant fluctuation around the mean population at the time of classification of the SPA, with due consideration to the potential for natural change.

(ii) The waterbird assemblage population and ability to use the site does not significantly change (subject to natural fluctuations and variation).

(iii) The extent and distribution of the supporting habitat available to the waterbird assemblage population within the site, including its structure, function and supporting processes, is maintained.

Digital aerial surveys of the original SPA boundary[33] took place over several successive winters (2015, 2018, 2019 & 2020) and this data was used as the basis for deriving the SPA population. There is therefore a reasonable estimate of the magnitude of inter-annual natural variation in population size within the boundary of the SPA. This knowledge of natural fluctuation will be used to inform future assessments of favourable condition.

Changes in extent will need to take account of the dynamic nature of the supporting habitats, but a trend of reduction in extent may indicate long-term changes in the physical conditions influencing the feature, whether it be natural processes or anthropogenically driven

3.8.2 Explanatory information for the waterbird assemblage conservation objectives

The waterbird assemblage refers to the non-breeding population of component species and reflects the diversity of species the SPA supports. Assemblage diversity is a product of species richness (the number of different species present), abundance (population size of each assemblage component species) and relative 'importance' (an assessment of the conservation status of each assemblage component).

Each component makes a different contribution to the diversity of the assemblage, and changes to some components may be considered to affect diversity more than others. Negative changes to small numbers of relatively important assemblage components may have a similar overall effect to negative changes in larger numbers of less important components. Abundance targets are set only for qualifying features (including the assemblage as a whole) and not individually for other component species within the assemblage. The species composition, including the main components of an assemblage, may change over time in response to natural processes. However, to meet this target, the total number of species contributing to the assemblage diversity should not decline significantly (Eaton, Brown and Noble, 2009).

Named components of the assemblage (i.e., species exceeding 1% of the GB total or 2,000 individuals) include all the non-breeding qualifying features:

- Common scoter

[33] A 4-year mean peak of the population size was estimated for the waterbird assemblage using the original SPA boundary rather than the most recent boundary. Due to the difference in area being small and containing a low waterbird assemblage density, no appreciable difference is expected.

- Red-throated diver, and
- Little gulls

As well as the non-breeding populations of:

- red-breasted merganser, and
- great cormorant

Other species contributing to the assemblage are recorded in the following report: JNCC Report 576 (Lawson and others, 2016). The mean peak value of 157,952 includes all marine waterbird species (HiDef, in prep.). HiDef (in prep.) found that birds were generally distributed throughout the SPA, with higher densities being found closer to the coast, especially in the north and southwest.

At classification, red-breasted merganser had a five-year peak mean of 131 individuals (2004/05 – 2010/11; Lawson and others, 2016) representing 1.56% of the GB population of 8,400 individuals in the non-breeding season (Musgrove and others, 2013). Great cormorant had a five-year peak mean of 732 (2004/05 – 2010/11; Lawson and others, 2016) representing 2.09% of the GB population of 35,000 in the non-breeding season (Musgrove and others, 2013).

The 'main component' assemblage species were defined as i) those present in nationally important numbers (≥1% GB population); ii) migratory species present in internationally important numbers (≥1% biogeographic population); iii) those species comprising ≥2,000 individuals (≥10% of the minimum qualifying threshold for an internationally important assemblage); and iv) 'named components' otherwise listed on the SPA citation.

In addition to the main components, other components should be considered as these contribute collectively to the assemblage diversity, in particular proportionally abundant populations of species of conservation importance. Examples are those red-listed as Birds of Conservation Concern and / or those listed on Sections 41/42 of the NERC Act 2006 (UK Government, 2006).

3.8.3 Key supporting habitats and distribution

Great cormorants are generally found in coastal areas where some colonies may remain in the same area year-on-year (Newson and others, 2013). However, sudden changes in location have been recorded which has led to uncertainty in assessing population trends (Mitchell and others, 2004). Furthermore, great cormorant distribution has moved further offshore due to the increase in roosting opportunities afforded by structures.

