Document Control

Title	**Poole Harbour Special Protection Area (SPA) Appropriate Assessment - Issue of Leases under the Poole Harbour Fishery Order 2015 for 2020-25**
SIFCA Reference	SIFCA/HRA_PP/PooleOrder202025
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Approver	
Owner	Southern IFCA
Template Used	HRA Template Plan/Project v1.0

Revision History

Date	Author	Version	Status	Reason	Approver(s)
31/03/2020	S Birchenough	1.0	Initial Draft		P Bateman
21/07/2020	S Birchenough	1.1	Draft	Updates following formal advice from NE received on 14/07/20	P Bateman
01/04/2021	S Birchenough	1.2	Final Draft	Updated to include evidence packages on Pacific oysters and lease beds 7, 8 and 12 following consultation and advice from NE received on 20/12/20.	P Bateman
25/10/2021	S Birchenough	1.3	Final Draft	Inconsequential amendments made to align timings of aquaculture activity across all documents (HRA, Business Plan, Management Plan)	P Bateman

This document has been distributed for information and comment to:

Title	Name	Date sent	Comments received
Marine Senior Advisor	Gavin Black	21/04/20	14/07/20
Marine Senior Advisor	Gavin Black	27/11/20 19/12/20	For additional evidence packages: 20/12/20 *In addition to this HRA being submitted to Natural England for information and comment, three evidence packages concerning measures specific to lease beds 7 and 8, lease bed 12 and the farming of Pacific oysters were sent to Natural England for information and comment.*

Southern Inshore Fisheries and Conservation Authority (IFCA)

Habitat Regulations Assessment for Plans/Projects

European Marine Site: Poole Harbour SPA

Plan/Project: Issue of leases for 2020-25 under the Poole Harbour Fishery Order 2015

Feature(s): Common tern, Sandwich tern, Mediterranean gull, Little egret, Spoonbill, Avocet, Shelduck, Black-tailed godwit (Icelandic Race), Water bird assemblage (Dunlin, Dark-bellied Brent goose, Teal, Goldeneye, Red-breasted merganser, Curlew, Spotted redshank, Greenshank, Redshank, Pochard, Black-headed gull)

Site Specific Sub-feature(s)/Supporting Habitat(s): Coastal lagoons, Freshwater and coastal grazing marsh, Mediterranean and thermo-Atlantic halophilous scrubs, Atlantic salt meadows, Spartina swards, Intertidal seagrass beds, Intertidal mixed sediments, Intertidal mud, Intertidal sand and muddy sand, Water column

1 Technical Summary

Duties under Regulation 63 of the Conservation of Habitats and Species Regulations 2017 require Southern IFCA, as a competent authority, to make an appropriate assessment of a plan or project likely to have a significant effect on a European site (either alone or in combination with other plans or projects). As such, Southern IFCA undertakes an appropriate assessment for the issuing of leases under the Poole Harbour Fishery Order 2015 ('The Order'). The Order manages aquaculture activity within a defined area of Poole Harbour by conferring on the Southern IFCA the right of several fishery for the cultivation of shellfish of any kind for a period of twenty years from 1st July 2015. The Order covers an area of 837.8 hectares and allows for the cultivation of aquaculture species, namely 'shellfish' as defined in the Marine and Coastal Access Act 2009 (MaCAA) as "crustaceans and molluscs of any kind". The main species harvested are Pacific oyster (*Magallana gigas*) and common mussel (*Mytilus edulis*) with other species including native oyster (*Ostrea edulis*), clam species (primarily the Manila clam, *Ruditapes philippinarum*) and common cockle (*Cerastoderma edule*) having been farmed and/or cultivated historically. The definition provided in MaCAA allows the Southern IFCA to retain flexibility for shellfish species that could potentially be the subject of future aquaculture activity within the Harbour. Leases are issued under the Order for a period of five years. At the creation of The Order in 2015 leases were issued for the period 2015-20 with a corresponding appropriate assessment. The purpose of this assessment is to determine, whether or not in the view of Southern IFCA, the issue of leases will hinder the achievement of the conservation objectives of the Poole Harbour SPA and lead to an adverse effect on site integrity.

A review of research into aquaculture activity and associated fishing practices identifies the activity occurring as a result of the issuing of a lease has the potential to disturb bird populations and lead to changes in prey availability and the extent and distribution of supporting breeding and non-breeding habitat. These potential impacts and risks to the integrity of the site are however mitigated through the provisions and management measures which must be observed by the lessee as detailed in The Poole Harbour Several Order 2015 Management Plan (2020 revision), each leaseholder's Business Plan and the lease. These include general conditions and/or specific conditions for individual lease beds which may include; requirement for lease holders to use and manage lease beds in accordance with the provisions submitted in the leaseholder's Business Plan, restrictions on removal of shellfish, compliance with species specific measures, vessel length requirements and temporal or spatial measures, requirement for lease beds to be marked and limits maintained and a requirement to facilitate inspections.

Based on the mitigation measures, in the form of provisions and management measures outlined in The Poole Harbour Several Order Management Plan 2015 (2020 revision), the Business Plan and the lease for each leaseholder and the biosecurity plan, it was concluded that the issuing of leases for 2020-25 under the Poole Harbour Fishery Order 2015 will not hinder the site from achieving its conservation objectives and as such will not have an adverse effect upon the integrity of the Poole Harbour SPA and Ramsar site.

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2 Introduction

2.1 Need for a Habitats Regulations Assessment (HRA)

The Natura 2000 is a network of protected sites which are designated for rare and threatened species and rare natural habitat types. These sites include Special Areas of Conservation (SAC) and Special Protection Areas (SPA), designated under the EC Habitats Directive 1992 and EC Birds Directive 2009 (amended), respectively. Article 6 of the Habitats Directive defines how Natura 2000 sites are managed and protected[1]. Similarly, protection is afforded under Article 4 of the Birds Directive for SPAs.

Southern IFCA has duties under Regulation 9 (1) of the Conservation of Habitats and Species Regulations 2017 as a competent authority, with functions relevant to marine conservation to exercise those functions so as to secure compliance with the Habitats Directive and Birds Directives.

Article 6(3) of the Habitats Directive requires any plan or project likely to have a significant effect on a Natura 2000, either individually or in combination with other plans or projects, to undergo an Appropriate Assessment to determine its implications for the site.

Article 4(4) of the Birds Directive states that 'Member states shall take appropriate steps to avoid …deterioration of habitats or any disturbances affecting the birds, in so far as these would be significant having regard to the objectives of this Article'.

Regulation 65 of the Conservation of Habitats and Species Regulations 2017 requires Southern IFCA, as the competent authority, to make an appropriate assessment of a plan or project which is likely to have a significant effect on a European site (either alone or in combination with other plans or projects) and is not directly connected with or necessary to the management of the site in question. The implications of any plan or project must be assessed in view of the site's conservation objectives.

This document forms the basis of an appropriate assessment for the issue of leases under the Poole Harbour Fishery Order 2015 for the period 2020-25. The purpose of this document is to assess whether or not in the view of Southern IFCA, the issue of leases under the Poole Harbour Fishery Order 2015 will have a likely significant effect on the bird features and supporting habitats of the Poole Harbour SPA alone, an in combination with other plans or projects. The assessment ensures Southern IFCA meets its responsibilities as a competent authority by ensuring that they conservation objectives of the Poole Harbour SPA will be met and the integrity of the site is not adversely affected.

2.2 Documents reviewed to inform this assessment

- Reference list[2] (Annex 1)
- Natural England's Conservation Advice[3]
- Site map(s) – sub-feature/feature location and extent (Annex 2)

[1] http://ec.europa.eu/environment/nature/natura2000/management/guidance_en.htm
[2] Reference list will include literature cited in the assessment (peer, grey and site specific evidence e.g. research, data on natural disturbance/energy levels etc)
[3] https://designatedsites.naturalengland.org.uk/Marine/MarineSiteDetail.aspx?SiteCode=UK9010111&SiteName=Poole%20harbour&countyCode=&responsiblePerson=&SeaArea=&IFCAArea=

- Maps of the Poole Harbour Fishery Order 2015 extent and location of lease beds (Annex 3)
- Natural England's advice on the potential impacts of aquaculture on the nature conservation features of Poole Harbour SPA, Ramsar site and SSSI (received 3rd June 2014) (Annex 4)
- Fisheries Impact Evidence Database (FIED)/SPA Tool Kit

3 Information about the EMS

- Poole Harbour SPA (Site Code: UK9010111)

3.1 Overview and qualifying features

The site qualifies under **Article 4** of the Birds Directive (2009/147/EC) for the following reasons (summarised in Table 1):

- The site regularly supports more than 1% of the Great Britain populations of five species listed in Annex I of the EC Birds Directive.

- The site regularly supports more than 1% of the biogeographic population of two regularly occurring migratory species not listed in Annex I of the EC Birds Directive.

Feature		**Interest Type**
A193	Common tern *Sterna hirundo*	Annex 1 Breeding
A191	Sandwich tern *Sterna sandvicensis*	Annex 1 Breeding
A176	Mediterranean gull *Larus melanocephalus*	Annex 1 Breeding
A026	Little egret *Egretta garzetta*	Annex 1 Non-breeding
A034	Spoonbill *Platalea leucorodia*	Annex 1 Non-breeding
A132	Avocet *Recurvirostra avosetta*	Annex 1 Non-breeding
A048	Shelduck *Tadorna tadorna*	Regularly occurring migrant Non-breeding
A156	Black-tailed godwit, Icelandic-race *Limosa limosa islandica*	Regularly occurring migrant Non-breeding

- The site qualifies under **Article 4** of the Birds Directive (2009/147/EC) as it used regularly by over 20,000 waterfowl (waterfowl as defined by the Ramsar Convention) or 20,000 seabirds in any season.

During the non-breeding season the area supports 25,176 individual waders and waterfowl including (in addition to the species which qualify as features in their own right (Table 1)): dunlin (*Calidris alpine)*, great cormorant (*Phalacracorax carbo)*, dark-bellied Brent goose (*Branta bernicla bernicla)*, teal (*Anas crecca),* goldeneye (*Bucephala clangula)*, red-breasted merganser (*Mergus serrator)*, curlew (*Numenius arquata),* spotted redshank (*Tringa erythropus)*, greenshank (*Tringa nebularia)*, redshank (*Tringa tetanus)*, pochard (*Aythya farina)* and black-headed gull (*Chroicocephalus ridibundus),* all of which are present in nationally important numbers. The features; little egret, spoonbill, black-tailed godwit and shelduck are also included within the water bird assemblage.

3.1.1 Supporting Habitat

Natural England's Advice on operations[4] details the supporting habitats as follows. No breakdown of supporting habitats is given per qualifying species.

- Coastal lagoons
- Freshwater and coastal grazing marsh
- Mediterranean and thermo-Atlantic halophilous scrubs
- Atlantic salt meadows
- Spartina swards
- Intertidal seagrass beds
- Intertidal mixed sediments
- Intertidal mud
- Intertidal sand and muddy sand
- Water column

Poole Harbour is a bar-built estuary of nearly 4,000 ha located on the coast of Dorset in southern England. The Harbour occupies a shallow depression towards the south-western extremity of the Hampshire Basin which has flooded over the last 5,000 years as a result of rising sea levels. The unusual micro-tidal regime means that a significant body of water is retained throughout the tidal cycle. The Harbour therefore exhibits many of the characteristics of a lagoon. There are extensive intertidal mud-flats and, away from the north shore that has become urbanised through the growth of the town of Poole, there are fringes of saltmarsh and reedbed. As a whole, the Harbour supports important numbers of water birds in winter and is also an important breeding site for terns and gulls, whilst significant numbers of Little Egret *Egretta garzetta* and Aquatic Warbler *Acrocephalus paludicola* occur on passage. Several river valleys converge on the Harbour, notably the Frome and the Piddle, and these support grazing marshes that contribute to the importance of the SPA for wintering waterbirds. Parts of the Harbour, especially along the western and southern shores, adjoin the Dorset Heathlands SPA. Where the two areas meet, there are unusual transitions from saltmarsh and reedbed to valley mire and heath habitats. The Harbour is separated from Poole Bay by the Studland Dunes (part of the Dorset Heaths [Purbeck and Wareham] and Studland Dunes SAC) and the SPA includes Littlesea, a large oligotrophic dune-slack lake of importance for wintering wildfowl.

4 https://designatedsites.naturalengland.org.uk/Marine/FAPMatrix.aspx?SiteCode=UK9010111&SiteName=Poole+harbour&SiteNameDisplay=Poole+Harbour+SPA&countyCode=&responsiblePerson=&SeaArea=&IFCAArea=

In 2016 Natural England held a consultation on a proposed extension to the Poole Harbour SPA to include all areas below the Mean Low Water mark which lie within the Harbour entrance, an additional landward extension in Lytchett Bay and the addition of three qualifying species; Sandwich tern, spoonbill and little egret. The rationale between the extension was to ensure that all areas of marine habitat which are exploited for resting, roosting or feeding by protected bird species were included. Poole Harbour regularly supports more than 1% of each of the populations of the three additional species. The proposed extension became a potential SPA (pSPA) on 21st January and as such the features and species proposed for inclusion were considered as part of the 2017/18 appropriate assessment. On 30th November 2017, the pSPA was included in the Register of European Sites in England (as required as Regulation 17 of The Conservation of Habitats and Species Regulations 2010) and as such was confirmed as part of the Poole Harbour SPA.

The full site citation is available at:
http://publications.naturalengland.org.uk/publication/6625771074355200

3.1.2 Ramsar Site

Poole Harbour is a Ramsar site, and as such is recognised as a wetland of international importance designated under the Ramsar Convention. The site was designated for the following reasons:

- Regularly supports 20,000 waterfowl
- Regularly supports over 1% of avocet, black-tailed godwit, common tern, Mediterranean gull and shelduck
- Supports an appreciable assemblage of rare, vulnerable or endangered species including a nationally scarce hydroid species *Hartlaubella gelatinosa* and nationally rare sponge *Suberites massa*
- Is of special value for maintaining the genetic and ecological diversity of a region because of the quality and peculiarities of its flora and fauna including supporting the nationally scarce plants narrow leaved eelgrass *Zostera augustifolia* and dwarf eelgrass *Zostera noltii*

3.2 Conservation Objectives

With regard to the SPA and the individual species and/or assemblage of species for which the site has been classified (the 'Qualifying Features' listed below), and subject to natural change;

Ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the site contributes to achieving the aims of the Wild Birds Directive, by maintaining or restoring;

- The extent and distribution of the habitats of the qualifying features
- The structure and function of the habitats of the qualifying features
- The supporting processes on which the habitats of the qualifying features rely
- The population of each of the qualifying features, and,
- The distribution of the qualifying features within the site.

The high level conservation objectives for the Poole Harbour SPA are available online at: http://publications.naturalengland.org.uk/publication/6625771074355200

3.3 Site of Special Scientific Interest (SSSI)

Section 28G of the Wildlife and Countryside Act 1981 (as amended) defines 'section 28G authorities', including the Southern IFCA, who have a duty to take reasonable steps, consistent with the proper exercise of their functions, to further the conservation and enhancement of the flora, fauna or geological or physiological features by reason of which the site is of special scientific interest.

In May 2018 Natural England notified additional land as a part of the Poole Harbour SSSI. The largest of which includes the estuarial open water below mean water. The other three areas comprise saltmarsh, wetland and supporting habitats around the fringes of Lytchett Bay and Holes Bay respectively. All four additional areas have been included as they support estuarine habitats and/or wintering wildfowl and waders for which the site is designated. The area below MLW is also seen to support other features for which the site is designated including foraging habitat for breeding seabirds and subtidal benthic habitats.

In order to ensure the protection of the entirety of the re notified SSSI Southern IFCA worked with Natural England to produce and agree a 'Site Management Statement' (SMS) for the Poole Harbour SSSI (Annex 5). This importantly includes the ongoing management of aquaculture within the Harbour. The SMS lists several provisions relating to aquaculture and operations under the Poole Harbour Fishery Order 2015 which will be outlined and referred to in this document.

4 Plan/Project Description

In accordance with Section (1) of the Sea Fisheries (Shellfish) Act 1967, Southern IFCA manage aquaculture activity within a defined area of Poole Harbour under The Poole Harbour Fishery Order 2015 ('The Order'). The Order confers on Southern IFCA the right of several fishery for the cultivation of shellfish of any kind for a period of twenty years from 1st July 2015. Leases are issued under the Order for a period of five years. The current leases (2015-20) will terminate on 30th June 2020 and therefore an HRA is required for the issuing of leases for the period 2020-25.

4.1 The Poole Harbour Fishery Order 2015

The Order manages aquaculture activity within a defined area of Poole Harbour by conferring on the Southern IFCA the right of several fishery for the cultivation of shellfish of any kind for a period of twenty years from 1st July 2015. The Order covers an area of 837.8 hectares and allows for the cultivation of aquaculture species, namely 'shellfish' as defined in the Marine and Coastal Access Act 2009[5] (MaCAA) as "crustaceans and molluscs of any kind". The main species harvested are Pacific oyster (*Magallana gigas*) and common mussel (*Mytilus edulis*) with other species including native oyster (*Ostrea edulis*), clam species (primarily the Manila clam, *Ruditapes philippinarum*) and common cockle (*Cerastoderma edule*) having been farmed and/or cultivated historically. The definition provided in MaCAA allows the Southern IFCA to retain flexibility for shellfish species that

[5] http://www.legislation.gov.uk/ukpga/2009/23/pdfs/ukpga_20090023_en.pdf

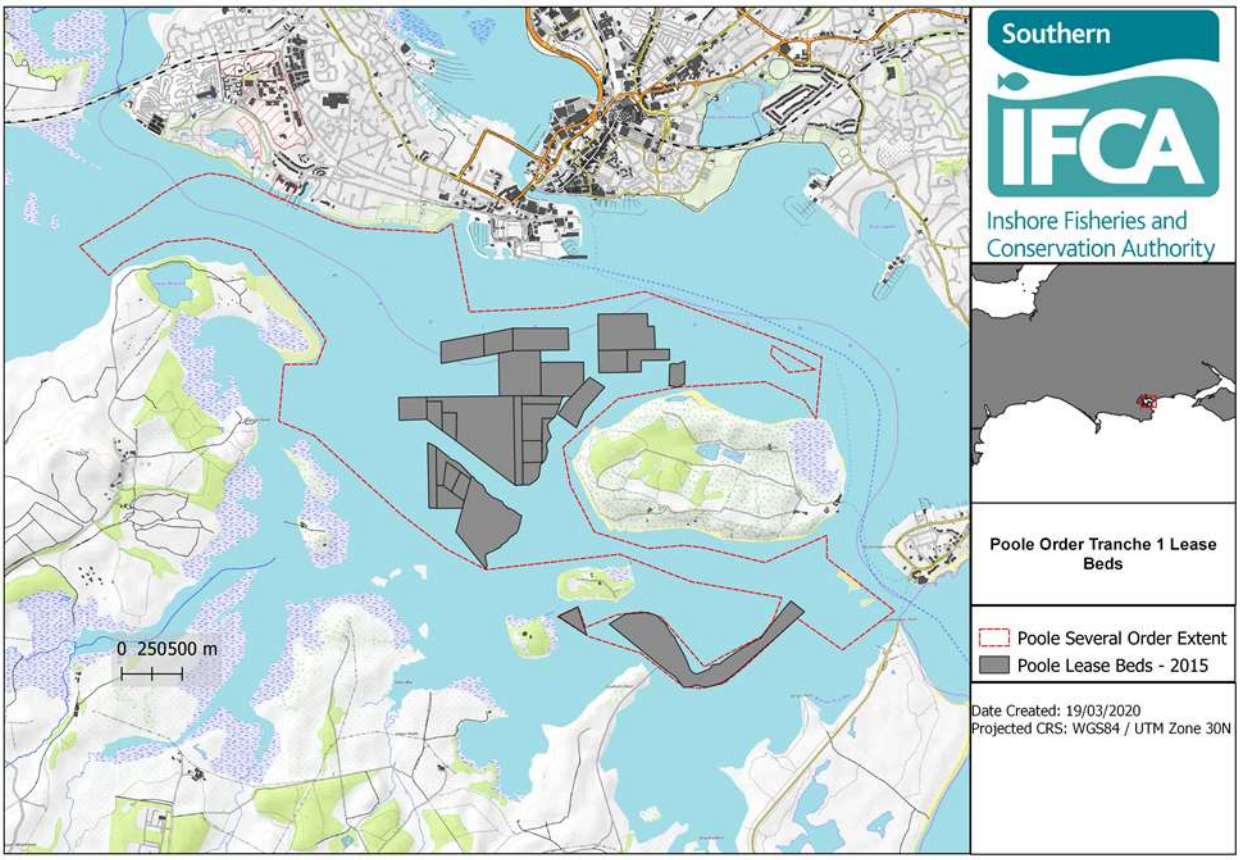

Figure 1: Extent of the Poole Harbour Fishery Order 2015 (red dashed line) and the lease beds under tranche 1, leased for a period of five years from 2015-20.

could potentially be the subject of future aquaculture activity within the Harbour. Leases are issued under the Order for a period of five years.