In the UK, wintering red-breasted merganser tend to be concentrated around estuarine environments (HiDef, in prep.; Kirby, Evans and Fox, 1993; Musgrove and others, 2013). They dive and swim to forage on fish and aquatic invertebrates in the water column (The Wildlife Trusts, 2022). Feeding, roosting, loafing and moulting occur within the site boundary (at sea), but some activities may also occur outside of the site boundary (within adjacent coastal habitats).

Supporting habitats may have a functional role (as nursery, spawning or feeding grounds or in providing shelter) in supporting their prey species. Physical loss or damage to supporting habitats may cause a loss of foraging sites and therefore lead to a reduction in food resources. Further detail on local environmental conditions and supporting habitats may be found in section 4.

3.9 Background to favourable condition

The favourable condition text sets out the principal sources of information that Natural England, Natural Resources Wales and the JNCC will use to assess the condition of the interest features as part of an ongoing monitoring requirement and reporting under Regulation 9 of the Habitats Regulations and Regulation 6 of the Offshore Habitats Regulations. A description of favourable condition can be found in each of the respective feature's conservation objectives in section 3.

On many terrestrial European sites, we know sufficient information about the required condition of qualifying habitats to be able to define favourable condition with confidence. In contrast, understanding the functioning of large, varied, dynamic marine and estuarine sites, which experience a variety of pressures resulting from historic and current activities, is much more difficult. Consequently, it is much harder to define favourable condition so precisely in such sites. In general, the conservation objectives provided are based on a working assumption that the current condition of the features is favourable for most attributes.

Where there are more than one year's observations on the condition of marine features, all available information will need to be analysed to determine, where possible, any natural environmental trends at the site. This will provide the basis for judgements of favourable condition to be determined in the context of natural change. Where it becomes clear that certain attributes may indicate a cause for concern, and if further investigation indicates this is justified, restorative management actions will need to be taken. The aim of such action would be to return the interest feature to favourable condition from any unfavourable state. Future editions of the advice within this document will revise the current assumptions about feature condition in light of ongoing and future monitoring. This will be linked with any developments in our understanding of the structure and functioning of features and the pressures they are exposed to.

This advice also provides the basis for discussions with relevant authorities, and as such the attributes and associated measures and targets may be modified over time. The aim is to have a single agreed set of attributes that will be used as a basis for monitoring in order to report on the condition of features. Condition monitoring of the attributes may be of fairly coarse methodology, underpinned by more rigorous methods on specific areas within the site. Common Standards Monitoring (JNCC 2004) requires mandatory monitoring of some attributes of a designated feature, while other attributes are considered discretionary (or site-specific) and are incorporated to highlight local distinctiveness. Monitoring of both bird populations and the extent of habitats are fundamental to assessing the condition of bird features (JNCC 2004) and are therefore identified as "mandatory attributes" in the text outlining favourable condition for each feature. It is not possible to make a robust assessment of the condition of a feature without assessing the mandatory attributes. In general, for bird features, all mandatory attributes must meet their targets for the feature to be in favourable condition. Priority will be given to measuring attributes that are at risk from anthropogenic pressure and for which changes in management may be necessary.
This information may be generated by Natural England/Natural Resources Wales/JNCC or collected by other organisations through agreements.

The condition monitoring programme will be developed through discussion with the relevant / competent authorities and other interested parties. Natural England, Natural Resources Wales and the JNCC will be responsible for collating the information required to assess condition and will form a judgement on the condition of each feature within the site.

Targeted monitoring of the attributes identified in the text outlining favourable condition will

be an important, but not the only, basis for assessing the condition of the features. Additional sources of information may also be selected to inform our view about the integrity and condition of the site. For example, a part of risk-based monitoring activity data (as collected by the relevant/competent authorities and their statutory advisers) could give an indication as to the levels of pressure that may impact on the site features. Any other relevant data, such as data on site integrity, results from compliance monitoring, (for example assessing the conduct of activities in relation to regulations and licence conditions), together with data obtained to inform appropriate assessments, licence applications etc. will also have an important role in informing assessments of feature condition.

Information about the size of the bird populations on the site will also need to be interpreted in the context of any wider changes in the populations of these species at a national or bio-geographic region level.

4. General site and feature information

4.1 Local environmental conditions and supporting habitats

Liverpool Bay is located in the south-eastern region of the northern part of the Irish Sea, bordering northwest England and north Wales, and running as a broad arc from Morecambe Bay to the east coast of Anglesey.

The Liverpool Bay / Bae Lerpwl SPA lies in both English and Welsh territorial waters and in offshore UK waters. The border between English and Welsh territorial waters running north-westwards from the Dee Estuary. The SPA comprises one area of 252,757.73 ha. The seaward boundary of the SPA is mostly within the 20-25m depth contour but off the coast of north Wales and in the top north west corner it extends marginally beyond the 25m depth contour.

4.1.1 Bathymetry and sediments

The seabed of Liverpool Bay consists of a wide range of mobile sediments. Sand is the predominant substrate with a concentrated area of gravelly sand off the Mersey Estuary. Sandbanks off the English coast include East Hoyle Bank (largely within the Mersey Narrows and North Wirral Foreshore SPA), and parts of Great Burbo Bank (off the mouth of the Mersey). West Hoyle Bank (at the mouth of the Dee Estuary), Dutchman Bank and Chester and Rhyl Flats/Gwastadeddau'r Rhyl, are amongst the sand banks off the Welsh coast.

4.1.2 Tidal currents

The tidal currents throughout the bay are generally weak and do not exceed 2m/sec. This combined with a relatively extended tidal range of 6 to 8m along the Lancashire coastline facilities the deposition of sediments, encouraging mud and sand belts to accumulate.

4.1.3 Water temperature and salinity

Water temperature ranges between a low of 5-6˚C in February and a high of 14-16˚C in August. The salinity level varies from 35 parts per thousand in the western seaward areas and decreases eastwards to 33 – 31 parts per thousand with the increased freshwater river input.

4.1.4 Fish species

The bay holds various fish of commercial importance. Pelagic species such as herring (*Clupea harengus*) and sprat (*Sprattus sprattus*) have nursery grounds in the bay. Demersal species such as plaice (*Pleuronectes platessa*) and sole (*Solea solea*) use the bay for spawning and as a nursery area. Herring and sprat are amongst the most frequently recorded prey species of red-throated divers (Cramp & Simmons, 1977), although this species is considered to be an opportunistic feeder, taking a rather broad range of fish species (Guse, Garther & Schirmeister, 2009 and references therein).

4.1.5 Shellfish species

A study in Liverpool Bay investigated how bivalve distributions may influence common scoter distributions (Kaiser and others, 2002; Kaiser and others, 2006). Benthic sampling undertaken to date has found three main bivalve species within the sampling areas. These were the white furrow shell (*Abra alba*), bean razor clam (*Pharus legumen*) and banded wedge shell (*Donax vittatus*). Species such as rayed trough shell (*Mactra stultorum*) and bean-like tellin (*Fabulina fabula*) were much more patchily distributed. It is clear that each species occurs in distinct patches of variable abundance, but as one species declines it is replaced by another species. Work in Carmarthen Bay/Bae Caerfyrddin (Woolmer 2003) indicates that common scoters are quite broad in their selection of prey species and will forage on species that are at sufficient density and at a suitable depth. This was also supported in the Liverpool Bay study (Kaiser and others, 2006).

4.1.6 Physical and chemical properties

Non-toxic contamination through nutrient loading, organic loading and changes to the thermal regime could impact on prey species and distribution.

Dissolved oxygen (DO) levels affect the condition and health of supporting habitats. Excessive nutrients and/or high turbidity can lead to a drop in DO, especially in warmer months. Low DO can have sub-lethal and lethal impacts on fish and infauna and epifauna communities (Best, Wither & Coates, 2007), and hence can adversely affect the availability and suitability of feeding habitats. However, there is a significant amount of natural variation that should be considered.