In 2015, under The Order, the first tranche (T1) of lease beds were allocated to nine companies or individuals for a period of five years, under the Terms of the Lease of Right of Several Fishery of Shellfish Laying in Poole Harbour. Under these Terms the T1 leases terminate on the 30th June 2020. The footprint of the T1 lease beds replicated the lease bed allocations under the former Poole Fishery Order 1985 (which expired in 2015) (Figure 1).

The allocation of lease beds under the second tranche (T2) will run from 1st July 2020 and expire on 30th June 2025.

4.1.1 Trance 2 Lease Application Process

In December 2019 Expressions of Interest (EOI) were invited from leaseholders who had leased ground from Southern IFCA during T1 (2015-20). This was to determine whether T1 leaseholders intended to apply for lease ground under T2 (2020-25). In addition, the EOI sought to provide confirmation that any T1 leaseholders wishing to apply for a T2 lease had a full understanding of the process and terms under which applications would be considered. Full information on these terms is available in the ‘Poole Harbour Several Order 2015 Management Plan, 2020 Revision’.

Consideration of the allocation of lease beds under T2 is subject to the production of specified documentation including;

- A comprehensive Business Plan which details;

  i. **Executive summary** providing an overview of your proposed business and plans.
  ii. **Methodology** to include:
     a. The target species to be grown and harvested;
     b. Details of supplier of seeds for laying;
     c. Details of buyers/target market of harvested product;
     d. Specification of vessel(s) and platforms to be used; and
     e. Details of equipment used in both laying of seeds and harvesting of seeds (please note that the proposed activity must not place any structure on the seabed).
  iii. **Company and management summary**
     a. Details of leaseholder and any other personnel involved in aquaculture operations.
  iv. **Financial Forecast**
     a. Funding and demonstrable sources of funding.
     b. The projected quantities of each species to be broken down into annual forecasts for years 2020 to 2025:
        i. kg/year seeding forecast;
        ii. kg/year harvesting forecast; and
        iii. Identification of any variables, which may compromise achievement of annual forecasts.
  v. Details of how the proposed business operations are compatible and consistent with the following **conservation considerations**:
     a. Applicants will need to demonstrate that there will be no significant impact on the Poole Harbour Special Protection Area (SPA) as a result of proposed business operations; and
     b. Compatibility with the special interest of the Poole Harbour SSSI.
  vi. **Safety**
     a. A Safety Plan to demonstrate that appropriate safety measures are in place for the proposed activity; and
     b. To provide evidence of permissions granted by Poole Harbour Commissioners (PHC) for the use of a commercial vessel within Poole Harbour, under the Registration of Small Commercial Craft[6], registration via https://phc.co.uk/webforms/register/
  vii. A **Biosecurity Plan** to detail the processes by which the lease bed operator will ensure that their activities are consistent with best practice and the legal requirements.

- A comprehensive end of Tranche 1 lease report which references;

  i. **Summary of business operations** under the T1 lease.
  ii. Demonstration of how lease holders **met their 2015-2020 Business Plan**
     a. Where projected seeding and harvesting forecasts weren't met, to provide detail on:
        - How and why projected forecasts (seeding and harvesting) weren't realised;

[6] '…*For the purpose of promoting or securing conditions conducive to the… safety of navigation…persons and property in the harbour, PHC seek to ensure that all commercial craft operating within Poole Harbour are properly maintained, equipped and manned and used only for the purposes for which they are capable...*' Extract taken from the General Direction – Registration of Small Commercial Craft.

- Any lessons learnt

b. Future mitigation considerations for proposed business operations under T2.

Consideration of lease allocation under T2 is subject to applicants meeting the criteria detailed above. Following submission of relevant documentation all applications will be subject to an assessment undertaken by the Southern IFCA. This process will be carried out with each application being considered on its own merits and Southern IFCA reserve the right to consider the proposals contained within the required documentation in accordance with their statutory responsibilities.

4.1.2 Tranche 2 Lease Bed Reallocation

Following the extension of the Poole Harbour Site of Special Scientific Interest (SSSI), as notified on 24th May 2018, Natural England advised that towed fishing has the potential to damage beds of the Peacock Worm *Sabella pavonina* if this activity were to take place over these beds. With the extension of the SSSI to below MLW and a clearer understanding of the location of *Sabella pavonina* beds and associated important sponge communities including *Suberites massa*, the advice from Natural England is that no towed gear should be allowed to operate in areas where *Sabella pavonina* is known to be located.

In 2015 the Southern IFCA undertook a survey, funded by Natural England, to map the presence/absence of *Sabella pavonina* using underwater video. The results of this survey (Figure 2) confirmed areas where *Sabella pavonina* beds had previously been identified which are within ground leased under T1 of the Poole Harbour Fishery Order 2015 (and previously under the Poole Fishery Order 1985). These areas have historically not been farmed due to an awareness of the presence of *S. pavonina* and the location of these *S. pavonina* beds within a leased bed has provided protection against other forms of bottom towed fishing gear. The survey also highlighted additional areas of importance for *S. pavonina* which, under the extension of the Poole Harbour SSSI, need to be considered in light of the advice from Natural England that aquaculture or any other bottom towed fishing gear should not take place in areas where *S. pavonina* beds are present. In addition, where the current location of lease beds from T1 overlay with areas of intertidal sediment there is the potential for aquaculture (through the use of bottom towed fishing gear) to damage the supporting feature of the Poole Harbour SPA.

To ensure that aquaculture activity occurring on lease beds under T2 does not have an adverse effect upon the integrity of the Poole Harbour SPA and Ramsar site and does not damage *Sabella pavonina* beds and associated species as notable communities for the SSSI, as part of the allocation of leases under T2, Southern IFCA are implementing the T2 Lease Bed Reallocation Programme.

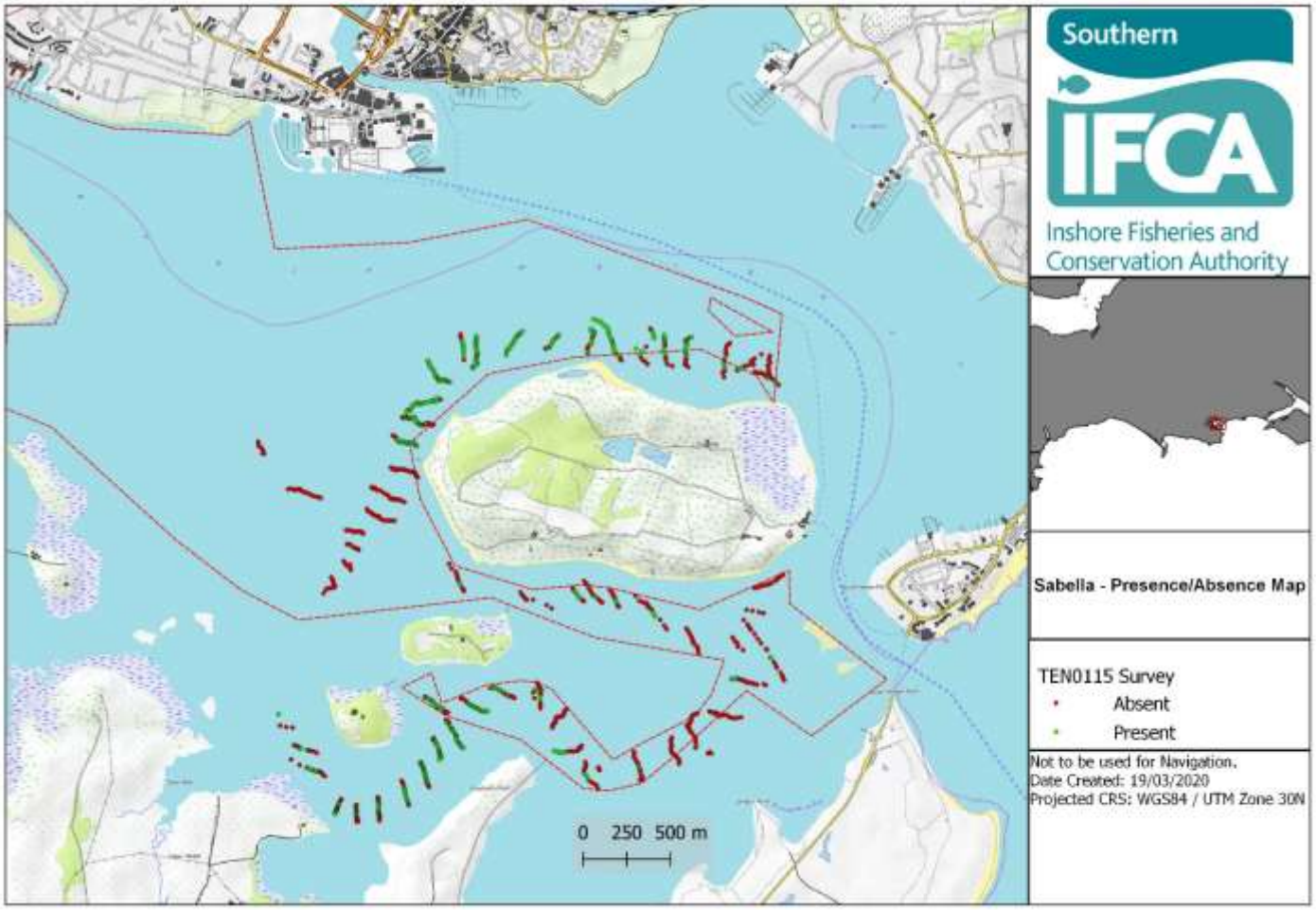

Figure 2: Results from the survey to map the presence/absence of the peacock worm *Sabella pavonina* in Poole Harbour undertaken by Southern IFCA and funded by Natural England. Red points indicate absence, green points indicate presence of *S. pavonina*.

Under the T2 Lease Bed Reallocation Programme, Southern IFCA have implemented the following:

- The closure and reallocation of three of the lease beds from T1 which were highlighted by Natural England as overlapping with the notable community of *Sabella pavonina*. These three beds are the ones which have historically not been farmed due to an awareness of the presence of *S. pavonina*. The total area of these closures equates to 32.4 hectares.
- The closure and reallocation of one further lease bed from T1 due to the presence of *Sabella pavonina* identified from the survey work. The total area equates to 9.8 hectares.
- The part closure and reallocation of two lease beds from T1 due to the presence of *Sabella pavonina* identified from the survey work. The total area equates to 1.77 hectares.
- The part closure and reallocation of one T1 lease bed due to a partial overlap with the supporting habitat of intertidal mud. The total area equates to 7.09 hectares.

This results in a total of 51.06 hectares of lease ground being closed and reallocated under tranche 2 (2020-25). The total hectarage for the tranche 2 lease beds is 199.76 compared to 198.35 under tranche 1. Figure 3 shows the location of the T1 lease beds and the T2 lease beds indicating where lease ground has been closed due to the presence of *S. pavonina*. Figure 4 shows the part closure of a T1 lease bed due to overlap with the intertidal sediment supporting feature of the SPA.

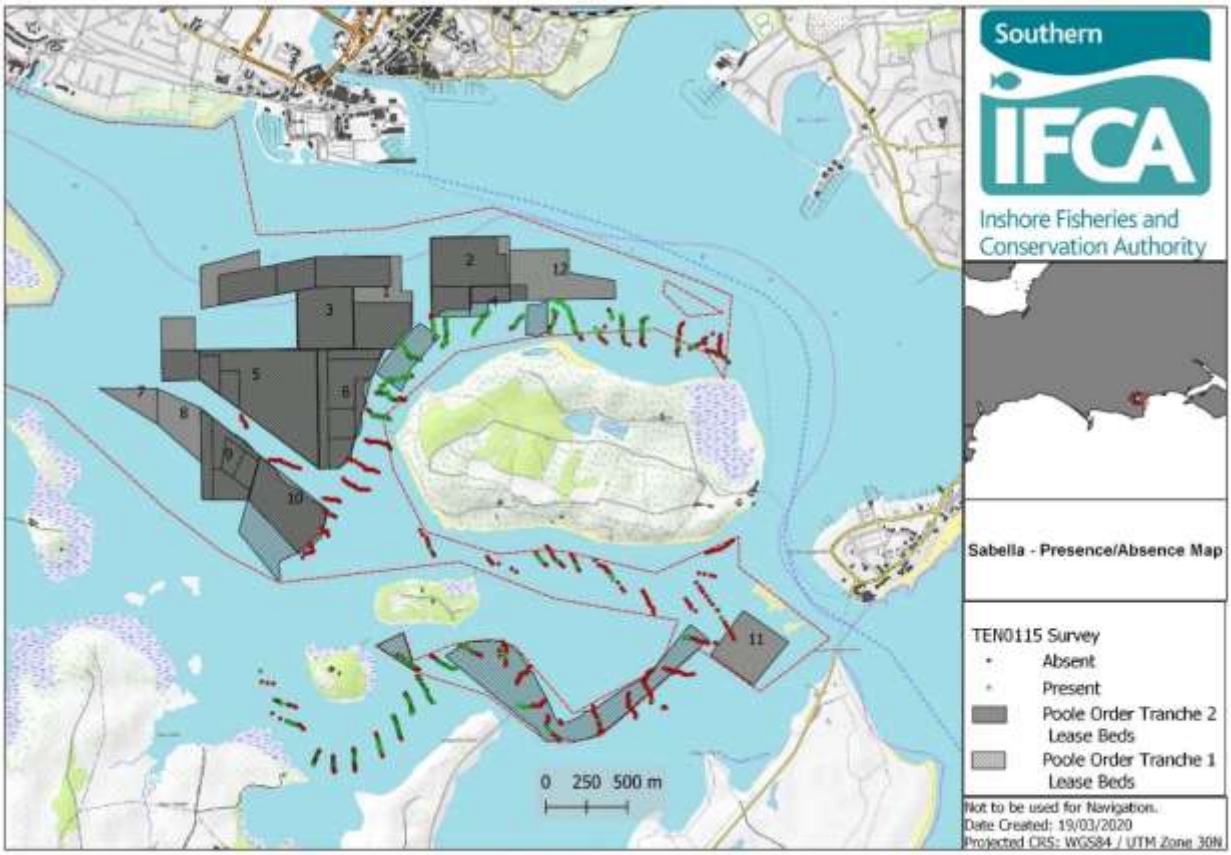

Figure 3: The location of Tranche 1 lease beds and Tranche 2 lease beds under the Poole Harbour Fishery Order 2015, overlaid with the results of the Southern IFCA survey on the presence/absence of *Sabella pavonina* in Poole Harbour. Four lease beds under T1 have been closed and one bed -part-closed due to the presence of *S. pavonina*.

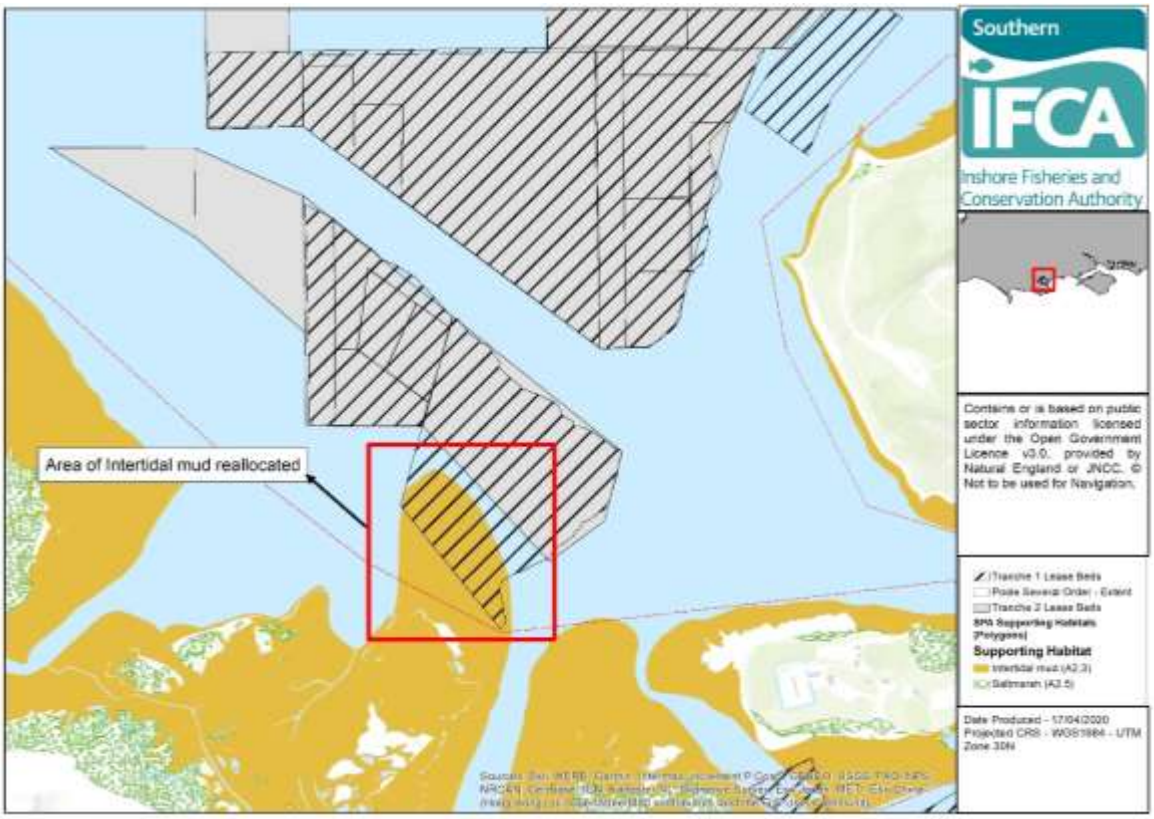

Figure 4: The area of one lease bed from Tranche 1 (hashed area within red square) subject to part closure due to overlap with the supporting habitat of intertidal mud. The position of the lease bed under Tranche 2 is shown in grey.

4.1.1 Leases under the Poole Harbour Fishery Order 2015

Each leaseholder is managed under the terms of a 'Lease of the Right of Several Fishery of Shellfish Laying'. The lease agreement documents the provisions and management measures that the Lessee must observe. These may be general conditions, or specific to individual lease beds and may include:

- The requirement for lease holders to use and manage the lease beds in accordance with the provisions submitted in the lease holder's Business Plan (as submitted at the time of application);
- Restrictions on the removal of shellfish, to include compliance with minimum conservation reference sizes and the identification of persons permitted to remove shellfish;
  - This includes clam species *Mercenaria mercenaria, Venerupis philippinarum, Venus verrucosa* and *Ruditapes decussatus*, the common cockle *Cerastoderma edule* and the native oyster *Ostrea edulis*.
  - Persons permitted to remove shellfish must either be named in the business plan or meet the conditions for written permission issued by the Authority.
- Compliance with species specific measures, such as measures specific to the farming of Pacific oysters;
  - Any stock of Pacific oyster laid must be of triploid stock or subject to an alternative method of sterilization
  - Applications to farm Pacific oyster using a type of stock different to that stipulated above will be considered on a case by case basis by the Authority in consultation with Natural England, with the proposed methodology provided by the lease holder subject to an appropriate assessment.
- Compliance with vessel length requirements;
  - Main vessel not to be in excess of 16.5m in overall length
  - An Ancillary Vessel(s) must be named in the Business Plan and, if in excess of 16.5m in overall length, must only be used in conjunction with a written dispensation issued by the Authority
- Compliance with temporal or spatial measures, in order to reduce water user interactions in Poole Harbour;
- The requirement for lease holders to mark and maintain the limits of lease bed boundaries;
- Compliance with any issues detailed in the HRA assessments within a given timeframe;
- The requirement for leaseholders to facilitate inspections

Leaseholders will be required to comply with all conditions outlined in the lease issued by the Authority. These conditions may be specific to a particular area of lease ground. Any leaseholder that contravenes any conditions may, at the discretion of the Authority, have the lease revoked and any lays shall return to the possession of the Authority.