High concentrations of nutrients in the water column can cause phytoplankton and opportunistic macroalgae blooms, leading to reduced DO availability. This can impact sensitive fish, epifauna and infauna communities (Devlin, Painting & Best, 2007; Best, 2014), and hence adversely affect the availability and suitability of bird breeding, rearing, feeding and roosting habitats.

Water turbidity is a result of material suspended in the water, including sediment, plankton, pollution or other matter from land sources. Turbidity levels can rise and fall rapidly as a result of biological (e.g. plankton blooms), physical (e.g. storm events) or human (e.g. development) factors. Prolonged changes in turbidity may influence the amount of light reaching supporting habitats, affecting the primary production and nutrient levels of the habitat's associated communities. Changes in turbidity may also have a range of biological effects on different species within the habitat, e.g. affecting their abilities to feed or breathe. A prolonged increase in turbidity is indicative of an increase in suspended particulates. This has a number of implications for the aquatic / marine environment, such as affecting fish health, clogging the filtering organs of suspension feeding animals and affecting sedimentation rates. This in turn can adversely affect the availability and suitability of bird breeding, rearing, feeding and roosting habitats. The level of turbidity should be maintained at natural levels. Aggregate extraction, dredging and other marine industries should consider impacts upon the natural sedimentary and hydrodynamic regime, along with the potential disturbance pressures from the associated vessel traffic. At the time of classification, these activities were geographically dispersed and cumulatively represented only a small area of the SPA habitat.

4.2 Red-throated diver - *Gavia stellata*

Red-throated divers in Liverpool Bay are listed in Annex 1 of the Birds Directive and are

assessed against stage 1(1) of the SPA selection guidelines (Stroud and others, 2001) using the relevant national population estimate. The wintering population of red-throated divers in Great Britain is estimated to be 17,116 individuals (O'Brien and others, 2008), representing between 10-19% (depending on the areas included) of the NW Europe non-breeding population. This population estimate was derived primarily from visual aerial surveys and supplemented by The Wetland Bird Survey (WeBS) counts and county bird records. The implementation of digital aerial surveys (DAS) has led to the detection of much larger numbers of red-throated divers wintering in British coastal waters (Irwin and others, 2019). The Great Britain population estimate is, therefore, considered to be an underestimate. The use of data obtained by DAS methods to derive population estimates of some of the features in this conservation advice package is likely to have contributed to increased abundance estimates.

In the UK, red-throated divers are associated with inshore waters, often occurring within sandy bays, firths and sea lochs, although open coastline is also frequently used (Skov and others, 1995; Stone and others, 1995). Lack (1986) found the distribution to be fairly even along the east coast, with perhaps slightly fewer in the south compared to the north. The species is less abundant around western coasts and has a patchy distribution, though it is still common, especially off western Scotland (Moser and others, 1986; Stone and others, 1995). Concentrations have been recorded in Cardigan Bay/Bae Ceredigion, the Moray Firth, the Clyde and Forth Estuaries, the Aberdeenshire coast, the Suffolk/Essex coast, as well as close to Tiree (Moser and others, 1986; Barrett & Barrett 1985; Pollitt and others, 2000; Thorpe 2002). O'Brien and others, (2008) note that distribution was uneven at the national scale and by far the greatest numbers were found off southeast and east Britain. Aerial and boat transect surveys in 2002/3 identified a significant concentration in the Outer Thames Estuary (Percival and others, 2004), and recent surveys have estimated the current SPA population at 18,079 overwintering individuals (Irwin and others, 2019). Shore-based observations from the North Norfolk Coast identified winter (December-January) peaks during 1992- 1995 of up to 820 individuals (Taylor and others, 1999). Subsequently, a mean peak population estimate of 1,787 red-throated divers was identified in the Greater Wash (Lawson and others, 2016). The Greater Wash area supports 10% of the GB wintering population of red-throated diver and is the second most important site in the UK for this species after the Outer Thames Estuary (Lawson and others, 2016).

4.3 Common scoter - *Melanitta nigra*

Common scoter is not listed in Annex I of the Birds Directive and is assessed against stage 1(2) of the SPA selection guidelines (Stroud and others, 2001) using the relevant biogeographical population estimate. Common scoter is a regularly occurring migratory species and winters in the Baltic and eastern Atlantic south to Mauritania (Wetlands International, 2006). The wintering population of common scoter within this area is considered to be approximately 1.6 million individuals (of which it was previously estimated that 50,000 individuals wintered around the coast of Britain) (Kershaw & Cranswick 2003). As described above for red-throated diver, the Great Britain population size (derived largely from shore-based surveys) is clearly an underestimate given the large numbers recorded in Liverpool Bay.

Non-breeding common scoters can be found around most of the coast of the UK, with concentrations around the Moray Firth, Firth of Forth, north-east England, East Anglia, Carmarthen Bay/Bae Caerfyrddin, Cardigan Bay/Bae Ceredigion, north Wales, and north-west England (Lack, 1986; Kirby, Evans & Fox, 1993). The preferred non-breeding habitat comprises shallow offshore areas with a sandy seabed (Lack, 1986).

4.4 Little gull – *Hydrocoloeus minutus*

Little gull in Liverpool Bay are listed in Annex 1 of the Birds Directive and are assessed against stage 1(4) of the SPA selection guidelines. The site is identified as supporting the second largest aggregation of little gulls in the UK, and therefore qualifies for SPA classification in accordance with the UK SPA selection guidelines (stage 1.4: JNCC, 1999).

The site provides protection for between 2.93% and 7.09% of the estimated European non-breeding population (though see earlier caveats). It also represents the only SPA for the species on the west of Britain, and as the UK itself forms the likely north-west edge of the species non-breeding range provides an important link in the species' range requirements.

The breeding population of little gulls in Europe is estimated to be between 22,700 and 45,200 pairs (BirdLife International 2015), with the majority (49%) in Russia. Declines in the core breeding range have led to a European Red List assessment of Near Threatened, although there is a suggestion that long-term expansion in the western breeding range (Sweden, Finland) has led to more non-breeding birds appearing around the UK (Balmer and others, 2013). BirdLife International (2015) estimate the non-breeding European population to be 4,500 – 10,900 individuals, although this is somewhat incomplete as data are absent for some countries within the non-breeding range, and do not always reflect estimates of birds at sea.

Little gulls mainly spend the non-breeding season in the Mediterranean or North Africa, but some are considered to remain in the Irish Sea (Wernham and others, 2002). This is supported by Lawson and others (2016) which estimated between 172 and 374 birds on three of the five surveys in the 'core' winter months (arbitrarily defined as December – January). From April, little gulls begin the return passage migration to their breeding grounds and numbers peak at roost sites (Seaforth) within the Mersey Narrows and North Wirral Foreshore SPA (Wernham and others, 2002; Brown & Grice 2005).

4.5 Common tern – *Sterna hirundo*

Common tern in Liverpool Bay are listed in Annex 1 of the Birds Directive and are assessed against stage 1(1) of the SPA selection guidelines (Stroud and others, 2001) using the relevant national population estimate. Common terns breed within the Mersey Narrows and North Wirral Foreshore SPA. The five-year mean used to classify this site, derived from Seabird Monitoring Programme (SMP) data, is 180 pairs (2011 – 2015). This represented 1.80% of the GB total of 10,000 pairs. The SPA thus offers protection of foraging areas to a significant proportion of common terns breeding in Great Britain.

At the time of classification, the breeding population of common terns in Great Britain was estimated to be 10,000 pairs (Musgrove and others, 2013), representing at least 15% of the Southern & Western European breeding population (67,000 pairs derived by division by 3 of the upper estimation of 200,000 individuals and rounded to the nearest 1,000: AEWA 2012). A significant proportion of the British population breeds in Scotland. Coastal colonies in England are concentrated in the north-east, East Anglia, a few localities along the south coast, and in the north-west (Mitchell and others, 2004). Common terns breed not only around coasts but, unlike the other tern species that breed in the UK, also breed frequently beside inland freshwater bodies.