4.2 Aquaculture Activity Specifications for Tranche 2

The footprint for lease beds under Tranche 2 is shown in Figure 5. Based on the Business Plans submitted by applicants under the Tranche 2 allocation of lease beds process there are a number of proposed species to be farmed and fishing practices to be used on lease beds for the period

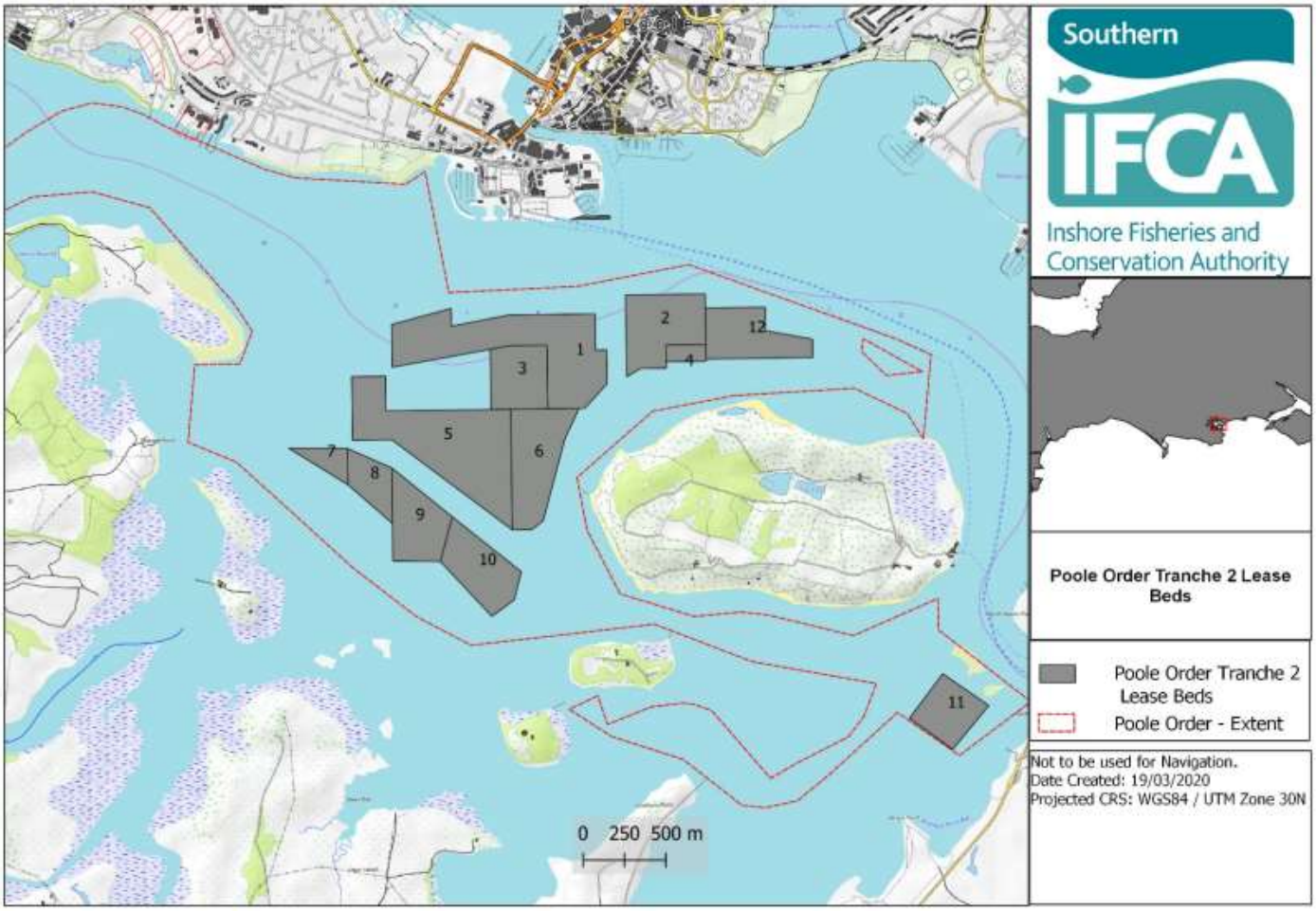

Figure 5: The location of Tranche 2 lease beds within the extent of The Poole Harbour Fishery Order 2015.

2020-25 under the Poole Harbour Fishery Order 2015. A summary of these species and fishing practices is given below. Due to commercial sensitivity there will be no information relating activities to a specific applicant or to the individual lease ground to which each activity pertains.

4.2.1 Species farmed

The species which will be farmed under the 2020-25 leases fall within the definition of aquaculture species that can be farmed under the Order, namely 'shellfish' as defined in the Marine and Coastal Access Act 2009[7] (MaCAA) as "crustaceans and molluscs of any kind". Specifically, these species are:

- Blue Mussel (*Mytilus edulis*)
- Pacific oyster (*Magallana gigas*)
- Manila clam (*Ruditapes philippinarum*)
- Native oyster (*Ostrea edulis*)
- Common cockle (*Cerastoderma edule*)
- American hard-shelled clam (*Mercenaria mercenaria*)

[7] http://www.legislation.gov.uk/ukpga/2009/23/pdfs/ukpga_20090023_en.pdf

4.2.2 Fishing practices and technical gear specifications

All aquaculture practices in Poole Harbour involve the direct laying of shellfish on to the seabed, no lease holder will be permitted to place or erect any structure on the seabed. Activity on the lease beds by the methods outlined above will occur all year round however some practices can be more seasonal depending on markets and demand for product.

Harvesting of shellfish from lease ground will be carried out using either a water-assisted dredge or a box dredge. There are two types of water-assisted dredge which will be used; a pump-scoop dredge of the same type used in the wild fishery for shellfish in Poole Harbour and a conveyor dredge system, specifically designed for shellfish farming in Poole Harbour. A pump-scoop dredge consists of toothed dredge basket which is towed through the seabed alongside a vessel (Jensen *et al*., 2005). Attached to the front end of the dredge is a series of water jets which direct a flow of water to the rear of the dredge basket (Jensen *et al*., 2005) (Figure 1). The water jets, powered by a hydraulic pump, allow sediment to be moved through the dredge basket (Jensen *et al*., 2005). In 2012, the use of a trailed pump-scoop dredge, which uses the aid of a davit arm and winch, was introduced. This type of dredge evolved from the previously used and more physically demanding hand-held dredge or scoop, pushed into the sediment and pulled along by a vessel (Jensen *et al*., 2005). The pump-scoop dredge is deployed from small (less than 10 metre in length) and shallow drafted vessels. This gear type is unique to Poole Harbour and differs from suction or hydraulic dredging techniques which both fluidise the sediment by spraying water in front of the dredge (Jensen *et al*., 2005). Dredges of this type which will be used on lease ground are the same dredges which are used for fishing the wild fishery therefore, the specifications of the gear are such that they comply with regulations under the Poole Harbour Dredge Permit Byelaw with the configuration of the pump-scoop dredge dictated by the conditions of the permit. These include restrictions on the dimensions of a dredge basket to a maximum of 460 mm in width, 460 mm in depth and 30 mm in height (excluding any poles or attachment). Dredges must be constructed on rigid bars having spaces of no less than 18 mm between them.

The conveyor system designed specifically for shellfish farming in Poole Harbour is of a similar design to the pump-scoop dredge. The dredge is attached to a conveyor belt and lowered to the seabed. The vessel moves forward causing the dredge to move through the sediment, jets of water flush the shellfish toward the rear of the dredge and on to the conveyor belt which delivers shellfish to the vessel above.

The box dredge system is a mechanical dredge typical of that used for the harvesting of wild clam and cockle species in the Solent area (Williams and Davies, 2018). This type of dredge typically consists of a metal frame with a row of metal teeth which is towed through the sediment using a boat (Wheeler *et al*., 2014). The dredge is characterised by skis which sit on the base of the dredge and allow it to sit on the seabed whilst being towed. There are no current management measures in the Southern IFCA District which specify a required configuration for a box dredge and as a result the size of a box dredge can vary. Box dredges typically vary from 82 to 122 cm in width, 111 to 130 cm in length and 20 to 36 cm in depth. Some box dredges have a diving plate which helps to stabilise the dredge during deployment. The metal teeth typically range from 9 to 14 cm (16 cm diagonally) and are situated on the base of the dredge mouth opening. Teeth can be orientated vertically or angled diagonally forward to help the dredge cut through the sediment. These teeth penetrate into the sediment collecting the shellfish which are subsequently retained in the dredge. The posterior metal box is made up of bars, with spacing typically varying from 1.4 to 3.4 cm. This allows the

dredge to pass through the sediment and unwanted debris can escape through the bars. Typically, either one dredge or two dredges side by side are deployed, depending on the size of the vessel, from the stern. The dredge is typically deployed using a mechanized winch to lower the gear to the seabed and lift it back onto the vessel. The dredge is attached to the vessel using a rope which is typically tied to the tow riddle. The angle at which the dredge is towed depends on the tow riddle configuration; the further forward the rope is attached to the dredge, the steeper the angle it will penetrate the sediment. The dredge is towed along the seabed in straight lines in the direction of the boat.

Specific management measures are also in place for specific lease beds and specific types of activity on these lease beds, developed through consultation with Natural England. For lease beds 7 and 8, the cleaning of these beds will not be permitted to take place during January and February and all activities will take place during the daytime. An evidence package has been produced for these lease beds and is included as annex 8 to this HRA. For lease bed 12 all cleaning and harvesting activities will only take place during the daytime and for seeding, which will take place between 20:00 and 08:00, this activity will only take place during April and May, outside of the period of sensitivity for the bird features of the SPA. An evidence package has been produced for this lease beds and is included as annex 9 to this HRA.

4.2.3 Preparation of new lease ground

Under the Tranche 2 Lease Bed Reallocation Programme (section 4.1.2) there will be 51.06 hectares of lease ground closed and reallocated to a new location. Where there are new areas of lease ground created under this programme there is a need for lease holders to prepare that ground for aquaculture. Information provided in the Business Plans submitted by applicants under Tranche 2 outlines how these preparation works will be carried out.

For 11.24 hectares of new lease ground, preparation of the ground will take place over a two-day period during the summer of 2020. The work will be carried out using the conveyor dredge system described in section 4.2.2 with the primary aim being to remove dead shell and any blanketing weed or algae.

For 26.29 hectares of new lease ground, preparation of the ground will take place periodically over a two-week period during April to September 2020. The work will be carried out using the box dredge system described in section 4.2.2. This hectarage includes lease bed number 12, therefore preparation works will also be subject to the temporal restriction of 20:00 and 08:00 to avoid conflict with the personal watercraft area.

Annual ‘cleaning’ of lease ground to allow for new shellfish to be laid down will also take place. However, this will be undertaken on ground which has historically already been subject to aquaculture activity and will use the same gear methods outlined in section 4.2.2. It is therefore not anticipated that this annual ‘cleaning’ will have any impact greater than normal operations undertaken on the lease beds.

4.2.4 Biosecurity

The 'T2 Poole Harbour Shellfish Biosecurity Plan' outlines measures that need to be taken by lease holders to ensure that correct biosecurity is maintained within Poole Harbour. The Plan sets out overarching requirements which are then mirrored and risk assessed according to activities and processes outlined in specific business plans for each lease holder. The overarching risk assessment is included in Annex 7.

The practices set out to reduce biosecurity risk as a result of aquaculture activity in Poole Harbour through the introduction of diseases (microbial pathogens) and Invasive Non-Indigenous Species (INIS) are summarised below.

Purchase of seed from any areas outside the UK

The seed must come from Cefas approved hatcheries and be accompanied by the appropriate paperwork to indicate this. Seed can only be brought into Poole Harbour, for the purposes of aquaculture, after the appropriate application has been made to the Southern IFCA and verified by Cefas. Any seed that shows any signs of disease will not be accepted onto the site and seed imports will be thoroughly washed and checked for INIS. All imports must be recorded and, following receipt, seed must be separated from other stocks for two weeks.

Seed moved or purchased from another shellfish farming area within the UK

The seed must come from an area with equal or higher water quality status than Poole Harbour (currently this is a long-term B or higher classification but may change if changes in classifications occur within Poole Harbour). Lease holders are required to keep abreast of any changes in classification with the local Environmental Health department. Any seed movements or purchases must be accompanied by the appropriate paperwork and movement documents and, where required, advice must be sought from Cefas before any movements take place. Seed must not be accepted onto the site if any signs of disease are noted, and seed will be thoroughly washed and checked for INIS. All movements and purchases must be recorded.

Relaying of wild seed or animals

For any seed or animals taken from wild stocks and relayed onto lease ground in Poole Harbour, the location from which the seed/animals are taken must first be verified with Cefas. No seed or animals are to be accepted onto the site if any signs of disease are noted and seed/animals will be thoroughly washed and checked for INIS. All seed/animals relayed from wild stocks must be separated from all other stocks for a two-week period. Seed/animals may only be relayed in Poole Harbour if they come from an area of equal or higher water quality status (currently this is a long-term B or higher classification but may change if changes in classifications occur within Poole Harbour). Lease holders are required to keep abreast of any changes in classification with the local Environmental Health department.

Any stock (seed/animals) from any area where the disease history is unknown is not permitted to be moved, imported, purchased or relayed into Poole Harbour.

Exported Product

All exported product from lease ground in Poole Harbour can only be sent to Cefas approved and bio-secure depuration and processing plants. Any destination for exported product must hold the appropriate licences. All exports must be recorded and documented.

Use of vessels and equipment

All vessels, equipment and staff PPE used on the lease ground in Poole Harbour must be checked, cleaned and dried each day (please see check, clean, dry protocol below). Where cleaning of vessels is taking place in an area other than the lease ground of the particular lease holder, the deck of the vessel should be sealed to prevent runoff. Any public or other visitors to any lease ground or associated vessels should be by invite only and appropriate, disinfected PPE should be provided.

Any equipment brought in from another area should be subject to the check, clean, dry protocol and thoroughly examined before use. Any rubbish materials must be disposed of on-board the vessel and taken ashore to be disposed of. All staff operating on any lease ground must be made aware of the protocols relating to biosecurity, overseen by the site manager.

Protocols for activity on lease ground

Lease beds must be seeded or harvested independently of one another and stock from individual beds kept separate to avoid contamination between areas. Any mortality events observed must be reported to the Southern IFCA and Cefas with samples provided so that the cause of mortality can be investigated and any mortality arising from disease can be identified.

Any instances of INIS on lease ground must be reported to the Southern IFCA. Photographs, date of discovery and precise geographic location must be provided to enquiries@southern-ifca.gov.uk. In addition, lease holders are encouraged to use INNS Mapper https://ywt-data.org/INNS-mapper/ to record any INNS into a wider database.

Pacific Oysters – there are specific provisions relating to biosecurity and the farming of Pacific oysters in Poole Harbour. Within any lease ground, any stock of Pacific oyster laid must be of triploid stock or stock subject to an alternative method of sterilization. Any applications to farm Pacific oyster using a type of stock different to that stipulated above will be considered on a case by case basis by the Authority in consultation with Natural England, with the proposed methodology provided by the lease holder subject to an appropriate assessment. A separate Evidence Package has been produced to outline how the Southern IFCA will manage the farming of Pacific oysters under The Order based on consultation with Natural England (Annex 10). As part of this evidence package, it is detailed that, commencing in 2021, the Southern IFCA will undertake a shore-based survey of the presence of wild Pacific oysters in Poole Harbour in conjunction with the University of Southampton. The data produced by this survey will be considered alongside any other available relevant data sources including but not limited to data on the sources of wild populations of Pacific oysters in the UK and any indication of a level of natural change which would be expected regardless of the presence of aquaculture activity on the site. From this, the Southern IFCA will liaise with Natural England to discuss the survey results and develop an on-going survey program and Monitoring and Control Plan for the fishery, where the results will feed into review of management measures where necessary.

Check, Clean, Dry

The check, clean dry protocol is provided by www.nonnativespecies.org/checkcleandry as follows:

Check equipment and clothing for live organisms – particularly in areas that are damp or hard to inspect

Clean and wash all equipment, footwear and clothes thoroughly, use hot water where possible. If you do come across any organisms, leave them at the water body where you found them.

Dry all equipment and clothing – some species can live for many days in moist conditions. Make sure you don't transfer water elsewhere.

5 Test of Likely Significant Effect (TLSE)

The Habitats Regulations Assessment (HRA) is a step-wise process and is first subject to a coarse test of whether the plan or project will cause a likely significant effect on an EMS[8]. Each feature/sub-feature was subject to a TLSE[9]. The operations considered under the TLSE, based on the activities outlined in the business plans for the 2020-25 leases, were; i) Shellfish aquaculture: bottom culture, ii) Dredges and iii) Hydraulic dredges. Where it was identified that a feature or supporting habitat was sensitive to a particular pressure exerted by a certain operation, the interaction was recommended for further assessment. The interactions requiring further assessment are shown in tables 1 (Shellfish aquaculture: bottom culture) and 2 (Dredges and Hydraulic dredges).

Table 1: Potential pressures on features and supporting habitats of the Poole Harbour SPA from shellfish aquaculture: bottom culture, identified as sensitive and requiring further assessment in the TLSE

Feature/Supporting Habitat	Potential Pressure	Comment	Relevant Attributes
Avocet Black-tailed godwit Little egret Shelduck Spoonbill Waterbird assemblage (non-breeding)	Introduction of microbial pathogens	Aquaculture operations which introduce seed or stock from locations outside of Poole Harbour have the potential to introduced microbial pathogens. Further assessment is required of proposed aquaculture operations and associated biosecurity measures	Non-breeding population: abundance; Supporting habitat: food availability;
	Removal of non-target species	In locations where lease ground has been identified to replace that which is closed under the T2 lease bed reallocation programme, there is the potential for removal of non-target species through clearing of the ground prior to the culture of shellfish.	Supporting habitat: food availability;
	Visual disturbance	Aquaculture activity on the lease beds has the potential to disturb wading	Disturbance caused by human activity;

[8] Managing Natura 2000 sites: http://ec.europa.eu/environment/nature/natura2000/management/guidance_en.htm
[9] The Test of Likely Significant Effect is a stand-alone document which can be viewed on request from Southern IFCA.

		birds and intertidal feeders due to temporal or permanent loss of roosting and feeding habitat from altered behaviour affecting energy budgets and bodily condition. Disturbance can result from presence of vessels in areas adjacent to feeding and roosting sites. Waterbirds like shelduck are considered sensitive to visual disturbance by human activities. The species responds by being altered or escape flights as a consequence of various visual stimuli. Walking and biking people are reported as a common cause of disturbance triggering stronger disturbance than vehicles. Shelduck could potentially be more sensitive to visual disturbance during moulting time at which time they form large flocks. Factors such as human disturbance may plan an important role in determining habitat quality for Shelduck. A study found that the main cause of disturbance of Spoonbills were aircrafts (37%) and humans (21%). They spent more time in flight in response to aircraft (57%) and shooting (22%) but no impact on the disturbed birds energy budget or feeding success was found.	
	Above water noise	Wading bird species can be directly impacted by above water noise causing a disturbance. Depending on	Disturbance caused by human activity;

		the sound intensity birds may react by being alerted or taking flight. Impulsive sound in particular may result in disturbance. Feeding waders are not as strongly affected as roosting birds and there are species-specific tolerance levels. No species-specific evidence on above water noise impacts on shelduck was found.	
	Collision ABOVE water with static or moving objects not naturally found in the marine environment (e.g. boats, machinery, and structures)	There is the potential for collision above water with vessels operating on lease ground. There are no other structures permitted on lease ground so the presence of vessels are the only potential risk for this pressure.	Supporting habitat: landscape; Connectivity with supporting habitats
Common Tern Sandwich tern	Changes in suspended solids (water clarity)	In locations where lease ground has been identified to replace that which is closed under the T2 lease bed reallocation programme, there is the potential for changes in water clarity from changes in sediment and organic particulate matter concentrations as a result of preparing the beds for shellfish cultivation. This process is likely to occur over relatively short time scales and then not need to occur again once shellfish has been laid onto the seabed.	Supporting habitat: water quality – turbidity
	Introduction of microbial pathogens	Aquaculture operations which introduce seed or stock from locations outside of Poole Harbour have the potential to introduced microbial pathogens. Further assessment is required of proposed aquaculture	Breeding population: abundance; Supporting habitat: food availability;

		operations and associated biosecurity measures	
	Removal of non-target species	In locations where lease ground has been identified to replace that which is closed under the T2 lease bed reallocation programme, there is the potential for removal of non-target species through clearing of the ground prior to the culture of shellfish.	Supporting habitat: food availability;
	Visual disturbance	Aquaculture activity on the lease beds has the potential to disturb Common tern during the breeding season although disturbance is mainly thought to be as a result of recreational activities. Common terns can be scared away from nesting sites which can lead to nearly total reproductive failure. Human disturbance has also been noted to markedly facilitate gull predation and therefore reduce the breeding success of common tern. Aquaculture activity has the potential to disturb Sandwich terns. Human disturbance of sandwich tern during the breeding season is mainly caused by recreational activities and the species is particularly sensitive to disturbance by e.g. tourism during the early breeding season. Premature nest-leaving as a result of human disturbance has been documented for Sandwich tern chicks increasing nestling mortality. When foraging at sea, Sandwich tern is reported to have a low sensitivity to disturbance	Disturbance caused by human activity; Predation - all habitats;

		by shipping activities. Surface feeding species can also be attracted to activities that may cause visual disturbance to other species i.e. Sandwich terns are reported to feed on fish trawler discards.	
	Above water noise	Surface feeding birds can be directly impacted by above water noise, especially at breeding sites. Depending on the sound intensity birds may react by being alerted or taking flight. Impulsive sound in particular may result in disturbance. Feeding waders are not as strongly affected as roosting birds and there are species-specific tolerance levels. Common tern is reported to be displaced from colonies by the noise from personal watercrafts and motor boats but information is sparse and no specific link to noise was found.	Disturbance caused by human activity;
	Collision ABOVE water with static or moving objects not naturally found in the marine environment (e.g. boats, machinery, and structures)	There is the potential for collision above water with vessels operating on lease ground. There are no other structures permitted on lease ground so the presence of vessels are the only potential risk for this pressure.	Supporting habitat: landscape; Connectivity with supporting habitats
Mediterranean gull	Introduction of microbial pathogens	Aquaculture operations which introduce seed or stock from locations outside of Poole Harbour have the potential to introduced microbial pathogens. Further assessment is required of proposed aquaculture operations and associated biosecurity measures	Breeding population: abundance; Supporting habitat: food availability;