Common terns breeding at The Dee Estuary SPA, adjacent to the SPA, are not predicted to forage within Liverpool Bay, as their nesting location is within the estuary and not on the open coast (Wilson and others, 2014). These breeding terns do not contribute to the

Liverpool Bay / Bae Lerpwl SPA total. Similarly, common terns roosting at the Mersey Narrows and North Wirral Foreshore SPA in the non-breeding season (i.e. on migratory passage) do not contribute to the Liverpool Bay / Bae Lerpwl SPA total.

4.6 Little tern – *Sternula albifrons*

Little tern in Liverpool Bay are listed in Annex 1 of the Birds Directive and are assessed against stage 1(1) of the SPA selection guidelines (Stroud and others, 2001) using the relevant national population estimate. At the time of classification, the breeding population of little terns in Great Britain was estimated to be 1,900 pairs (Musgrove and others, 2013), representing about 10.3% of the Eastern Atlantic breeding population (18,500 pairs derived by division by 3 of the upper estimate of 55,500 individuals: AEWA 2012). Breeding occurs in scattered colonies along much of the east and west coasts of Britain, from the north of Scotland to the south coast of England (Mitchell and others, 2004). The greater part of the population occurs in south and east England from Dorset to Norfolk (Mitchell and others, 2004). All British little terns nest on the coast, utilising sand and shingle beaches and spits, as well as tiny islets of sand or rock close inshore (Mitchell and others, 2004).

Little terns breed at Gronant Beach/Traeth Gronant, within The Dee Estuary SPA. The five-year mean citation population, derived from SMP data, is 69 pairs (1995-1999). More recent SMP data indicates an increase in that population, to 130 pairs (2010 – 2014). This represented 6.84% of the GB population of 1,900 pairs. The SPA thus offers protection of foraging areas to a significant proportion of little terns breeding in Great Britain, and all of the foraging range for little terns breeding at Gronant Beach/Traeth Gronant.

4.7 Waterbird assemblage

Under Stage 1.3 of the UK SPA selection guidelines (JNCC 1999), sites may be selected as SPAs on the basis of supporting regular aggregations of 20,000 waterbirds or more. The original citation for Liverpool Bay / Bae Lerpwl SPA included a waterbird assemblage comprising red-throated divers and common scoters.

The assemblage qualifies under Stage 1.3 using the most up to date data. In the period 2004/05 – 2010/11 a five year peak mean of 69,687 individual waterbirds was estimated (Lawson and others, 2016). The most recent four-year peak mean population estimate for the waterbird assemblage in Liverpool Bay / Bae Lerpwl SPA is 157,952 individuals based on recent digital aerial surveys (HiDef, in prep.). The use of data obtained by digital aerial survey methods to derive population estimates of some of the features in this conservation advice package is likely to have contributed to increased abundance estimates.

Named components of the assemblage (i.e. species exceeding 1% of the GB total or 2,000 individuals) include all the non-breeding qualifying features common scoters, red-throated divers and little gulls. As well as the non-breeding populations of red-breasted merganser and great cormorant.

Other species recorded (Lawson and others, 2016; HiDef, in prep.) and contributing to the assemblage total in numbers less than 1% of their respective GB populations or less than 2,000 individuals include: black-headed gull (*Chroicocephalus ridibundus*), common gull (*Larus canus*), common eider (*Somateria mollissima*), fulmar (*Fulmarus glacialis*), great black-backed gull (*Larus marinus*), great crested grebe (*Podiceps cristatus*), guillemot (*Uria aalge*), gannet (*Morus bassanus*), herring gull (*Larus argentatus*), kittiwake (*Rissa tridactyla*), lesser black-backed gull (*Larus fuscus*), great northern diver (*Gavia immer*), puffin (*Fratercula arctica*), razorbill (*Alca torda*), shag (*Gulosus aristotelis*) and velvet scoter

(*Melanitta fusca*).