	Removal of non-target species	In locations where lease ground has been identified to replace that which is closed under the T2 lease bed reallocation programme, there is the potential for removal of non-target species through clearing of the ground prior to the culture of shellfish.	Supporting habitat: food availability;
	Visual disturbance	Aquaculture activity on the lease beds has the potential to disturb Mediterranean gulls. Human disturbance will be a higher risk during the breeding season and is mainly attributed to recreational activities. Mediterranean gulls appear to be tolerant to human disturbance although tourist disturbance/other disturbance at breeding colonies is one of the greatest direct losses of birds.	Disturbance caused by human activity; Predation - all habitats;
	Above water noise	Surface feeding birds can be directly impacted by above water noise, especially at breeding sites. Depending on the sound intensity birds may react by being alerted or taking flight. Impulsive sound in particular may result in disturbance. Feeding waders are not as strongly affected as roosting birds and there are species-specific tolerance levels. There is sparse specific information on vulnerability to noise for Mediterranean gull.	Disturbance caused by human activity;
	Collision ABOVE water with static or moving objects not naturally found in the marine environment (e.g. boats, machinery, and structures)	There is the potential for collision above water with vessels operating on lease ground. There are no other structures permitted on lease ground	Supporting habitat: landscape; Connectivity with supporting habitats

		so the presence of vessels are the only potential risk for this pressure.	
Coastal lagoons	Introduction of microbial pathogens	Aquaculture operations which introduce seed or stock from locations outside of Poole Harbour have the potential to introduced microbial pathogens. There is an exchange of water between the lagoon and the main Harbour therefore there is the potential for microbial pathogens in the water to enter the lagoon. Further assessment is required of proposed aquaculture operations and associated biosecurity measures.	Supporting habitat: food availability;
	Introduction or spread of invasive non-indigenous species (INIS)	Aquaculture operations which introduce seed or stock from locations outside of Poole Harbour have the potential to introduced INIS. There is an exchange of water between the lagoon and the main Harbour therefore there is the potential for microbial pathogens in the water to enter the lagoon. Further assessment is required of proposed aquaculture operations and associated biosecurity measures.	Supporting habitat: extent and distribution of supporting habitat; Supporting habitat: food availability;
Atlantic salt meadows Spartina swards	Changes in suspended solids (water clarity)	In locations where lease ground has been identified to replace that which is closed under the T2 lease bed reallocation programme, there is the potential for suspended silt/sediments as a result of preparing the beds for shellfish cultivation. This process is likely to occur over relatively short time scales at the beginning of the five-year lease	Supporting habitat: water quality - turbidity

		period and then not need to occur again once shellfish has been laid onto the seabed.	
	Smothering and siltation rate changes (Light)	In locations where lease ground has been identified to replace that which is closed under the T2 lease bed reallocation programme, there is the potential for suspended silt/sediments as a result of preparing the beds for shellfish cultivation. This process is likely to occur over relatively short time scales at the beginning of the five-year lease period and then not need to occur again once shellfish has been laid onto the seabed.	Supporting habitat: water quality - turbidity
Intertidal seagrass beds	Changes in suspended solids (water clarity)	In locations where lease ground has been identified to replace that which is closed under the T2 lease bed reallocation programme, there is the potential for suspended silt/sediments as a result of preparing the beds for shellfish cultivation. This process is likely to occur over relatively short time scales at the beginning of the five-year lease period and then not need to occur again once shellfish has been laid onto the seabed.	Supporting habitat: water quality – turbidity
	Introduction of microbial pathogens	Aquaculture operations which introduce seed or stock from locations outside of Poole Harbour have the potential to introduced microbial pathogens. Further assessment is required of proposed aquaculture	Supporting habitat: food availability; Supporting habitat: extent and distribution of supporting habitat;

		operations and associated biosecurity measures.	
	Introduction or spread of invasive non-indigenous species (INIS)	Aquaculture operations which introduce seed or stock from locations outside of Poole Harbour have the potential to introduced INIS. Further assessment is required of proposed aquaculture operations and associated biosecurity measures.	Supporting habitat: extent and distribution of supporting habitat; Supporting habitat: food availability;
	Smothering and siltation rate changes (Light)	In locations where lease ground has been identified to replace that which is closed under the T2 lease bed reallocation programme, there is the potential for suspended silt/sediments as a result of preparing the beds for shellfish cultivation. This process is likely to occur over relatively short time scales at the beginning of the five-year lease period and then not need to occur again once shellfish has been laid onto the seabed.	Supporting habitat: water quality – turbidity
Intertidal mud	Abrasion/disturbance of the substrate on the surface of the seabed	There is a small area of intertidal mud identified within lease ground no. 12. The area of intertidal mud is approx. 0.1 Ha in size. Over this part of this specific lease ground there is the potential for aquaculture activity to cause abrasion/disturbance of the supporting habitat on the surface of the seabed.	Supporting habitat: extent and distribution of supporting habitat; Supporting habitat: food availability
	Changes in suspended solids (water clarity)	In locations where lease ground has been identified to replace that which is closed under the T2 lease bed reallocation programme, there is the potential for suspended	Supporting habitat: water quality – turbidity

		silt/sediments as a result of preparing the beds for shellfish cultivation. This process is likely to occur over relatively short time scales at the beginning of the five-year lease period and then not need to occur again once shellfish has been laid onto the seabed.	
	Introduction of microbial pathogens	Aquaculture operations which introduce seed or stock from locations outside of Poole Harbour have the potential to introduced microbial pathogens. Further assessment is required of proposed aquaculture operations and associated biosecurity measures.	Supporting habitat: food availability
	Introduction or spread of invasive non-indigenous species (INIS)	Introduction or spread of invasive non-indigenous species (INIS)	Supporting habitat: extent and distribution of supporting habitat; Supporting habitat: food availability;
	Penetration and/or disturbance of the substratum below the surface of the seabed, including abrasion	There is a small area of intertidal mud identified within lease ground no. 12. The area of intertidal mud is approx. 0.1 Ha In size. Over this part of this specific lease ground there is the potential for aquaculture activity to cause penetration and/or disturbance of the substratum below the surface of the seabed, including abrasion.	Supporting habitat: extent and distribution of supporting habitat; Supporting habitat: food availability
	Removal of non-target species	There is a small area of intertidal mud identified within lease ground no. 12. The area of intertidal mud is approx. 0.1 Ha In size. Over this part of this specific lease ground there is the potential for aquaculture activity to cause removal of non-target species.	Supporting habitat: food availability

	Smothering and siltation rate changes (Light)	In locations where lease ground has been identified to replace that which is closed under the T2 lease bed reallocation programme, there is the potential for suspended silt/sediments as a result of preparing the beds for shellfish cultivation. This process is likely to occur over relatively short time scales at the beginning of the five-year lease period and then not need to occur again once shellfish has been laid onto the seabed.	Supporting habitat: water quality – turbidity
	Physical change (to another sediment type)	There is a small area of intertidal mud identified within lease ground no. 12. The area of intertidal mud is approx. 0.1 Ha in size. Over this part of this specific lease ground there is the potential for aquaculture activity to cause physical change (to another sediment type)	Supporting habitat: extent and distribution of supporting habitat
Water Column	Changes in suspended solids (water clarity)	In locations where lease ground has been identified to replace that which is closed under the T2 lease bed reallocation programme, there is the potential for suspended silt/sediments as a result of preparing the beds for shellfish cultivation. This process is likely to occur over relatively short time scales at the beginning of the five-year lease period and then not need to occur again once shellfish has been laid onto the seabed. Tern species are visual foragers and are dependent on	Supporting habitat: water quality - turbidity; Supporting habitat: food availability.

		clear water to identify and catch potential prey i.e. sand eels.	
	Genetic modification & translocation of indigenous species	Genetic modification can occur as a result of the introduction of farmed individuals to the wild e.g. cultivated shellfish where genetic modification practices are employed. There is the potential for this to occur as a result of aquaculture activity, details on whether genetic modification is employed for any species cultivated on T2 lease ground will need to be investigated through the biosecurity and management plans.	Supporting habitat: food availability
	Introduction or spread of invasive non-indigenous species (INIS)	Aquaculture operations which introduce seed or stock from locations outside of Poole Harbour have the potential to introduced INIS. Further assessment is required of proposed aquaculture operations and associated biosecurity measures.	Supporting habitat: extent and distribution of supporting habitat; Supporting habitat: food availability;
	Visual disturbance	There is the potential for aquaculture activity to cause visual disturbance to the bird features of the site through the presence of vessels on leased ground. This disturbance can impact the feeding regimes of terns and subsequently impact their reproductive success.	Disturbance caused by human activity; Connectivity with supporting habitats

Table 2: Potential pressures on features and supporting habitats of the Poole Harbour SPA from dredges and hydraulic dredges, identified as sensitive and requiring further assessment in the TLSE

Feature/Supporting Habitat	Potential Pressure	Comment	Relevant Attributes
Avocet Black-tailed godwit Little egret Shelduck Spoonbill Waterbird assemblage (non-breeding)	Visual disturbance	Dredging activity on the lease beds has the potential to disturb wading birds due to temporal or permanent loss of roosting and feeding habitat from altered behaviour directly affecting energy budgets and body condition of wading birds. Disturbance can result from presence of vessels in areas adjacent to feeding and roosting sites. Waterbirds like shelduck are considered sensitive to visual disturbance by human activities. The species responds by being alerted or escape flights as a consequence of various visual stimuli. Walking and biking people are reported as a common cause of disturbance triggering stronger disturbance than vehicles. Shelduck could potentially be more sensitive to visual disturbance during moulting time at which time they form large flocks. Factors such as human disturbance may plan an important role in determining habitat quality for Shelduck. A study found that the main cause of disturbance of Spoonbills were aircrafts (37%) and humans (21%). They spent more time in flight in response to aircraft (57%) and	Disturbance caused by human activity;

		shooting (22%) but no impact on the disturbed birds energy budget or feeding success was found.	
	Above water noise	Wading bird species can be directly impacted by above water noise causing a disturbance. Depending on the sound intensity birds may react by being alerted or taking flight. Impulsive sound in particular may result in disturbance. Feeding waders are not as strongly affected as roosting birds and there are species-specific tolerance levels.	Disturbance caused by human activity;
	Collision ABOVE water with static or moving objects not naturally found in the marine environment (e.g. boats, machinery, and structures)	There is the potential for collision above water with vessels operating on lease ground. There are no other structures permitted on lease ground so the presence of vessels are the only potential risk for this pressure.	Supporting habitat: landscape; Connectivity with supporting habitats
Common tern Sandwich tern	Changes in suspended solids (water clarity)	Dredging on lease beds to harvest shellfish has the potential for changes in water clarity from changes in sediment and organic particulate matter concentrations.	Supporting habitat: water quality – turbidity
	Visual disturbance	Dredging activity on the lease beds has the potential to disturb Common tern during the breeding season although disturbance is mainly thought to be as a result of recreational activities. Common terns can be scared away from nesting sites which can lead to nearly total reproductive failure. Human disturbance has also been noted to markedly facilitate gull predation and	Disturbance caused by human activity; Predation - all habitats;

		therefore reduce the breeding success of common tern. Dredging activity has the potential to disturb Sandwich terns. Human disturbance of sandwich tern during the breeding season is mainly caused by recreational activities and the species is particularly sensitive to disturbance by e.g. tourism during the early breeding season. Premature nest-leaving as a result of human disturbance has been documented for Sandwich tern chicks increasing nestling mortality. When foraging at sea, Sandwich tern is reported to have a low sensitivity to disturbance by shipping activities. Surface feeding species can also be attracted to activities that may cause visual disturbance to other species i.e. Sandwich terns are reported to feed on fish trawler discards.	
	Above water noise	Wading bird species can be directly impacted by above water noise causing a disturbance. Depending on the sound intensity birds may react by being alerted or taking flight. Impulsive sound in particular may result in disturbance. Feeding waders are not as strongly affected as roosting birds and there are species-specific tolerance levels. Common tern is reported to be displaced from colonies by the noise from personal watercrafts and motor boats but	Disturbance caused by human activity;

		information is sparse and no specific link to noise was found. There is sparse species-specific information on vulnerability to noise.	
	Collision ABOVE water with static or moving objects not naturally found in the marine environment (e.g. boats, machinery, and structures)	There is the potential for collision above water with vessels operating on lease ground. There are no other structures permitted on lease ground so the presence of vessels are the only potential risk for this pressure.	Supporting habitat: landscape; Connectivity with supporting habitats
Mediterranean gull	Visual disturbance	Dredging activity on the lease beds has the potential to disturb Mediterranean gulls. Human disturbance will be a higher risk during the breeding season and is mainly attributed to recreational activities. Mediterranean gulls appear to be tolerant to human disturbance although tourist disturbance/other disturbance at breeding colonies is one of the greatest direct losses of birds.	Disturbance caused by human activity; Predation - all habitats;
	Above water noise	Surface feeding birds can be directly impacted by above water noise, especially at breeding sites. Depending on the sound intensity birds may react by being alerted or taking flight. Impulsive sound in particular may result in disturbance. Feeding waders are not as strongly affected as roosting birds and there are species-specific tolerance levels. There is sparse specific information on vulnerability to noise for Mediterranean gull.	Disturbance caused by human activity;

	Collision ABOVE water with static or moving objects not naturally found in the marine environment (e.g. boats, machinery, and structures)	There is the potential for collision above water with vessels operating on lease ground. There are no other structures permitted on lease ground so the presence of vessels are the only potential risk for this pressure.	Supporting habitat: landscape
Atlantic salt meadows Spartina swards	Changes in suspended solids (water clarity)	In locations where lease ground has been identified to replace that which is closed under the T2 lease bed reallocation programme, there is the potential for suspended silt/sediments as a result of preparing the beds for shellfish cultivation. This process is likely to occur over relatively short time scales at the beginning of the five-year lease period and then not need to occur again once shellfish has been laid onto the seabed.	Supporting habitat: water quality - turbidity
	Smothering and siltation rate changes (Light)	In locations where lease ground has been identified to replace that which is closed under the T2 lease bed reallocation programme, there is the potential for suspended silt/sediments as a result of preparing the beds for shellfish cultivation. This process is likely to occur over relatively short time scales at the beginning of the five-year lease period and then not need to occur again once shellfish has been laid onto the seabed.	Supporting habitat: water quality - turbidity
Intertidal seagrass beds	Changes in suspended solids (water clarity)	Dredging on lease beds to harvest shellfish has the potential for changes in water clarity from changes in	Supporting habitat: water quality – turbidity

		sediment and organic particulate matter concentrations.	
	Smothering and siltation rate changes (Light)	Dredging on lease beds to harvest shellfish has the potential to result in smothering and siltation rate changes due to sediment disturbed by the action of the dredge.	Supporting habitat: food availability
Intertidal mud	Abrasion/disturbance of the substrate on the surface of the seabed	There is a small area of intertidal mud identified within lease ground no. 12. The area of intertidal mud is approx. 0.1Ha In size. Over this part of this specific lease ground there is the potential for dredging activity to cause abrasion/disturbance of the supporting habitat on the surface of the seabed.	Supporting habitat: extent and distribution of supporting habitat; Supporting habitat: food availability
	Changes in suspended solids (water clarity)	Dredging on lease beds to harvest shellfish has the potential for changes in water clarity from changes in sediment and organic particulate matter concentrations. Tern species are visual foragers and are dependent on clear water to identify and catch potential prey.	Supporting habitat: water quality - turbidity; Supporting habitat food availability
	Penetration and/or disturbance of the substratum below the surface of the seabed, including abrasion	There is a small area of intertidal mud identified within lease ground no. 12. The area of intertidal mud is approx. 0.1Ha in size. Over this part of this specific lease ground there is the potential for dredging activity to cause penetration and/or disturbance of the substratum below the surface of the seabed, including abrasion.	Supporting habitat: extent and distribution of supporting habitat; Supporting habitat: food availability
	Removal of non-target species	There is a small area of intertidal mud identified within lease ground no. 12. The area of intertidal mud is approx.	Supporting habitat: food availability

		0.1Ha in size. Over this part of this specific lease ground there is the potential for dredging activity to cause removal of non-target species.	
	Smothering and siltation rate changes (Light)	Dredging on lease beds to harvest shellfish has the potential to result in smothering and siltation rate changes due to sediment disturbed by the action of the dredge.	Supporting habitat: food availability
	Physical change (to another sediment type)	There is a small area of intertidal mud identified within lease ground no. 12. The area of intertidal mud is approx. 0.1Ha in size. Over this part of this specific lease ground there is the potential for dredging activity to cause physical change (to another sediment type)	Supporting habitat: extent and distribution of supporting habitat
Water column	Changes in suspended solids (water clarity)	Dredging on lease beds to harvest shellfish has the potential for changes in water clarity from changes in sediment and organic particulate matter concentrations. Tern species are visual foragers and are dependent on clear water to identify and catch potential prey.	Supporting habitat: water quality - turbidity; Supporting habitat food availability
	Removal of non-target species	There is the potential for dredging activity to result in the removal of non-target species in areas where sand eels are present on subtidal sand banks. There is an area of sand bank located between the main channel and Brownsea Island where sand eels are present in the subtidal sediment.	Supporting habitat: food availability
	Visual disturbance	There is the potential for dredging activity to cause visual disturbance to	Disturbance caused by human activity

		the bird features of the site through the presence of vessels on leased ground. This disturbance can impact the feeding regimes of terns and subsequently impact their reproductive success.	

6 Appropriate Assessment

Note: this is only to be undertaken in the Test of Likely Significant Effect (Section 5) concluded 'Yes' or 'Uncertain' for LSE, either alone or in-combination

6.1 Co-location of Bird Features (and their supporting habitats) and Project/Plan(s)

Key areas favoured by designated bird species in Poole Harbour SPA are summarised in table 3.

Table 3: Key areas for designated bird species in the Poole Harbour SPA. Information taken from the draft supplementary advice on conserving and restoring site features, Natural England's Conservation Advice Package and Poole Harbour Aquatic Management Plan Appendix 5 (Selection of Bird Sensitive Areas in Poole Harbour).

Common Name	Latin Name	Favoured Area(s)
Avocet	*Recurvirostra avosetta*	Roosting areas include Brownsea Lagoon, towards the end of Wych and Middlebere channel and on the Spartina saltmarsh in north Holes Bay. Main feeding areas include Wych and Middlebere channels, Brownsea Lagoon, East Fitzworth.
Black-tailed godwit	*Limoa limosa islandica*	To feed, flocks tend to congregate in one bay, including Holes Bay or Lytchett Bay and roosting is limited to the area in which they are feeding. Preferred feeding sites also include Brownsea Lagoon. Arne Bay, Brands Bay, Wych Lake, Newton Bay, Ower Bay and Middlebere Lake and Brownsea Lagoon are important roost sites for waders, including black-tailed godwit.
Common tern and Sandwich tern	*Sterna hirundo*	Brownsea Island lagoon is the site of the principal and probably only nesting colony of common terns and Sandwich terns within the Poole Harbour SPA.
Mediterranean gull	*Larus melanocephalus*	Only confirmed breeding colony in Poole Harbour is saltmarsh islands of off Holton Heath where the species nests alongside black-headed gulls.

Shelduck	*Tadorna tadorna*	Feeding takes place throughout the harbour, although favoured areas include Keysworth, Hole Bay and Brands Bay. Keysworth is reported to be an important area for feeding, with the food requirements for the numbers of shelduck recorded to exceed food availability.
Eurasian spoonbill	*Platalea leucorodia*	Brownsea Lagoon and Middlebere channel represent favoured feeding sites. Species is also recorded at other locations including Arne and Holes Bay. but also recorded at other locations e.g. Arne and Holes Bay
Little egret	*Egretta garzetta*	Occurs throughout the harbour. Known to roost in trees around Littlesea (the dune slack lake on Studland) and Plantation trees in Arne.
Curlew	*Numenius arquata*	Keysworth is reported to be an important area for feeding, with the food requirements for the numbers of curlew recorded to exceed food availability.
Redshank	*Tringa totanus*	Arne Bay, Brands Bay, Wych Lake, Newton Bay, Ower Bay and Middlebere Lake are important roost sites for waders, including redshank.
Greenshank	*Tringa nebularia*	Arne Bay, Brands Bay, Wych Lake, Newton Bay, Ower Bay and Middlebere Lake are important roost sites for waders, including greenshank.
Waterbird assemblage, non-breeding	Over 20,000 waterbirds over the winter	All of the above sensitive areas are utilised by bird species comprising the waterbird assemblage. Saltmarsh habitats, seagrass beds and reedbed are all important supporting habitats.

A map of the extent of the Poole Harbour Fishery Order 2015 and the T2 lease beds alongside the supporting habitats for the SPA can be found in Annex 6. This reveals where the lease beds under T2 are located in relation to designated supporting habitats of the site and shows how lease beds have been positioned to aim to avoid overlap with supporting habitats of the SPA and notified features of the SSSI. Using knowledge presented in table 3, aquaculture activity under T2 is likely to have minimal to no effect on the sites used by the bird features in Poole Harbour. The location of lease beds does not overlap with any of the areas highlighted in the table and therefore the key feeding and roosting sites will not be subject to aquaculture activity.

The potential effect on the features and supporting habitats of the SPA is mitigated through the management outlined in the ‘Poole Harbour Several Order 2015 Management Plan, 2020 Revision’ and the conditions specified in each ‘Lease of the Right of Several Fishery of Shellfish Laying’. This mitigation is primarily in the form of the location of T2 lease beds which aims to avoid the supporting habitats of the SPA and the notified features of the SSSI. The location of the lease beds is at a distance from areas identified in table 3 and are all located within the subtidal, removing them from the supporting habitats of the SPA including intertidal seagrass and intertidal mud (only one area of intertidal mud, measuring 0.1 ha is included within lease bed number 12). The operations which will be carried out over lease beds will also not be operating at low tide, which when

combined with the distance between activities and feeding areas, further lowers the disturbance risk to bird features. Other pressures including siltation, microbial pathogens and Invasive Non-Native Species are mitigated through specific lease conditions and requirements under the Biosecurity Plan for the Order and individual businesses.

6.2 Potential Impacts

From the pressures outlined in the Advice on Operations (as identified in the TLSE process), a list of pressures and relevant attributes has been created and is shown below. In this section, these pressures and associated potential impacts are explored further through a review of available scientific literature and relevant research studies.

Pressure	Relevant Attribute
Removal of non-target species	Supporting habitat: food availability
Visual disturbance	Disturbance caused by human activity Predation – all habitats Breeding population: abundance *(Common tern, Sandwich tern, Mediterranean gull only)*
Above water noise	Disturbance caused by human activity
Collision ABOVE water with static or moving objects not naturally found in the marine environment (e.g. boats, machinery, and structures)	Supporting habitat: landscape Connectivity with supporting habitats
Introduction of microbial pathogens	Non-breeding population: abundance Breeding population: abundance Assemblage of species: abundance
Introduction or spread of invasive non-indigenous species (INIS)	Supporting habitat: extent and distribution of supporting habitat Supporting habitat: food availability
Genetic modification & translocation of indigenous species	Supporting habitat: food availability
Changes in suspended solids (water clarity)	Supporting habitat: water quality – turbidity Supporting habitat: food availability *(Common tern and Sandwich tern only)*
Smothering and siltation rate changes (Light)	Supporting habitat: water quality – turbidity

Abrasion/disturbance of the substrate on the surface of the seabed	Supporting habitat: extent and distribution of supporting habitat Supporting habitat: food availability
Physical change (to another sediment type)	Supporting habitat: extent and distribution of supporting habitat

6.2.1 Removal of non-target species

Generic pressure description

This pressure addressed the effects caused by fishing, hunting or harvesting of marine resources including direct removal of individuals and physical resources (e.g. aggregates, cooling water, etc.). Ecological consequences include food web dependencies, population dynamics of fish, marine mammals, turtles and sea birds (including survival threats in extreme cases). Includes entrapment in static fishing gear and power plants as a form of by-catch on aquatic fauna.

Overview of potential impacts

Fishing activity can have an indirect impact upon bird species by affecting the availability of prey through pathways that do not include targeted removal (Natural England, 2014). Bottom towed fishing gears have been shown to reduce biomass, production and species richness as well as diversity of benthic communities and result in alterations to the size structure of populations and communities in areas subject to fishing pressure (Veale *et al.,* 2000; Hiddink *et al.,* 2003; Roberts *et al.,* 2010). Impacts to benthic communities can occur from the direct action of towing a dredge, whereby surface-dwelling organisms can be removed, crushed, buried or exposed, with particular impacts for sessile organisms (Mercaldo-Allen and Goldberg, 2011). Burial and smothering of infaunal and epifaunal species can also occur due to enhance suspended sediments from dredging (Mercaldo-Allen and Goldberg, 2011), this aspect is covered in section 6.2.7.

In a meta-analysis of 39 studies on the effects of bottom towed fishing gear, there was an overall reduction in abundance of individuals within a disturbed (fished) plot of 46% (Collie *et al.,* 2000). In a separate meta-analysis of 28 studies looking at the impacts of intertidal harvesting on benthic invertebrate communities (representing bird prey sources), the average abundance across all taxa in the first 10 days following harvesting disturbance declined by 42% (Clarke *et al.,* 2017). A simultaneous increase in species diversity (39% increase) was noted in the first 10 days following disturbance, however this was followed by a significant reduction in diversity between 51 and 500 days post fishing with no significant effect after 500 days (Clarke *et al.,* 2017). The magnitude of the response of fauna to bottom towed fishing gear varied with the gear type, habitat type (including sediment type) and among different taxa (Collie *et al.,* 2000). This is also noted by Mercaldo-Allen and Goldberg (2011) who stated

that the relative impact of shellfish dredging on benthic organisms is species-specific and is largely related to the biological characteristics of the species and their physical habitat. The vulnerability of an organism is ultimately seen to be related to whether or not it is infaunal or epifaunal, mobile or sessile and soft-bodied or hard-shelled (Mercaldo-Allen and Goldberg, 2011) with soft-bodied, deposit feeding crustaceans, polychaets and ophiuroids to be the most affected by dredging activities (Constantino *et al.,* 2009). The meta-analyses discussed previously predicted a reduction in anthozoa, malacostraca, Ophiuroidea and polychaete species of 93% after chronic exposure to dredging (Collie *et al.,* 2000) and a decline in annelida (39.17%), mollusca (33.76%) and crustacea (29.61%) in the first 10 days following dredging (Clarke *et al.,* 2017). These findings are supported by an additional study investigating the effects of mechanical cockle harvesting in intertidal muddy sand and clean sand where annelids were seen to decline by 74% in intertidal muddy sand and 32% in clean sand and molluscs declined by 55% in intertidal muddy sand and 45% in clean sand (Ferns *et al.,* 2000). EMU (1992) also found a distinct reduction in polychaetes but a less distinct difference in bivalves between dredged and control sites.

In areas that are intensively fished (more than three times per year), the faunal community is likely to be maintained in a permanently altered state and inhabited by fauna that are adapted to frequent physical disturbance (Collie *et al.,* 2000). Communities are likely to be dominated by small-sized organisms compared to relatively high biomass species in less disturbed areas (Collie *et al.,* 2000). A study around the Isle of Man indicated that regular fishing activity resulted in the exclusion of large-bodied individuals with the resulting benthic community dominated by smaller bodied organisms more adapted to physical disturbance (Kaiser *et al.,* 2000; Johnson, 2002). The mortality of both target and non-target species may also be affected due to an increase in opportunistic and scavenging species in recently disturbed areas (Gaspar *et al.,* 1995; Wheeler *et al.,* 2014). Whilst dredging can cause direct mortality of some infaunal and epifaunal organisms, many small benthic organisms including crustaceans, polychaetes and molluscs have short generation times and high fecundities, both of which enhance their capacity for rapid recolonization (Coen, 1995). With such species, the effect of dredging may only be short lived and therefore it is thought that short-term and localised depressions in infaunal populations is not a primary concern for subtidal habitats (Coen, 1995).

Examples of impacts

There has been a significant amount of research conducted into the impacts of fishing activity on the removal of non-target species and the resultant impact on bird species and other food web dependencies.

A number of studies have highlighted species that are particularly vulnerable to dredging as well as those which appear to be more tolerant. For example, the polychaete *Lanice conchilega* is highly incapable of movement in response to disturbance and therefore a significant period of time is required for recolonization of disturbed habitats (Goss-Custard, 1977). Deep burrowing molluscs, such as *Macoma balthica*, also have limited capability to escape. Following suction dredging for the common cockle on intertidal sand, the abundance of *Macoma* declined for 8 years from

1989 to 1996 (Piersma *et al*., 2001). Ferns *et al*. (2000) reported reductions of 30% in the abundance of *Lanica conchilega* in intertidal muddy sand after mechanical cockle harvesting (using a tractor) took place, although abundances of *Macoma balthica* increased. The same study also revealed large reductions of 83% and 52% in the abundance of the polychaetes *Pygospio elegans* and *Nephtys hombergii*, respectively (Ferns *et al*., 2000). The former species remained significantly depleted in the area of muddy sand for more than 100 days after harvesting and the latter for more than 50 days (Ferns *et al*., 2000).

In a study by Ferns *et al.,* (2000), bird feeding activity increased shortly after the mechanical harvesting of cockles using a tractor, particularly in areas of muddy sand when compared to areas of clean sand. Gulls and waders were noted to take advantage of the invertebrates made available by the harvesting. Dunlin (80 individuals) and curlew (7 individuals) were observed feeding in harvested areas 6 days after harvesting took place. Following this initial increase however the level of bird activity was seen to decline in areas of muddy sand when compared to control areas at 21 and 45 days after harvesting (Ferns *et al.,* 2000). Levels of feeding activity by bird species remained low in curlews and gulls for more than 80 days post-harvesting and for more than 50 days for oystercatchers. Any initial benefit observed by harvesting was matched by decreased feeding opportunities in the winter. It was noted that harvesting of large areas would not result in a neutral effect as the initial bird population would not be large enough to fully exploit the enhanced feeding opportunities provided by initial harvesting activity and the subsequent reduction in feeding opportunities would persist for a greater period of time (Ferns *et al.,* 2000). Other effects are thought to include the migration of birds into unharvested areas, thereby increasing bird densities over smaller spatial scales (Sutherland and Goss-Custard 1991; Goss-Custard, 1993).

Site-Specific Studies

There are a number of studies which have specifically investigated the impacts of pump-scoop dredging on non-target species removal in Poole Harbour.

Jensen *et al*. (2005) reported on the preliminary results of an MSc project looking at the potential impact of pump-scoop dredge fishing (for clam species) in Poole Harbour At thirteen sites, three replicate sediment samples were taken before and after the 2002/03 clam fishing season (late October to early January). Preliminary results from four sites, including data from a site experiencing ‘high’ fishing pressure (Seagull Island in the Wareham Channel) were analysed and presented. The results show the infaunal community at Seagull Island to have a similar level of disturbance before and after the fishing season, with no significant differences at all four sites. Some quantitative changes were observed in the fine sediment granulometry at Seagull Island, however sediment samples from all four sites showed no significant differences before and after the season. From the preliminary results it was concluded that there was no significant additional disturbance to the infaunal community before and after the 2002/03 fishing season occurred and whilst not statistically significant, changes to sediment granulometry at the site subject to high fishing pressure did occur.

Parker and Pinn (2005) investigated the impacts of pump-scoop dredge fishing (for cockles) on the intertidal sedimentary environment and macro-infaunal community at two sites located within the Whitley Lake area of Poole Harbour. The study area was characterised by sandy mud with some patches of shingle ground occurring close inshore. Samples from each site were collected in April prior to the cockle fishing season opening (fishing season ran from 1st May to 31st January), and then again in May, June and July during the season. The results showed little change in the sediment particle size distribution on a monthly basis, with no significant differences observed. After three months of dredging, species richness had declined by from 17.2±1.1 to 12.6±0.9 at the first site and 17.0±2.3 to 14.8±2.3 at the second site. A decline in abundance was also observed, with reductions of 42.3% at the first site and 50.6% at the second site, with post-hoc tests revealing differences between April and July. No significant differences were found in infaunal communities between April and May, indicating either low fishing effort or no initial impact of pump-scoop dredging. After three months, significant differences were detected, with changes between June and July potentially attributable to sudden temperature changes, reproduction-induced mortality or disturbance from another source (hand gathering of cockles or bait digging), although there is the potential that results were indicative of an effect caused by pump-scoop dredging. The species characterising the faunal assemblage in April consisted of *Scoloplos armiger*, *Cingula trifasciata* and *Hydrobia* spp., with May and June similar to April, although with the additional of *Arenicola marina*. In July the dominant species characterising faunal assemblage were *Urothoe* spp., *C. trifasciata*, *A. marina* and *Corophium* spp. *S. armiger* abundance showed the most change, with abundance decreasing to zero in July at both sites. Over the duration of the study *Hydrobia* spp. abundance declined at both sites, *Corophium* abundance and *Urothoe* spp. increased at both sites and *A. marina* abundance increased at the first site and remained constant at the second site. It was noted by the authors that two species commonly cited as important prey species for bird populations, *Arenicola marina* and *Corophium* spp., did not observe any obvious reductions in response to pump-scoop dredging and as such it was concluded that dredging may not have an obvious adverse impact on bird populations through impacts on the infaunal community.

Clarke *et al*. (2018) used a Before-After-Control-Impact (BACI) sampling design to assess the impacts of pump-scoop dredging on the benthic community structure and physical characteristics of the sediment. Core samples were taken from separate areas representing different levels of dredging intensity: an area that had historically been intensively dredged and remained open for a seven-month season; an area that had historically been closed to dredging but was opened for a four-month season and an area that remained permanently closed to dredging (control site). The samples were taken in June, prior to the start of the fishing season in 2015 and November, before the end of the season. Throughout the study period significant changes were noted in community structure at both dredged sites, with a significant effect of both site and time before and after fishing, indicating a variation in the magnitude of change in the overall assemblage between sites. The overall community structure of the newly dredged site shifted during the study period from a community resembling the control site to one more similar to that at the intensively dredged site. The community structure of the intensively dredged site, and to some extent that of the newly dredged site in November, were characterised by a high abundance of polychaete worms, in particular *Hediste diversicolor*, *Aphelochaeta marioni*, *Streblospio shrubsolii* and *Tubificoides* spp.; with the former three species showing notable increases in the newly dredged site (Figure 6). Densities of *H. diversicolor* more than doubled in the

newly dredged site and were largely dominated by smaller (<10mm) individuals. Control sites were largely dominated by *Peringia ulvae* and *Abra tenuis*, which declined at both dredged sites, a trend also observed for *A. tenuis*, and there was also a general absence of *A. marioni*.

Throughout the study period, densities of all species at the control site were generally lower but more stable than at both dredged sites, at which the magnitude of change was larger. Across both sampling months, species richness was also found to be significantly higher in both dredged sites compared to the control site. Biotic indices indicate all sites to be classed as 'moderately disturbed', with the control site and newly dredged site classified as 'good' quality and the intensively dredged site classified as 'moderate' quality. Despite the significant changes in community structure in the newly dredged site, as described above, no change in the biotope or ecological quality of either of the dredged sites were identified. It is worth noting that prior to the opening of the fishing season statistical analyses showed site differences in community structure, likely to be driven by a gradient in sediment type. Throughout the study period there were also clear seasonal changes in species abundance. The BACI sampling design allows for assessment of seasonally-induced changes however, and the greatest changes in community structure were observed in the newly dredged site with significant increases in species richness and total abundance.

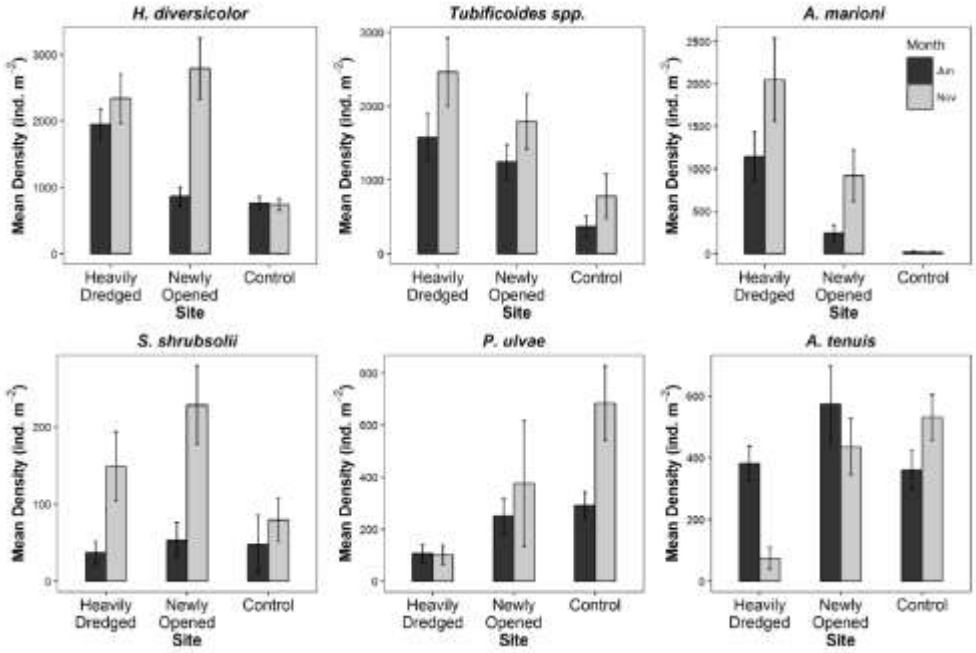

Figure 6: Mean densities of common benthic species in June (dark grey) and November (light grey) 2015 at three sites representing different intensities of pump-scoop dredging (heavily dredged, newly opened, control) in Poole Harbour. Source: Clarke *et al*., 2018.

Species-specific diets

With regard to the potential impact to bird species from removal of non-target species, there is a need to understand the important prey species in relation to features of a protected site. While birds will typically eat a range of different prey species including molluscs and annelids, the preferential species will vary according to the particular bird species (Natural England, 2014). The variations in prey preference will, to a certain extent, dictate the vulnerability of a particular bird species to the effects of fishing activity. The plasticity of a particular bird species diet will also vary, along with the value of particular prey items in terms of energetic value. It is therefore important to consider alternate prey species as well. Table 4 below indicates the prey items taken by bird species specifically designated under the Poole Harbour SPA and those included in the waterbird assemblage. Considerations need to include the availability of alternative prey species, which bird species may be forced to seek out due to lack of availability of primary food sources, for example prey species which burrow further into the sediment will require a higher energy expenditure by the bird (Zwarts *et al.,* 1996). In addition, bird may directly compete with fisheries where the target species and prey species are the same. The key bird species at risk from changes in prey availability are non-breeding overwintering species as food requirements are considerably greater during the winter period due to increased thermoregulatory needs and increased metabolic costs (Wheeler *et al.,* 2014).

Table 4: Typical prey items known to be taken by designated bird species in Poole Harbour SPA. Information on general prey preference was obtained from the SPA Tool Kit and Natural England's Poole Harbour Conservation Advice Package. Specific information on prey species was taken, where available, from the draft supplementary advice on conserving and restoring site features and also from other conservation advice packages from nearby SPAs with the same bird features

Common Name	Latin Name	General Prey Preference	Prey Species
Avocet	*Recurvirostra avosetta*	Fish, molluscs, crustaceans, insects, worms	*Gammarus, Corophium, Nereis, Hydrobia, Cardum,* gobie spp.
Little egret	*Egretta garzetta*	Fish, amphibians, insects	
Eurasian spoonbill	*Platalea leucorodia*	Insects, small fish, crustaceans, frogs and tadpoles, worms, leeches	
Black-tailed godwit	*Limosa limosa islandica*	Insects, worms, plants/grasses/seeds	*Scrobicularia, Macoma, Hediste, Arenicola, Cardium, Nereis*
Shelduck	*Tadorna tadorna*	Molluscs, crustaceans, worms, insects	*Hydrobia ulvae, Macoma, Corophium, Hediste, Enteromorpha, Nereis*

Dunlin	*Calidris alpina*	Molluscs, insects, worms	*Macoma, Hydrobia* spp., *Nereis, Crangon, Carcinus, Scrobicularia, Corophium, Hediste*
Dark-bellied brent goose	*Branta bernicla bernicla*	Plants/grasses/seeds	*Zostera* spp., *Enteromorpha, Ulva lactuca*
Goldeneye	*Bucephala clangula*	Fish, molluscs, crustaceans, insects	
Teal	*Anas crecca*	Plants/grasses/seeds	*Enteromorpha* spp., *Ulvae* spp.
Curlew	*Numenius arquata*	Molluscs, crustaceans, insects, worms	*Mya, Cerastoderma, Scrobicularia, Macoma, Hediste, Arenicola, Carcinus*
Red-breasted merganser	*Mergus serrator*	Fish	Gobies, flatfish, herring fry (<11cm), shrimp, sticklebacks, *Nereis* spp.
Spotted redshank	*Tringa erythropus*	Insects, worms	
Greenshank	*Tringa nebularia*	Fish, crustaceans, worms	
Redshank	*Tringa totanus*	Molluscs, crustaceans, insects, worms	*Mya, Scrobicularia, Macoma, Hydrobia, Corophium, Hediste, Nereis*
Pochard	*Aythya farina*	Fish, insects, plants/grasses/seeds	

Additional information was also obtained from Durrell & Kelly (1990), Cox *et al*. (2014), European Commission (2009), Brearey (1982) & Clarke *et al*., (2017) (Supplement 1)

Recovery

The timescale for recovery of benthic communities and therefore potential prey species will depend on the sediment type, the associated faunal assemblage and the rate of natural disturbance (Roberts *et al.,* 2010). Where levels of natural disturbance are high, the faunal assemblage is characterised by species adapted to and able to withstand a greater level of disturbance promoting faster recovery (Collie *et al.,* 2000; Roberts *et al.,* 2010). Less disturbed habitats, often distinguished by high species diversity and epifaunal species are likely to take a longer time to recover (Roberts *et al.,* 2010). A 10-year monitoring study on gravel habitats located close to the Isle of Man following closure of the area to scallop dredging

showed that the recovery time for this habitat type was in the order of 10 years (Collie *et al.,* 2005; Bradshaw *et al.,* 2000). Recovery periods for muddy sands were also estimated to take years with studies discovering that this sediment type was particularly vulnerable to fishing activities (Kaiser *et al.,* 2006). Sandy habitats are quicker to recovery with recovery periods estimated at days to months (Kaiser *et al.,* 2006).