5. Advice on operations

5.1 Background

Natural England and Natural Resources Wales have a duty under Regulation 37(3)(b) of the Habitats Regulations to advise other relevant authorities as to any operations which may cause deterioration of natural habitats or the habitats of species, or disturbance of species, for which the site has been designated. Similarly, JNCC have a duty under Regulation 21 (b) of the Offshore Habitats Regulations to advise such competent authorities as it considers appropriate of any operations which in its opinion may adversely affect the integrity of the site.

5.2 Purpose of advice

The aim of this advice is to enable all relevant authorities to direct and prioritise their work on the management of activities that pose the greatest potential threat to the favourable condition of interest features at Liverpool Bay / Bae Lerpwl SPA. The advice given here is without prejudice to any advice provided in relation to the consideration of plans or projects within the meaning of Part 6 of the Habitat Regulations or Regulation 28 of the Offshore Habitats Regulations.

5.3 Mobile species

Some mobile species features e.g. birds are able to move outside the site boundary where there may be direct impacts to those features, for example, collision risk. In most cases it will be possible to use the advice on operations to assess impacts to features that move outside the site. Finally, activities operating at distance from the site may cause pressures that travel into the site which may affect features in this site.

5.4 Specific advice on operations for Liverpool Bay / Bae Lerpwl SPA

The following table is intended to identify where operations or activities may have the potential to have adverse effects on the designated features of this site, or their supporting habitats, resulting in a deterioration in the conservation objectives. The list of activities identified in Table 7 is not exhaustive, as new activities, or new technologies associated with existing activities, may arise at any time. It may also include activities that are currently not known to occur within the site. The inclusion of activities does not imply an actual significant impact, as this will depend on the specific details of a proposed plan or project (e.g., specific location, activity duration, season, scale, etc.). Activities included may require further permissions from other authorities or parties. Specific advice should still be sought from the relevant SNCB (Natural England, Natural Resources Wales or JNCC) or other authorities as appropriate, and a full Habitats Regulations Assessment (HRA) carried out where required. An initial assessment of whether a proposed plan, project, or ongoing activity may have an impact on a designated feature of the site can be seen by viewing Natural England's Advice on Operations for Liverpool Bay/ Bae Lerpwl SPA. The information contained within the Advice on Operations online database is the

advice of Natural England only. The supporting habitats have not been agreed by all SNCBs and this Advice on Operations does not necessarily reflect the advice of all authors.

Table 7. Activities that have the potential to cause disturbance or deterioration to designated features and supporting habitats

Aggregate Extraction	
Aggregate dredging	Beach sand extraction
Cables	
Cables: Horizontal Directional Drilling (HDD) Power cable: decommissioning Power cable: laying, burial and protection Power cable: operation and maintenance	Telecommunication cable: Decommissioning Telecommunication cable: Laying, burial and protection Telecommunication cable: Operation and Maintenance
Coastal Development and Flood and Erosion Risk Management Schemes	
Construction and operation of offshore coastal defence structures (e.g., wave screens/breakwaters) Construction of coastal flood and erosion risk management schemes (e.g., seawalls, groynes, bunds) Intertidal recharge Managed realignment	Piling Reclaim and land take (e.g., the footprint of coastal defences) Maintenance of hard coastal defences Maintenance of soft coastal defences Operation of coastal flood and erosion risk management schemes
Coastal Infrastructure	
Outfalls/ Intake pipes (maintenance/construction/usage)	Slipway (maintenance/construction)
Commercial Shipping	
Commercial hovercraft Navigation markers/lights Vessel anchorages	Vessel discharges/emissions Vessel moorings Vessel movements
Ports and Harbours	
Anchorages/moorings (construction phase) Berths/moorings/anchorages (operation) Capital dredging Capital dredging disposal Cargo operations and landward transportation Clearance slipways, similar structures and water ways Construction of port and harbour structures Habitat creation	Land reclaim Maintenance dredging Maintenance dredging disposal Maintenance of port and harbour structures Operation of port and harbours Piling Shoreside industry and operations Vessel maintenance
Electricity from Renewable Energy Sources	
Offshore wind: during construction (if relevant see Cables also) Offshore wind: operation and maintenance (if relevant see Cables also) Offshore wind: decommissioning (if relevant see Cables also) Tidal lagoon/impoundment: during	Tidal lagoon/impoundment: decommissioning Tidal stream: during construction Tidal stream: operation and maintenance Tidal stream: decommissioning Wave: during construction Wave: operation and maintenance