Recover of particular populations is known to be species specific (Roberts *et al.,* 2010). Long-lived bivalve species and other megafauna are found to take longer to recover from disturbance, especially for sessile species, as a result of slow growth (Roberts *et al.,* 2010). Macrofaunal species are seen to recover quicker and in particular, short-lived and small benthic organisms exhibit excellent recolonization abilities as a result of rapid generation times and high fecundities (Coen, 1995). For example, sponges and soft-corals are estimates to take up to 8 years to recolonise following disturbance whilst polychaetes take less than a year (Kaiser *et al.,* 2006).

A meta-analysis of 38 studies, investigation the recovery of invertebrate communities from intertidal harvesting showed that recovery of non-target species did not occur for more than 500 days following disturbance across all habitat types, with further reductions in abundance also occurring over this timescale (Clarke *et al.,* 2017). Recovery trends for the majority of gear-habitat interactions were shown to be unstable and highly variable. Recovery after hydraulic dredging in mud habitats showed relatively short-term impacts with respect to abundance, with reductions seen in the first 10 days following disturbance and then close to no effect after this (Clarke *et al.,* 2017). There was a difference in the recovery of different species following mechanical dredging in mud habitats with mollusc abundance supressed for more than 60 days post-fishing but annelid and crustacean species demonstrating near recovery over the same period (Clarke *et al.,* 2017). Time taken for partial recovery in sand habitats was observed after 400 days. Selected surveys on the recovery rate for biological and physical disturbance caused by shellfish dredging indicated that rates varied from no effect up to 12 months with intermediate recovery rates reported at 56 days and 7 months (Peterson *et al.,* 1987; Kaiser *et a.,* 1996; Hall and Harding, 1997; Spencer *et al.,* 1998; Ferns *et al.,* 2000).

6.2.2 Disturbance (Visual and Noise)

Generic pressure description

For visual disturbance, the pressure relates to the disturbance of biota by anthropogenic activities, e.g. increased vessel movements, such as during construction phases for new infrastructure (bridges, cranes, port building, offshore platforms, offshore wind farms etc.), increase personnel movements, increased tourism, moving wind turbine blades, increased vehicular movements onshore and offshore disturbing bird roosting areas, rafting areas, feeding areas, seal haul out areas etc.

For noise disturbance, the pressure relates to any loud noise made onshore or offshore by construction, vehicles (including aircraft), vessels, tourism, mining, blasting etc. that may disturb birds and reduce time spent in feeding or breeding areas.

Overview of potential impacts

Human disturbance to birds can be defined as 'any situation in which human activities cause a bird to behave differently from the behaviour it would exhibit without presence of that activity' (Wheeler *et al.,* 2014). The response by birds to disturbance can be influenced by a number of factors including proximity to the disturbance source, scale of the disturbance and the time of year (Stillman *et al.,* 2009). Disturbance resulting from many small-scale sources is thought to be more detrimental than fewer, large-scale sources (West *et al.,* 2002).

One of the main impacts of disturbance is displacement, where birds are unable to use an area due to the magnitude of the disturbance present (Natural England, 2014). Under certain circumstances the impacts of disturbance may be equivalent to habitat loss, although such effects are reversible (Madsen, 1995; Hill *et al*., 1997; Stillman *et al*., 2007; Natural England *et al*., 2012). The impacts of habitat loss through disturbance can include a reduction in the survival of displaced individuals and effects on the overall population size (Goss-Custard *et al*., 1995; Burton *et al*., 2006). Sites with high levels of anthropogenic activity are often characterised by lower densities of birds when compared with sites that have low levels (Burger, 1981; Klein *et al*., 1995). The movement of birds to alternate, and potentially less suitable, feeding areas as a result of disturbance can lead to increased shorebird density and thus interspecific competition; with alternate sites becoming depleted in food resources if used for prolonged periods of time (Goss-Custard et al., 2006; Wheeler *et al*., 2014). Disturbance can affect wintering bird populations in a number of ways including reduced food intake a result of enhanced vigilance (Riddington 1996; Goss-Custard *et al*. 2006; Klaassen *et al*. 2006) and physiological impacts such as stress (Thiel *et al*., 2011). Such impacts can affect the fitness of individuals and have knock-on effects at a population scale (Natural England, 2011). Furthermore, disturbance can cause birds to take flight which increases the demand for energy and reduces the opportunity for food intake. Both of these factors have potential consequences for survival and reproduction.

Birds have been noted to modify their behaviour in order to compensate for disturbance (Stillman *et al*., 2009). Some bird species may become habituated to particular disturbance events or types of disturbance (Walker *et al*., 2006, Nisbet, 2000, Baudains & Lloyd, 2007; Blumstein *et al*., 2003) and can do so over short periods of time (Rees *et al*., 2005; Stillman *et al*., 2009). The frequency of the disturbance will be a factor in determining the extent to which birds can become habituated and thus the distance at which they respond (Stillman *et al*., 2009). The behavioural response of a bird to disturbance is also dependent on the time of year (Stillman *et al*., 2009). Towards the end of winter, when migratory birds need to increase feeding rates to provide energy for migration, behavioural response to disturbance is less (Stillman *et al*., 2009). Under these circumstances, birds have been documented to approach a disturbance source more closely and return more quickly after a disturbance has taken place (Stillman *et al*., 2009). In the context of shellfish harvesting from a vessel, there is limited evidence on the potential effects for bird populations

through disturbance. It is thought that shellfish dredging has very little direct impact on disturbance of waders since it occurs at high tide (Sewell *et al*., 2007). Sewell *et al*. (2007) stated that 'We know of no evidence that dredging will have a direct impact in terms of disturbance on seabirds since most dredging occurs subtidally or at high-tide'. Wheeler *et al*. (2014) however stated, like other forms of disturbance, it could cause relocation and therefore increased energy expenditure of birds.

Examples of impacts

Disturbance to birds as a result of fishing activity has been assessed for a variety of species/gear interactions including both hand worked and vessel operated gear types. Results are mixed and highlight the number of factors including the species involved, the habitat/location and the fishing gear type in determining the level of impact seen.

In the mid-1980s, a study was carried out at the Lindisfarne National Nature Reserve where it was considered that localised and sustained disturbance from bait diggers was responsible for a significant decline in the numbers of Wigeon, Bar-tailed godwit and Redshank (Townsend and O'Connor, 1993). Further work in 1996/97 on human-induced disturbance to Black-tailed godwits across 20 sites on the east coast of England found no significant relationship between the number of birds and human activity across a range of spatial scales (Gill *et al.,* 2001). The presence of marinas and public footpaths adjacent to mudflats also showed no effect on the number of birds.

Durrell *et al.* (2005) used a behaviour-based model to investigate the potential effect of an extension to the port at Le Havre and proposed mitigation measures on the mortality and body condition of three overwintering bird species; curlew, dunlin and oystercatcher. There was a significant effect of disturbance to feeding birds with impacts to the mortality and body condition of all three species. Similar effects were demonstrated for roosting birds with increased energy costs as a result of an extra 10 minutes or more flying time each day (Durrell *et al.,* 2005). If the model was limited to just daytime, the effect of disturbance was removed for curlew and oystercatcher and a reduced disturbance effect was seen for dunlin, however this species still indicated a significant effect on mortality and body condition. Introducing a buffer zone of 150m from the seawall in to the model reduced the effects of disturbance and levels of mortality and body condition were similar to pre-disturbance levels.

Disturbance studies conducted in the Solent have reported disturbance levels of 30% during the winter of 1993/4 based on disturbance events observed during low tide counts. Sources of disturbance included dog walking, walking, bait digging and kite flying (Thompson, 1994). More recent work on the period between December 2009 and February 2010, which formed Phase II of the Solent Disturbance and Mitigation Project, found that 25% of observations of water-based recreational activities and 41% of observations of intertidal activities resulted in disturbance (Liley *et al.,* 2010). Activities found most likely to cause disturbance to birds were surfing, rowing and horse riding. Over half the incidences where major flight was observed involved activities on the intertidal, with dog walking accounting for 47% of major flight events (Liley *et al.,* 2010). Oystercatcher and Wigeon had the highest proportion of observations involving a disturbance response. Primary data collected by Liley *et al*. (2010) as part of this

study was used to predict if disturbance could reduce the survival of birds using computer models (Stillman *et al*., 2012). Dunlin, ringed plover, oystercatcher and curlew were predicted to be the species most vulnerable to disturbance due to a combination of disturbance distances (table 5), night-time feeding efficiency and vulnerability to food competition at high competitor densities (Stillman *et al*., 2012). Redshank, grey plover and black-tailed godwit typically had the shortest disturbance distances and were able to feed relatively effectively at night, meaning that these species were less affected by visitors (Stillman *et al*., 2012). Disturbance was predicted to result in an increase to the time spent feeding intertidally by dunlin, ringed plover, redshank and grey plover, with no effect on black-trailed godwit and a reduction in time spent by oystercatcher and curlew (Stillman *et al*., 2012). This was related to the ability of modelled birds to feed in terrestrial habitats, with those unable to do so spending longer feeding in intertidal habitats (Stillman *et al*., 2012).

Site-specific impacts

A study by Liley and Fearnley (2012) surveyed a total of 15 sites located within the vicinity of Poole Harbour between November and February, recording access levels, bird counts and bird response to disturbance, in addition to paired night and day counts at 13 of the sites. During the survey period there was 1981 potential disturbance events, generating a total of 3755 species-specific observations. Of the disturbance events recorded, 87% resulted in no visible change in behaviour or response and 12% resulted in some form of disturbance, with 6% of these involving birds undertaking major flight. Disturbance was found to have a significant effect on the number of waders and wildfowl present. Overall, 5.6 potential disturbance events were recorded per hour and responses occurred 1.7 times per hour, with birds flushed approximately once per hour. In December, the number of disturbance events resulting in a response, particularly birds being flushed, was markedly higher, with locations where birds were more frequently flushed including Arne and Studland. In areas with the highest levels of access, birds were found less likely to respond to a disturbance event. Dog walkers without a lead accounted for 40% of birds being flushed, followed by walkers (17%) and canoeists (17%).

A number of variables were found to influence the probability of major flight including distance and length of disturbance time, with a shorter disturbance more likely to result in major flight. Other factors included flock size, with a larger flock less likely to result in major flight, the presence of a dog, availability of alternate foraging or roosting sites, temperature and the bird species present. A higher probability of major flight was recorded for curlew, oystercatcher and shelduck. The highest proportion of flushing in response to a disturbance event was seen in the species red-breasted merganser and sanderling. Water-based activities, including canoeing, pump-scoop dredging, small sailing boats and kite surfing were more likely to cause disturbance, relative to other activities. These activity types made up a relatively small proportion of all recorded activities and it is worth noting the low sample sizes for water-based activities, with, for example, only 2 observations of pump-scoop dredging throughout the survey period. This is important as it distorts the likelihood of disturbance occurring, for example if major flight occurred for 1 out of 2 observations for pump-scoop dredging, disturbance would be considered to occur 50% of the time.

Species-specific disturbance response

Responsiveness to disturbance by birds is thought to be a species-specific trait (Yasué, 2005). Gathe and Hüppop (2004) developed a wind farm sensitivity index (WSI) for seabirds based on nine factors derived from species attributes, including; flight manoeuvrability, flight altitude, percentage of time flying, nocturnal flight activity, sensitivity towards disturbance by ship and helicopter traffic, flexibility in habitat use, biogeographical population size, adult survival rate and European threat and conservation status. Each factor was scored on a 5-point scale from 1 (low vulnerability of seabirds) to 5 (high vulnerability of seabirds). The WSI was used by King *et al*. (2009) to develop sensitivity scores for species likely to be susceptible to cumulative impacts of offshore wind farm development. Table 3 provides available sensitivity scores of species within Poole Harbour SPA, with details of scores given for the species vulnerability to disturbance by ship and helicopter traffic.

Table 5: Sensitivity scores for bird species designated under the Poole Harbour SPA taken from scores assigned in relation to offshore wind farm developments. Higher scores are indicative of a greater sensitivity. Information on species vulnerability to disturbance by ship or helicopter traffic is also provided. Scores were taken from King *et al*. 2009 who calculated scores using methods by Garthe & Hüppop (2004)

Species	Total sensitivity score	Disturbance by ship and helicopter traffic (1 – very flexible in habitat use to 5 – reliant on specific habitat characteristics)
Sandwich tern	25.0	2
Dark-bellied Brent goose	21.7	2
Red-breasted merganser	21.0	3
Goldeneye	15.8	3
Common tern	15.0	2
Black-tailed godwit	9.9	1
Black-headed gull	7.5	2
Redshank	6.7	1

Curlew	5.7	1
Shelduck	5.3	1
Teal	3.8	1
Dunlin	3.3	1

In considering disturbance response, there is great variation in the escape flight distances between species (Kirby *et al*., 2004). The distance at which birds fly away from a disturbance can be viewed as a species-specific trait (Blumstein *et al*., 2003), with response distances dependent on a number of factors, including; the time of year, tide, frequency, regularity and severity of disturbance, flock size and age of bird (WWT Consulting, 2012). Body mass has also been shown to be positively related to response distance (Liley *et al*., 2010). Table 6 provides details of the distance from a disturbance stimuli (m) at which bird species took flight, data is taken from seven different studies as outlined in Kirby *et al.* (2004). The data also indicates the activity causing the disturbance and the type of distance measured i.e. minimum versus mean distance.

Table 6: Distances from disturbance stimuli (m) at which studied bird species took flight. Taken from Kirby *et al*., 2004.

	Study						
	Tydeman 1978	Cooke 1980	Tensen and van Zoest	Watmough 1983a,b	Smit and Visser 1993	Smit and Visser 1993	Smit and Visser 1993
Activity	Boats	Researcher	People	Researcher	People	Kayaks	Surfers
Distance measure	Min	Mean	Mean	Mean	Mean	Mean	Mean
Brent goose					105		
Shelduck		126			148/250	220	400
Teal	400	86					
Pochard	60						

Goldeneye	100	168		280			
Dunlin		30			71/163		
Redshank		92	95			175	260

Mitigation

The negative effects of disturbance on the usage of a particular area important for birds are reversible (Natural England *et al*., 2012). Studies have shown that bird numbers increase when either the source of disturbance is removed or is mitigated (Natural England *et al*., 2012). Modelling overwintering oystercatchers in the Exe estuary showed that by preventing disturbance during late winter, when the ability to find food is harder and the energetic demands of a bird are higher, predicted consequences to a species' population can be largely eliminated (West *et al.,* 2002). The results of this study suggested that competent management authorities could successfully mitigate against adverse impacts by preventing disturbance during this key period (West *et al.,* 2002).

An understanding of the distance at which flight response is initiated is considered a good first step for management authorities to help minimise the adverse effects caused by disturbance (Wheeler *et al.,* 2014). The establishment of buffer areas to address this are possible but dependent on a number of factors including; population densities, food availability, the time of year and the behaviour of particular bird species (Wheeler *et al.,* 2014). In the study looking at the impacts of the port development at Le Havre, a buffer of 150m was seen to reduce adverse effects on the mortality and body condition of dunlin, curlew and oystercatcher back to pre-disturbance levels (Durrell *et al.,* 2005). The disturbance study in the Solent however indicated that there was no clear buffer distance that would be applicable to all species within a single site due to differences in the distance at which flight behaviour was initiated (Liley *et al.,* 2010). This has been echoed in other literature (Stillman *et al.,* 2009) where there can be variation between species as well as between individuals of the same species (Beale and Monaghan, 2004; Blumstein *et al.,* 2005). Other factors such as habitat type, flock size and temperature will also affect the ability of and the degree to which a bird responds to disturbance (Rees *et al.,* 2005; Stillman *et al.,* 2001). In addition, there are other adverse effects which may result from disturbance and it would need to be confirmed that a distance buffer would have benefits for a multitude of different potential consequences (Gill *et al.,* 1996; Gill *et al.,* 2001). The large variability in the distance at which flight response is initiated suggests that management bodies should be conservative in developing buffer zones although published distance information for specific species provides a good guideline (Blumstein *et al.,* 2003).

6.2.3 Collision ABOVE water with static or moving objects not naturally found in the marine environment (e.g. boats, machinery, and structures)

Generic pressure description

This pressure relates to the injury or mortality of biota from collisions with both static and/or moving structures. Examples include collisions with; rigs (e.g. birds), screens in intake pipes (e.g. fish at power stations), wind turbine blades (e.g. birds), tidal devices (e.g. fish and mammals) and shipping (e.g. fish and mammals). Activities increasing the number of vessels transiting areas, e.g. new port development or construction works will influence the scale and intensity of this pressure.

Overview of potential impacts

Most man-made structures have the potential to pose a collision risk for bird species (Blew *et al.,* 2008). Collisions have been recorded for lighthouses, electricity pylons, communication masts, plate glass windows, offshore marine research facilities and oil and gas rigs (Huppop *et al.,* 2006). However, collisions with vessels are rare. Most of the current research on this topic focuses around collision with wind farms (Exo *et al.,* 2003; Camphuysen *et al.,* 2004; Garthe and Huppop, 2004; Desholm *et al.,* 2006; Huppop *et al.,* 2006; Larsen and Guillemette, 2007; Blew *et al.,* 2008; Furness *et al.,* 2013; Brabant *et al.,* 2015). While this research can give an indication of potential impacts from collision, it should be noted that wind turbines introduce additional risk than that posed by fixed structures due to the moving element of the turbines introducing a collision risk to flight paths otherwise free from obstruction (Blew *et al.,* 2008).

Behavioural studies indicate that birds will avoid flying close to vertical structures (Blew *et al.,* 2008) and that likelihood of collision is related to a number of factors including weather conditions, time of day and species-specific traits such as flight altitude (Exo *et al.,* 2003; Camphuysen *et al.,* 2004). Collision risk is also seen to be more of a factor when structures, such as wind farms, are placed on migration routes (Huppop *et al.,* 2006). Avoidance has been seen to occur at three different levels; i) large-scale avoidance where birds become aware of large structures or multiple objects in a landscape traditionally without obstacles and evading action is taken at distances of >2000m. This is mostly during good migration conditions and good visibility, ii) medium to small scale avoidance where evading action is taken at 1000m to 150m mostly during good to medium visibility, avoidance action in this case may be vertical or horizontal and iii) last second avoidance which result from birds either not seeing the obstruction due to low visibility or being in a flight formation. This type of avoidance is thought to be rare and are more likely to occur during inclement weather (Blew *et al.,* 2008).

Examples of impacts

As outlined above, the majority of studies on collision with seabirds look at impacts caused by wind farms and the majority use modelling techniques or vulnerability assessments to determine risk and sensitivity of particular species. In a study of North Sea wind farms where potential effects were modelled using a collision risk model, the number of interactions for a particular bird species depended on the species concerned and the distance of the wind farm from the shore with fewer interactions the further offshore the farm (Brabant *et al.,* 2015). It was noted that there is the potential for site-specific avoidance effects resulting from the wind farm having been in place for a time before the study was carried out. Further work in the North Sea found that over 50% of the collisions recorded at a wind farm occurred over the period of two nights characterized by inclement weather and very poor visibility (Huppop *et al.,* 2006). It is thought that, in areas where there are limited if any resting places, installations attract sea birds, particularly at night (Huppop *et al.,* 2006; Huppop *et al.,* 2016). For this study, it was postulated that the illumination from the wind farm in the inclement conditions at night attracted the birds but that the poor visibility prevented appropriate avoidance of the turbines (Huppop *et al.,* 2006). This was also seen in a study of an offshore platform in the North Sea where light was seen to be a dominant factor in attracting birds to the installation thus increasing the risk of collision (Huppop *et al.,* 2016). A reduction the number of lights as well as reducing the use of light intensity and steady burning lights was seen to be a way forward in trying to reduce the number of collisions (Huppop *et al.,* 2016). Night-time activity was seen to pose the biggest risk, linked to the presence of artificial light, with areas in migratory routes and at frequent risk of fog and drizzle increasing the risk further (Huppop *et al.,* 2016).

A study specifically on the common eider at a Danish wind farm found that the birds largely avoided offshore wind parks, postulating that their reluctance to approach human-made structures likely influences this behaviour (Larsen and Guillemette, 2007). This species has also been observed to alter flight altitude to avoid ships, wind turbines and peninsulas and that, with regard to wind parks, collision was more likely to occur with the structure than the wind turbine due to flying height (Larsen and Guilemette, 2007). A study by Furness *et al.* (2013) ranked bird species according to their vulnerability to offshore wind farms in the context of collision risk, and found that primarily gull species (herring, great black-backed, lesser black-backed), white-tailed eagle and northern ganet were most vulnerable. Several of the species for which Poole Harbour is protected were also studied but all fell outside the top 10 for vulnerability (Furness *et al.,* 2013). The study did note that analyses such as this, where species traits are used to define vulnerability, should be treated with caution as many of the relative avoidance responses of individual bird species are not yet well known.

6.2.4 Introduction of microbial pathogens and Introduction of Invasive Non-Indigenous Species

Generic pressure description

For the introduction of microbial pathogens, the pressure relates to the untreated or insufficiently treated effluent discharges and run-off from terrestrial and offshore sources and vessels. It may also be a consequence of ballast water releases. In aquaculture where seed stocks are imported, 'infected' seed could be introduced, or microbial pathogens could be introduced from accidental releases of effluvia. Escapees, e.g. farmed salmon, could be infected and spread pathogens to the indigenous populations. Aquaculture may release contaminated faecal matter, from which pathogens could enter the food chain.

For introduction of Invasive Non-Indigenous Species (INIS), the pressure refers to the direct or indirect introduction of non-indigenous species e.g. Chinese mitten crabs, slipper limpets, Pacific oyster and their subsequent spreading and out-competing of native species. Ballast water, hull fouling, stepping stone effects (e.g. offshore wind farms) may facilitate the spread of such species. This pressure could be associated with aquaculture, mussel or shellfishery activities due to imported seed stock or from accidental releases. Introduction of predators such as mink, weasels, rats, hedgehogs and domestic cats can result in predation of nesting birds.

Overview of potential impacts

Introduction of Non-Indigenous Species (INIS) as a result of aquaculture can occur in two ways; either by INIS being intentionally introduced for the purposes of aquaculture (i.e. Pacific oyster and historically, the Manila clam) or being accidentally introduced with aquaculture species (i.e. with seed or in batches of adult stock). Intentional introductions are normally due to the species providing economic benefit, fast growth and adaptation to a wide ecological niche (Cook *et al.,* 2008), factors which often outweigh the potential ecological risk (Gozlan, 2010). Intentional introductions are usually subject to some form of testing prior to introduction to reduce the risk of environmental impacts but this does not always eliminate the risk entirely. The biggest risk comes from the accidental introduction of INIS to the marine environment. This can be through spill-over, escape or accidents in operation when farming INIS (Cook *et al.,* 2008). This is seen to be common for farmed Atlantic salmon with up to 2 million escaping each year into the North Atlantic Ocean and mass escapes of Pacific white shrimp have also been noted in the United States and Thailand (Cook *et al.,* 2008). Accidental introduction can also occur with species being introduced with seed or animal imports.

Introductions, by whatever method can affect species diversity, cause habitat modification, change ecosystem functioning, outcompete native flora and fauna, transfer disease and result in hybridisation with native species (Cook *et al.,* 2008). Non-indigenous aquatic species are seen as one of the top four anthropogenic threats to the world's oceans (Gollasch, 2006) and the second most important reason for biodiversity loss worldwide

(Collins *et al.,* 2019). Changes to ecosystems and the response of native communities is complex and can be positive, negative or insignificant depending on the species involved, the location, the type of habitat and the scale of the introduction (Cook *et al.,* 2008). Although there can be biodiversity loss as a result of INIS, there can also be a net increase in diversity at the ecosystem level and benefits to ecosystem function (Stachowicz and Tilman, 2005). Other benefits can come through increased sources for fishing (Gollasch, 2006) or in creating a new food source i.e. the Manila clam in Poole Harbour reducing the mortality of oystercatcher (Caldow *et al.,* 2007).

Effects on native species are seen as a big risk to native ecosystems. Competition between introduced and native species has been documented to occur to differing degrees with this posing more of a risk with aquatic plant species or invertebrates that attached to a substrate (Hill, 2008). Competition for spawning sites has been documented for non-native tilapia and carp where the spawning process of native fish is disrupted (Hill, 2008). Predation may also occur where non-native species predate on native species, this is most noticeable when a novel predator is introduced which is larger and more efficient for example the flathead catfish in US river systems which has reduce the abundance of redbreast sunfish *Lepomis auratus* and bullhead catfish *Ameiurus* spp. due to its large size (Hill, 2008). Other impacts involve changes to habitat which can affect community structure and water quality (Hill, 2008). The introduction of grass carp *Ctenopharyngodon Idella* changed the diversity of plant communities through its feeding preferences, thus reducing water clarity and ultimately changing the abundance and size of fish and invertebrate species (Hill, 2008). Extinction of native species is often attributed to the presence of non-native species however there are other environmental factors which are also likely to play a role in the distribution of different species such as habitat loss, changes in land use, eutrophication, over harvesting (Cook *et al.,* 2008). Of the 762 species globally document to have become extinct as a result of human activities in the past few hundred years (up to 2008), less than 2% is attributed to non-native species (Gurevitch and Padilla, 2004). Species in the marine environment are considered to be at lower risk of extinction due to larger more continuous habitats and the life history characteristics of many species including extensive dispersal potential increasing the ability for recolonization (Gurevitch and Padilla, 2004). However, where populations are declining for other reasons and exploitation of marine species has increased in the recent past, native species may be more susceptible to INIS introductions.

Movements of stock in to aquaculture areas have the potential to introduce pests, parasites and diseases (Gozlan *et al.,* 2006; Cook *et al.,* 2008). Diseases can also be introduced via species causing biofouling on the hulls of ships and by being carried in the water and sediments in ballast tanks (Cook *et al.,* 2008; Crego-Prieto *et al.,* 2015) as well as by natural means (Elston and Ford, 2011). There are mixed views on the ability of shellfish to introduce disease as a result of aquaculture. Transport of bivalves as juveniles, to be grown, on has been stated to be responsible for the spread of infectious shellfish diseases but this is not always well documented (Elston and Ford, 2011). In some cases, it is clear that the shellfish has been the vector for the disease i.e. the spread of *Bonamia ostreae* in Europe via oyster shipments from the US West Coast, however in others it is less clear cut i.e. the introduction of Pacific oysters to the US East Coast was blamed for introducing *Haplosporidium nelsoni* yet imports occurred in regions where the disease was not found and/or well before or after outbreaks (Elston and Ford, 2011). The ability of a disease introduced by aquaculture to infiltrate local populations is related to the discrepancy between potential high prevalence of infection in farmed

animals when compared to lower or absent prevalence in wild populations (Gozlan *et al.,* 2006). If a disease becomes established in aquaculture stock then high stocking densities are a strong factor in that pathogen spreading within the stock (Gozlan *et al.,* 2006).

Examples of impacts

Whether accidental or intentional, the introduction of non-indigenous species has shown mixed impacts on the local marine ecology. Where species have been introduced for aquaculture such as *A. melas*, *Procambarus clarkia* or *P. parva* there have been documented ecological impacts on native fauna via disease introduction and direct competition with native species with no associated ecosystem benefits (Gozlan, 2010). The intentional introduction of the Pacific oyster (*Crassostrea edulis*) to the Pacific north west (USA) resulted in the unintentional introduction of the invasive smooth cordgrass *Spartina alterniflora* as packing material for the transplanted oysters (Feist and Simenstad, 2000). *S. alterniflora* can re-engineer a habitat by providing biogenic structures that allow for fish, invertebrate and macroalgal recruitment and sediment accumulation (Ruesink *et al.,* 2006). Habitat modification was also caused in South African waters following the accidental introduction of the Mediterranean mussel *Mytilus galloprovincialis* (Robinson *et al.,* 2005). The species became the dominant intertidal mussel and modified the natural community composition by dominating rock surfaces. In addition, the faster growth, greater tolerance to desiccation and higher fecundity led to it being more dominant than the native mussel species (Robinson *et al.,* 2005).

Predation from an introduced species has been demonstrated in the green crab *Carcinus maenas* when it was introduced to North America in association with aquaculture species. The predatory preference for bivalves has led to suggestions that it is responsible for the decline in softshell clam populations and has also been seen to feed on mussel lines and in scallop cages (McKindsey *et al.,* 2007).

Bivalve species are used heavily for aquaculture and have been grown and transported for this purpose for hundreds of years. The introduction of oyster species including *Crassostrea gigas* and *Crassostrea virginica* have been suggested as one of the greatest single modes of introduction for other INIS species around the world and are well suited to establishing wild populations (McKindsey *et al.,* 2007). In the Netherlands and the German Wadden Sea, *C. gigas* introduced for aquaculture has formed natural, self-sustaining populations which have caused issues for mussel culture and conservation (McKindsey *et al.,* 2007). However, the introduction of *C. gigas* has also been documented to have benefits to local ecosystems. The presence of *C. gigas* on the intertidal was seen in increase the abundance of infauna and epifauna as well as bird species relative to a control site (Escapa *et al.,* 2004). Also, a study in Washington State showed that diversity and abundance of benthic organisms in mud flats were increased by the presence of *C. gigas* and on rocky shores in British Columbia, *C. gigas*, occupying the high intertidal zone, increased the surface area for barnacle species (Ruesink *et al.,* 2005). The slipper limpet *Crepidula fornicata* is another introduced species in Europe, believed to have arrived with imports of the oyster *Crassostrea virginica*. It is now widely spread across Europe, including the UK, and is considered a pest,

changing the topography of the seabed, affecting commercial beds of oyster species and competing with other species for suspended food (Blanchard, 1997; Padilla *et al.,* 2011).

With regard to disease, the introduction of the trematode *Gyrodactylus salaris* with the Atlantic salmon into Norway led to serious salmon mortalities (Cook *et al.,* 2008). Importation of Japanese eels *Anguilla japonica* for cultivation trials in Europe also resulted in the release of a nematode that cause significant internal damage in other eel species including the native freshwater eel *Anguilla Anguilla* (Peeler *et al.,* 2011). The nematode then became dispersed by copepods and other hosts, becoming widely dispersed in Europe resulting in unknown implications for the population of the North Atlantic eel (Cook *et al.,* 2008). There are a number of examples from freshwater aquaculture which accounts for 80% of the aquatic species introductions (Gozlan *et al.,* 2006). The introduction of the topmouth gudgeon *Pseudorasbora parva* into an English fish farm carried with it an intracellular eukaryotic parasite. The escape of these farmed fish into the connected river system has introduced the potential for this pathogen to reach native fish populations. The crayfish plague also occurred as a result of aquaculture with imports of North American signal crayfish, which are resistant to the disease, introducing the oomycete fungus *Aphanomyces astaci* (Gozlan *et al.,* 2006). Native European crayfish species are highly susceptible to the pathogen which has led to eradication of populations in certain areas (Gozlan *et al.* 2006). Shellfish diseases have also been demonstrated to be spread by movement of animals. A paramyxean parasite, *Marteilia refringens* has been documented to cause mass mortalities in the European native oyster *Ostrea edulis* where movements of shellfish appear to have spread the disease between France, Spain and the Netherlands. Bonamiasis, caused by the haplosporean parasite *Bonamia ostreae* was also introduced to Europe via introduction of infected *Ostrea edulis* from North America. First mapped in France, it has spread across Europe including the UK and is regarded as a major threat to oyster stocks (Gozlan *et al.,* 2006).

6.2.5 Genetic modification & translocation of indigenous species

Generic pressure description

Genetic modification can be either deliberate (e.g. introduction of farmed individuals to the wild, GM food production) or a by-product of other activities (e.g. mutations associated with radionuclide contamination). The former is related to escapees or deliberate releases e.g. cultivated species such as farmed salmon, oysters and scallops if GM practices are employed. The scale of the pressure is compounded if GM species are ‘captured’ and translocated in ballast water. Mutated organisms as by-products could be transferred on ships hulls or in ballast water, with imports for aquaculture, aquaria and live bait, with species traded as live seafood or as part of ‘natural’ migration.

Overview of potential impacts

There is an increasing practice of selecting and modifying species for aquaculture to improve performance (Cook *et al.,* 2008). It is often seen as a method of aquaculture businesses being able to compete. Genetic modification in aquaculture results in the genetic variation residing at the population level rather than below the family level which is where variation in natural populations is found (Cook *et al.,* 2008). This can result in genetic complexes as a function of the environment in which the modified population has developed causing spatial, behavioural or temporal isolating mechanisms (Cook *et al.,* 2008). Select genetic modification results in the magnification of such genetic complexes within a species' population. Hybridization, introducing foreign DNA/genes into local populations as a result of breeding between native and genetically modified species is known as introgression (Crego-Prieto *et al.,* 2015). Modified animals breeding with natural populations and resulting hybridisation can result in the breakdown of these genetic complexes reducing fitness in the hybrid individuals (Skaala *et al.,* 2006). This can increase the risk of extinction in the hybridised natural population. This is seen to occur more for rare native species with some species showing hybridization with no negative effects. However, the extent of genomic introgression will depend on the degree of domestication of cultivated stocks and the quality and abundance of native populations (Crego-Prieto *et al.,* 2015). There is the potential for introgression to result in a loss of biodiversity and changes in the adaptation of native species to their local environment (Manchester and Bullock, 2000). The long-term effects of introgression are not well known and the modification of the gene pool of native species may cause unpredictable effects over longer time scales (Crego-Prieto *et al.,* 2015).

Examples of impacts

The driver for genetic modification is almost always improvements in performance of farmed species. Examples include Coho salmon *Oncorhynchus kisutch* introduced with growth hormones from Chinook salmon *Oncorhynchus tshawytscha* that then showed faster growth and hybridization between the Yesso scallop *Patinopecten yessoensis* and a local species *Chlamys farreri* improving growth performance (Cook *et al.,* 2008).

The occurrence of hybridisation has also been studied and the effects documented. In Spain, where farmed brown trout with a different genetic strain have bred with native brown trout the lower spawning success of cultured fish has entered into native populations with 25% of native populations showing genes of hatchery origin (Cook *et al.,* 2008). Trout species in the US also showed similar patterns where rainbow trout *Oncorhynchus mykiss* introduced into waters containing cutthroat trout *Oncorhynchus clarkia* passed genes from the introduced into the native fish, swamping rare stocks with new genetic material resulting in extinction of the original species (Hill, 2008). An assessment of mussel (*Mytilus*) populations on rocky shores on Vancouver Island showed a significant association between mussel farms and introduction of non-native species with between 0.6 and 8.7% of individuals carry genes from the non-native population, the 8.7% being in areas with more mussel farming (Crego-Prieto *et al.,* 2015). The study noted that the spread of non-natives and as such hybridization effects are strongly affected by currents with areas

that have no nearby farms still showing some non-native species (Crego-Prieto *et al.,* 2015). Because this is a relatively new practice, the overall impacts on native populations are not well studied and although there are a number of studies demonstrating that genetic transfer and hybridization can occur, the long-term effects are not yet known.

6.2.6 Abrasion/disturbance of the substrate on the surface of the seabed and penetration and/or disturbance of the substratum below the surface of the seabed; including abrasion

Generic pressure description

Physical disturbance or abrasion at the surface of the substratum in sedimentary or rocky habitats. The effects are relevant to epifloral and epifauna living on the surface of the substratum. In intertidal and sublittoral fringe habitats, surface abrasion is likely to result from recreational access and trampling (inc. climbing) by human or livestock, vehicular access, moorings (ropes, chains), activities that increase scour and grounding of vessels (deliberate or accidental). In the sublittoral, surface abrasion is likely to result from pots or creels, cables and chains associated with fixed gears and moorings, anchoring of recreational vessels, objects placed on the seabed such as the legs of jack-up barges, and harvesting of seaweeds (e.g. kelps) or other intertidal species (trampling) or of epifaunal species (e.g. oysters). In sublittoral habitats, passing bottom gear (e.g. rock hopper gear) may also cause surface abrasion to epifaunal and epifloral communities including epifaunal biogenic reef communities. Acivities associated with surface abrasion can cover relatively large spatial areas e.g. bottom trawls or bio-prospecting or be relatively localised activities e.g. seasweed harvesting, recreation, potting and aquaculture.

Overview of potential impacts

The use of mechanical and hydraulic dredges can cause physical damage to the sediment. This can be through a number of mechanisms including increased suspended sediment, increased turbidity, creation of sediment plumes, changes in sediment composition and alterations to seabed topography (Mercaldo-Allen and Goldberg, 2011; Natural England, 2014; Wheeler *et al.,* 2014). Changes in suspended solids, smothering and siltation are discussed in section 6.2.7.

Resulting impacts to the sediment can be in a change to the layering structure and corresponding grain size fractions as well as release of contaminants from underlying sediment layers (Jones, 1992; Kaiser *et al.,* 2003; Contessa and Bird, 2004; Roberts *et al.,* 2010; Cooper *et al.,* 2011). Changes to these aspects of the sediment can result in a change to the benthic community and the ability of certain organisms to colonise in a specific area (Weiser, 1959; Ozolin'sh, 2000). Impacts resulting from anthropogenic activities are most evidence where the disturbance causes

changes to the sediment which are elevated above normal background changes resulting from biotic and abiotic factors i.e. changes caused by benthic organisms through burrow formation and the deposition of faecal material (Probert, 1984). The creation of depressions can result in an accumulation of suspended sediment leading to greater proportions of fine-grained sediment fractions. This has been noted for bait pumping and digging where depressions persist after the activity has taken place (McClusky *et al.,*1983; Wynberg and Branch, 1994; Contessa and Bird, 2004).The scale over which changes can be seen, and therefore the overall impact on the associated community varies with, in some cases, the differences to the sediment being noticeable over small spatial scales i.e. between the centre and the top edge of a depression (Birchenough, 2015). It has been shown that changes to habitat structure in the immediate vicinity of certain macrofauna species (within 30cm2) was not closely related to changes in species diversity (Thrush *et al.,* 2001). In addition, communities within intertidal habitats will often exhibit a greater resilience to disturbance due to long-term adaptations as a result of higher levels of natural disturbance and a greater range of anthropogenic inputs (Dernie *et al.,* 2003).

Examples of impacts

One of the main potential impacts to the sediment from dredge activity is the creation of trenches and depressions in areas of mud or the smoothing of ripples and creation of ridges in sandier sediments (Wheeler *et al.,* 2014). The depth of penetration and the width of the resulting depression is largely determined by the type of fishing gear and how it is set up (i.e. tooth length), fishing practice (frequency, method of deployment and towing speed) and the target species (Mercaldo-Allen and Goldberg, 2011; Wheeler *et al.,* 2014). Mobile gears can penetrate from 5-30cm into the sediment with normal fishing practice (Johnson, 2002) with dredges documented to disturb the top 2-6cm (Thrush and Dayton, 2002). Specific studies on intertidal shellfish dredging found resulting furrows up to tens of centimetres deep (Kaiser *et al.,* 2006), while studies of the effects of clam dredging in Langstone Harbour, UK, based on the use of a modified oyster dredge, found a clear disturbance of muddy gravel sediment down to a depth of 15-20cm (EMU, 1992). A study in southern Portugal showed that the passage of a clam dredge produced a depression 30cm wide and 10cm deep (Constantino *et al.,* 2009) and trawling has been shown to leave tracks of 1-8cm in depth in mixed sediment habitats (Freese *et al.,* 1999; Roberts *et al.,* 2010). These depressions and tracks may persist for days (Gasper *et al.,* 2003), weeks (Manning and Dunnington, 1955; Mercaldo-Allen and Goldberg, 2011) or months (Wheeler *et al.,* 2014). The degree to which tracks persist may be dependent on the depth to which the gear has penetrated the sediment. The Portugal based study of impacts caused by clam dredging indicated that tracks at a depth of 6cm were no longer distinguishable after 24 hours but at a depth of 18cm remained visible for 13 days (Constantino *et al.,* 2009).

Studies on the impacts to the sediment composition have shown mixed results. Experimental clam dredging in Langstone Harbour using a modified oyster dredge led to the removal of the coarse grained, larger sand fractions with minor differences in the silt component (EMU, 1992). However, a study on the impacts of cockle suction dredging in the Dutch Wadden Sea showed a loss of fine silts and increase in the median grain size

(Piersma *et al.,* 2001). It was postulated that the loss of adult shellfish as a result of the fishing practice may have resulted in a reduction in the production of faeces and pseudo-faeces which contribute to the fine-grained sediment fraction (Piersma *et al.,* 2001).

Parker and Pin (2005) assessed the effects of pump-scoop dredging for cockles in Poole Harbour and found that tracks were visible on the sediment at low tide. The time over which these marks disappeared was not assessed but it was postulated that they may only persist for a short time based on evidence from other surveys which showed no detectable effect on the sediment from suction dredging after 40 days (Hall and Harding, 1997) and in the Solway Firth, trenches from tractor dredges disappearing after one day (Hall and Harding, 1997). Scar marks from pump-scoop dredging were also detected in Poole Harbour using aerial photographs (Clarke *et al.,* 2018; Clarke *et al.,* 2019) but no assessment was made of the time taken for these marks to disappear. Studies of the impacts on the macrobenthos have also been studied for pump-scoop dredging in Poole Harbour where an increase in colonisation by opportunistic species was found following disturbance and a decline in smaller mollusc species (Clarke *et al.,* 2018). The study documented no impact on the organic content of the sediment but did note reduction in fine sediments in a heavily dredged site however there was no large-scale shift in the overall biotope or habitat quality (Clarke *et al.,* 2018).

Clarke *et al.,* (2018b) undertook a similar study to assess the impacts of mechanical shellfish dredging using a box dredge and a ladder dredge on the sediment characteristics of Langstone Harbour in areas subject to three different management regimes for bottom towed fishing gear. Samples taken from areas seasonally open to shellfish dredging, recently closed permanently to shellfish dredging and areas historically closed to bottom towed fishing gear (since January 2014) showed an increase in organic content and volume of fine grained sediment in the control samples throughout the study period but no significant difference between the control and dredged sites.

6.2.7 Changes in suspended solids (water quality) and Smothering and siltation rate changes (light)

Generic pressure description

Changes in suspended solids (water quality) relates to changes in water clarity from changes in sediment and organic particulate matter concentrations. It is related to activities disturbing the sediment and/or organic particulate mater thereby mobilising it into the water column. Anthropogenic activities such as all forms of dredging, disposal at sea, cable and pipeline burial, secondary effects of construction work e.g. breakwaters all affect water clarity. Particle size, hydrological energy (current speed and direction) and tidal excursion are all influencing factors on the spatial extent and temporal duration. This pressure also relates to changes in turbidity from suspended solids of organic origin. Salinity, turbulence, pH and temperature may result in flocculation of suspended organic matter. Anthropogenic sources are mostly short lived and occur over relatively small special extents but could affect species that rely on underwater vision for hunting.