construction Tidal lagoon/impoundment: operation and maintenance	Wave: decommissioning
Oil, gas and carbon capture storage	
Oil and gas exploration and installation Oil and gas production	Oil and gas decommissioning Pipelines
Fishing	
Anchored nets/lines Demersal seines Demersal trawl Diving (including recreational) Dredges (e.g., scallops, oysters, mussels including seed) Electrofishing	Hydraulic dredges Pelagic fishing (or fishing activities that do not interact with seabed, including rod and line) Seaweed harvesting Shore-based activities (e.g., bait digging, shellfish collection, recreational angling) Traps
Aquaculture	
Finfish aquaculture Seaweed aquaculture: suspended rope/net culture Shellfish aquaculture: bottom culture	Shellfish aquaculture: suspended rope/net culture Shellfish aquaculture: trestle culture
Recreation	
Firework and laser displays Hovercraft Leisure (e.g., swimming, rock pooling, horse-riding) Light aircraft and drones (e.g., microlites, gliders, parasail, hot-air balloons) Non-motorised land craft (e.g., sand yachting, kite buggying) Non-motorised watercraft (e.g., kayaks, windsurfing, dinghies, paddleboards)	Powerboating or sailing with an engine: launching and recovery, participation Powerboating or sailing with an engine: mooring and/or anchoring Sailing without an engine: launching and recovery, participation Sailing without an engine: mooring and/or anchoring

5.5 Seasonality

The advice on seasonality provides evidence-based and site-specific information on when a mobile feature is expected to be either present or undertaking a key life stage within Liverpool Bay / Bae Lerpwl SPA. The advice on seasonality is presented in Table 8.

In Table 8, the months highlighted in grey indicate the months in which significant numbers of each designated species are most likely to be present at the site during a typical calendar year. The months which are highlighted with grey horizontal lines indicate the transitional months where there is potential for significant numbers of the designated species to be present at the site, although these are the months when numbers start to change due to migration. The transitional months for little gull have been highlighted as a precautionary approach based on national indices. The seasonal definitions have been informed by scrutiny of the data presented by Frost and others (2021), HiDef (2020), Lawson and others (2016), Webb and others (2006) and local SPA intelligence for little terns based on personal communication data from the wardens at Gronant dunes.

Applicants considering plans or projects scheduled in the periods highlighted with grey boxes and grey horizontal lines would benefit from early consultation with Natural England, Natural Resources Wales, and the JNCC given the greater scope for there to be likely significant effects that require consideration. The months which are not highlighted in grey or grey horizontal lines are not ones in which the features are necessarily absent, rather that features may be present in less significant numbers in typical years, but there may still be a significant effect. Please note that this period can vary between years and that in any one year considerable numbers of a species may be present throughout the year or outside of the months indicated in the table. Any assessment of potential impacts on the features must be based on up-to-date count data and take account of population trends evident from these data and any other available information. Additional surveys may be required.

Table 8: Advice on Seasonality for the features: red-throated diver (non-breeding); common scoter (non-breeding); little gull (non-breeding); common tern (breeding); and little tern (breeding). This table is provided as a general guide only.

Feature	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Red throated diver (nb)												
Common scoter (nb)												
Little gull (nb)				*	*	*	*					
Common tern (breeding)												
Little tern (breeding)												

Months in which significant numbers of each designated species are most likely to be present at the site during a typical calendar year.

Months where there is potential for significant numbers of the designated species to be present at the site.

Months where features may be present in less significant numbers in typical years.

* These months have not been defined due to a lack of survey data.

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