For smothering and siltation rate changes (light) refers to when the natural rates of siltation are altered (increased or decreased). Siltation (or sedimentation) is the settling out of silt/sediments suspended in the water column. Activities associated with this pressure type include mariculture, land claim, navigation dredging, disposal at sea, marine mineral extraction, cable and pipeline laying and various construction activities. It can result in short lived sediment concentration gradients and the accumulation of sediments on the sea floor. This accumulation of sediments is synonymous with 'light' smothering, with relates to the depth of vertical overburden. 'Light' smothering relates to the deposition of layers of sediment on the seabed. It is associated with activities such as sea disposal of dredged material where sediments are deliberately deposited on the sea bed. For 'light' smothering most benthic biota may be able to adapt i.e. vertically migrate through the deposited sediment.

Overview of potential impacts

Resuspension of sediment can impact benthic communities through smothering, burial and increased turbidity. Depending on the scale and spatial extent of the activity, effects may extend to organisms living a distance away from the fished area (Kyte and Chew, 1975; Vining, 1978). The severity of impacts may increase with increased levels of sediment being resuspended and regular exposure to such events (Mercaldo-Allen and Goldberg, 2011). Increased water turbidity can inhibit respiratory and feeding functions as well as burrowing capacity for benthic organisms and clog the gills of fish (Dorsey and Penderson, 1998; Johnson *et al.,* 2002). Smothering on the sea floor can also result in the creation of hypoxic or anoxic conditions in the sediment (Morgan and Chuenpagdee, 2003). Small and immobile species are most vulnerable to smothering (Manning, 1957) and the redistribution/increase in the deposition of finer grained sediment can hinder the settlement of certain organisms that cannot access shell or cultch materials (Tarnowski, 2006). The severity of impacts from these pressures is largely determined by the sediment type, the level of sediment burden and the tolerance of organisms (largely related to their biology i.e. mobility, relationship to substrate, life history) (Coen, 1995). Shallow water environments with sediments that have a high silt and clay content are thought to be more likely to experience larger plumes and therefore greater turbidity (Ruffin 1995; Tarnowski, 2006).

Examples of impacts

Studies conducted in England and in Florida found that the redistribution of sediments caused by dredging activity did not result in the smothering of benthic organisms within the nearby area, with any impacts limited to the directly disturbed area of the dredge (Schroeder, 1924; Spencer *et al.,* 1998). Estuarine ecosystems, where small-scale dredging often takes place, are high variable environments with elevated and variable suspended sediment loads and organisms which are therefore well adapted to such conditions (Coen, 1995). Organisms commonly associated with estuarine environments are therefore generally considered to be tolerant to short-term perturbations in sediment loads (Lutz, 1938; Kyte *et al.,* 1975). Experiments under laboratory conditions have shown that the majority of estuarine infaunal species are able to survive burial depths of up to 20cm

or more, however epifaunal and non-mobile species were seen to suffer high mortality rates after burial (Coen, 1995). Seagrass beds are also at risk of burial by suspended sediments, a study on the species *Zostera noltii* showed 50% shoot mortality after burial with 2cm of sediment and 100% mortality at 8cm (Cabaco *et al.,* 2008). The occurrence and growth of the seagrass species *Zostera marina* was also found to be highly dependent on the transparency of the water column (Giesen *et al.,* 1990) with a clear relationship between transparency and the maximum depth at which sublittoral strands of *Z. marina* were found (de Jonge and de Jong, 1992).

Visual predators also rely on light in order to find, recognize and capture prey (Karel, 1999). The degree to which visual predators will be affected by increased turbidity is related to the tolerances of the predator as well as the characteristics of the prey (i.e. size, enhanced ability to escape in turbid waters) (Karel, 1999). For fish species, herring and sprat were noted to avoid turbid waters while dab was seen to decline in the Dutch Wadden Sea after 1960, replaced by young plaice, a changed seen to be related to an increase in turbidity in the western part of the Sea (de Jonge *et al.,* 1993). Common tern and Sandwich tern are also visual feeders, commonly targeting young herring, sprat and sand-eel, and are directly affected by the turbidity of the water column. The increase in the turbidity of the water in the Dutch coastal zone since the 1960s was considered a possible cause of the reduction in breeding success of Sandwich terns in the Wadden Sea area with the decline attributed to the birds having to fly a greater distance in order to find clear water and obtain prey (Karel, 1999).

Particle tracking models have been used to determine the effect of towing dredges on suspended sediments and smothering (Dale *et al.,* 2011). For a vessel towing 8 dredges each side in a water current of 0.1m per second, the model suggested that the majority of all sediment size classes suspended in the water column settled within 100m of the dredge (Dale *et al.,* 2011). For sand and large particles, all but 3.6% of the particles settled within 10m of the dredge however for the silt fraction, 92.5% was seen to persist in the water column 100m away from the dredge site (Dale *et al.,* 2011). The total sediment accumulation immediately outside the dredging areas was documented at 1.6mm and, after 1 hour, only 8.2% of the suspended silt remained in suspension, 315m from the dredge site. These figures are comparable to low suspended sediment levels found naturally (Dale *et al.,* 2011). It was documented that if suspended sediment from multiple fishing vessels coincided, it would take more than 15 tows for silt concentrations to match low natural levels and more than 200 tows for levels to equal those seen during storm conditions (Dale *et al.,* 2011). The model was assessing impacts on adjacent reef features and determined that the reefs were only at risk if they were within 10m of the dredge site and that those at a distance further than this would not be significantly affected beyond natural levels.

Additional studies have found similar results, with sediment plumes documented up to 30m beyond the dredge site in some cases (Manning, 1957; Haven, 1979; Manzi *et al.,* 1985; Maier *et al.,* 1998). In most cases however, the suspended sediment rapidly returns to low levels with the rate of return increasing with distance from the dredge activity (Kyte *et al.,* 1976; Maier *et al.,* 1998) with one study showing 98% resettling within 15m (Mercaldo-Allen and Goldberg, 2011). The effects caused by sediment plumes and enhanced turbidity levels appear to be temporary, with the majority of sediment plumes disappearing within 30 minutes to 24 hours of dredging taking place (Lambert and Goudreau, 1996; Maier *et al.,* 1998).

It is thought that the resuspension of sediment caused by clam dredging in comparison to long-term wild-induced suspension of sediments may be relatively minor (Auster and Langton, 1999). Natural levels of turbidity, generated by wind and tide action, has been shown to produce particle loads equal to or exceeding those caused by dredging disturbance (Tamowski, 2006). Organisms living in inshore environments are therefore more adapted to tolerating the resuspension of sediment to a certain level (Tarnowski, 2006). The limitation of shellfish dredging to discrete areas also results in the effects of resuspension occurring over a much smaller spatial scale than those caused by natural disturbance (Wilber and Clarke, 2001).

6.2.8 Physical change (to another sediment type)

Generic pressure description

The permanent change of one marine habitat type to another marine habitat type, through the change in substratum, including to artificial (e.g. concrete). This therefore involves the permanent loss of one marine habitat type but has equal creation of a different marine habitat type. Associated activities include the installation of infrastructure (e.g. surface of platforms or wind farm foundations, marinas, coastal defences, pipelines and cables), the placement of scour protection where soft sediment habitats are replaced by hard/coast substratum habitats, removal of coarse substrata (marine mineral extraction) in those instances where surficial finer sediments are lost, capital dredging where the residual sedimentary habitat differs structurally from the pre-dredge state, creation of artificial reefs, mariculture i.e. mussel beds. Protection of pipes and cables using rock dumping and mattressing techniques. Placement of cuttings piles from oil and gas activities could fit this pressure type, however there may be additional pressures e.g. pollution and other changes. This pressure excludes navigation dredging where the depth of sediment is changed locally but the sediment typology is not changed.

Overview of potential impacts

The physical change of one marine habitat type to another encompasses a wide range of habitats including saltmarsh, seagrass and intertidal sediments. Previous advice from Natural England has indicated that erosion of saltmarsh may take place where shellfish dredging occurs in close proximity to the habitat. A study by Dyrynda (1995) referenced in Liley *et al.* (2012) also indicates the ability for bottom towed fishing gear, in this case bait dragging, to cause changes to certain habitats and communities involving rooted species such as saltmarsh, seagrass and beds of the peacock worm *Sabella pavonina*. However, the study notes that these areas are not usually suitable for this particular gear type and are actively avoided by fishers resulting in no impact. It is recognised that bottom towed fishing gear is unlikely to occur over saltmarsh habitats and this is

further supported by a lack of literature on this subject. With regard to intertidal sediments, impacts and changes to sediment type i.e. change in the dominant grain size fraction, organic matter content etc. the resultant change arises as a result of direct impacts to the sediment from pressures such as abrasion, penetration and siltation. The potential for these pressures is explored in sections 6.2.6 and 6.2.7.

6.3 Site Condition

Natural England provides information on the condition of designated sites and describes the status of interest features.

Under the Habitats Directive, relevant for Special Areas of Conservation (SACs) and Sites of Community Importance (SCIs), the United Kingdom is obliged to report on the Favourable Conservation Status of Annex I and Annex II features every 6 years. There are similar reporting requirements under the Birds Directive, relevant for Special Protection Areas (SPAs). Feature condition influences the Conservation Objectives in that it is used to determine whether a 'maintain' or 'recover' objective is needed to achieve the target level for each attribute.

During 2015-16 Natural England reviewed, refined and tested condition assessment methodology to provide more robust results. Natural England aimed to employ this methodology to start a rolling programme of marine feature condition assessments in 2017-18, conducted by their Area Teams. The condition assessment currently available for Poole Harbour SPA is comprised of an analysis of data collected by the British Trust for Ornithology (BTO) and the condition assessment of Poole Harbour SSSI which was compiled in 2010, with a few of the units having been re assessment in 2018.

6.3.1 Poole Harbour SSSI Condition Assessment

An indication of the condition of site interest features can be inferred, if available, from assessments of SSSIs[10] that underpin the SPA. The Poole Harbour SSSI was extended in 2018 to include four new areas, the largest of which being open water and channels below mean low water. The relevant feature condition assessments for units under the Poole Harbour SSSI are summarised in table 7.

[10] SSSI Condition assessments: http://designatedsites.naturalengland.org.uk/.

Table 7: Relevant feature condition assessments for units under the Poole Harbour SSSI

Unit Number	Unit Name	Habitat	Condition	Condition Risk Threat	Comments
001	Sandbanks	Littoral Rock	Favourable	High	Intertidal sediment feature: thin strip of largely degraded shoreline with hard sea defence and numerous jetties and slipways. Condition not changed since notification and no scope for improvement through management. Parts of the shoreline important for feeding birds when unit 002, Whitley Lake, disturbed by recreational users. Estuarine feature: No significant algal mat cover in 2005 so no further samples.
002	Whitley Lake	Littoral Sediment	Favourable	High	Saltmarsh feature: approx. 80% loss of Spartina and Salicornia since 2004. Some trampling by no adverse effect apparent, no signs of pollution, appears to be natural change. Intertidal mudflat feature: reduction in the biomass of small invertebrates (particularly worms) from 2002-2009, although *Nephtys* had increased. Change may be a result of slightly seasonal differences in sampling or natural variation. Estuarine feature: No significant algal mat cover in 2005 so no further samples. Aggregation of non-breeding birds, Whitley Lake supports large numbers of feeding and roosting wildfowl although there is some disturbance from activities like windsurfing and dog walking.
015	Ham Common	Littoral Sediment	Favourable	High	Estuarine feature: No significant algal mat cover in 2005 so no further samples.
037	Patchin Point and Arne Bay	Fen, Marsh and Swamp – Lowland	Unfavourable – declining	High	Condition is based on an assessment of the water environment, the saltmarsh and mudflat habitats, and wintering birds. The unit was assessed as unfavourable in 2010 and a number of factors indicate this is still the case. Water quality and biological indicates of eutrophication affecting the ecology. No evidence that the problem is

					reducing. Concentrations of dissolved inorganic nitrogen, measured in winter, are at less than WFD Good status across the Harbour as a whole. Encourages growth of macroalgae on mudflat and within saltmarsh although has little effect on phytoplankton abundance. Aerial photographs show algal mats widespread on mudflats in Arne Bay in 2002, 2008, 2009, 2016, 2017 and 2018. Research in Poole Harbour on mudflat invertebrates and wintering birds indicates that macroalgae cause adverse biological effects. Widespread saltmarsh loss has been happening for many years. Extent of saltmarsh at Arne Bay appears relatively stable compared to elsewhere in the Harbour, extent of marsh still similar to 1947. For the Harbour as a whole, numbers of all wintering bird species are above the indicative level for favourable condition, apart from Shelduck. Numbers of wintering shelduck have declined in the Harbour in recent years. Steeper decline at this site than expected from regional and national trends therefore likely to be site-specific pressures contributing in part to the decline. Numbers increased a little since last WeBs count but still lower than at any time since 1960s. Studies suggest decline may be linked to reduced food availability as a result of opportunistic algal mat cover possibly leading to a physical inhibition of feeding activity in the presence of dense algal mats. Also seen to be vulnerable to disturbance, study in Poole Harbour in 2012 found probability of a major flight being higher compared to other species. Numbers of breeding redshank on the Arne saltmarshes have remained stable since 1997.
046	Long and Round Island saltmarsh and mudflat	Fen, Marsh and Swamp - Lowland	Favourable	High	Saltmarsh feature – little change between 2002 and 2009 save for very small retreat on the NE shorelines of both islands.

					Intertidal sediment feature – reduction in the biomass of small worms and overall biomass of invertebrate between 2002 and 2009, including a reduction in *Corophium* (an important prey item for avocet). Change may be a result of slightly seasonal differences in sampling or natural variation.
047	Ower Bay and Fitzworth	Fen, Marsh and Swamp – Lowland	Unfavourable – declining	High	Condition is based on an assessment of the water environment, the saltmarsh and mudflat habitats, and wintering birds. The unit was assessed as unfavourable in 2010 and a number of factors indicate this is still the case. Water quality and biological indicates of eutrophication affecting the ecology. No evidence that the problem is reducing. Concentrations of dissolved inorganic nitrogen, measured in winter, are at less than WFD Good status across the Harbour as a whole. Encourages growth of macroalgae on mudflat and within saltmarsh although has little effect on phytoplankton abundance. Green algal mats were widespread in 2016 and 2017. Research in Poole Harbour on mudflat invertebrates and wintering birds indicates that macroalgae cause adverse biological effects. Substantial changes in saltmarsh extent, using aerial photos and geomatic data comparison (some ground truthing for selected units). Widespread saltmarsh loss has been happening in Poole Harbour for many years. Identified erosion at marsh edges assigned to effects of wave attach, die-back within the interior of the sward edge, formation of new marsh channels. Algal mats dislodged from mudflat deposited on saltmarsh is having a direct damaging effect. For the Harbour as a whole, numbers of all wintering bird species are above the indicative level for favourable condition, apart from Shelduck. Numbers of wintering shelduck have declined in the Harbour in recent years. Steeper decline at this site than expected

					from regional and national trends therefore likely to be site-specific pressures contributing in part to the decline. Numbers increased a little since last WeBs count but still lower than at any time since 1960s. Studies suggest decline may be linked to reduced food availability as a result of opportunistic algal mat cover possibly leading to a physical inhibition of feeding activity in the presence of dense algal mats. Also seen to be vulnerable to disturbance, study in Poole Harbour in 2012 found probability of a major flight being higher compared to other species.
050	Green Island Shoreline	Fen, Marsh and Swamp – Lowland	Favourable	High	Saltmarsh is quite varied, especially low-mid zone although some communities are confined to small linear strands. Since the 2001 survey there has been very minor erosion of the outer edge of the saltmarsh and some small-scale patchy die back of Spartina in the lower marsh.
052	Newton Bay	Fen, Marsh and Swamp – Lowland	Unfavourable – declining	High	Condition is based on an assessment of the water environment, the saltmarsh and mudflat habitats, and wintering birds. Concentrations of dissolved inorganic nitrogen, measured in winter, are at less than WFD Good status across the Harbour as a whole. Encourages growth of macroalgae on mudflat and within saltmarsh although has little effect on phytoplankton abundance. The extent, density and biomass of macroalgae in Newton Bay equates to WFD Moderate class based on four years data (2008, 2009, 2011 and 2015). In most years macroalgae has a presence in this part of the Harbour at less than WFD Good class and a sheet forming Ulva spp., dominant in Newton Bay, forms dense mats. These algal mats were widespread on mudflats in Newton Bay in 2016 and 2017. Research in Poole Harbour on mudflat invertebrates and wintering birds indicates that macroalgae cause adverse biological effects. Substantial changes in saltmarsh extent, using aerial photos and geomatic data comparison (some ground

					truthing for selected units). Widespread saltmarsh loss has been happening in Poole Harbour for many years. Identified erosion at marsh edges assigned to effects of wave attach, die-back within the interior of the sward edge, formation of new marsh channels. Algal mats dislodged from mudflat deposited on saltmarsh is having a direct damaging effect. For the Harbour as a whole, numbers of all wintering bird species are above the indicative level for favourable condition, apart from Shelduck. Numbers of wintering shelduck have declined in the Harbour in recent years. There are gaps in data collected in Newton Bay but a complete dataset between 2012/13 and 2016/17 shows a decline in this period. Numbers increased a little since last WeBs count but still lower than at any time since 1960s. Studies suggest decline may be linked to reduced food availability as a result of opportunistic algal mat cover possibly leading to a physical inhibition of feeding activity in the presence of dense algal mats. Also seen to be vulnerable to disturbance, study in Poole Harbour in 2012 found probability of a major flight being higher compared to other species.
053	Inner Brands Bay and Drove Island	Fen, Marsh and Swamp – Lowland	Unfavourable – declining	High	Condition is based on an assessment of the water environment, the saltmarsh and mudflat habitats, and wintering birds. Concentrations of dissolved inorganic nitrogen, measured in winter, are at less than WFD Good status across the Harbour as a whole. Encourages growth of macroalgae on mudflat and within saltmarsh although has little effect on phytoplankton abundance. The extent, density and biomass of macroalgae in Brands Bay equates to WFD Moderate class based on four years data (2008, 2009, 2011 and 2015). Green algal mats were widespread on mudflats in Brands Bay in 2016 and 2017. In most years macroalgae has a presence in this part of the Harbour at less than WFD Good class and the tubular or filamentous fronds of the

					algal species dominant in Brands Bay form dense impenetrable mats. Research in Poole Harbour on mudflat invertebrates and wintering birds indicates that macroalgae cause adverse biological effects. Substantial changes in saltmarsh extent, using aerial photos and geomatic data comparison (some ground truthing for selected units). Substantial loss of saltmarsh has occurred in Brands Bay however, the timing and pattern of loss is very different from other units. Most of the change occurred between 1972 and 1997 with the situation relatively stable since. Algal mats dislodged from mudflats are deposited on saltmarsh at high tide, causing smothering. The main effect in Brands Bay has been on the lower saltmarsh. For the Harbour as a whole, numbers of all wintering bird species are above the indicative level for favourable condition, apart from Shelduck. Numbers of wintering shelduck have declined in the Harbour in recent years. Data in Brands Bay itself is incomplete so does not allow a robust assessment of local changes but indicates that numbers may have held up better in Brands Bay than the Harbour as a whole. Numbers increased a little since last WeBs count but still lower than at any time since 1960s. Studies suggest decline may be linked to reduced food availability as a result of opportunistic algal mat cover possibly leading to a physical inhibition of feeding activity in the presence of dense algal mats. Also seen to be vulnerable to disturbance, study in Poole Harbour in 2012 found probability of a major flight being higher compared to other species.
054	Bramble Bush Bay, east South Deep and Stone Island	Fen, Marsh and Swamp – Lowland	Favourable	High	Saltmarsh feature: ongoing erosion of the small Spartina islands, otherwise few changes, still one of the most varied areas of saltmarsh in the Harbour. Some deposition of algal mats onto pioneer marsh. Intertidal sediment feature: reduction in the overall biomass of invertebrates. Change may be a result of

					slightly seasonal differences in sampling or natural variation. Estuarine feature: No significant algal mat cover in 2005 so no further samples.
060	Brownsea South Shoreline	Littoral Sediment	Unfavourable – Recovering	High	Estuarine feature: No significant algal mat cover in 2005 so no further samples. Intertidal sediment feature: coastal defences at the back of the beach make this site unfavourable but will be removed by National Trust in 2011.
061	Furzey Shoreline	Littoral Rock	Favourable	High	Saltmarsh feature: very little change in area of saltmarsh since previous survey apart from very minor natural erosion on seaward edges of narrow strips on the eastern and southern shores. Estuarine feature: No significant algal mat cover in 2005 so no further samples. Intertidal sediment feature: Site was characterized by a species poor assemblage consisting of the catworm (Nephtys) and high densities of oligochate spp. And Tubificoides spp. In 2009. Presence of algal mats were recorded over these areas during the winter invertebrate surverys.
062	Goathorn mudflat	Littoral Rock	Unfavourable – declining	High	Estuarine feature: algal mats were recorded here in the summer 2009 assessment by the EA however none of the samples had more than 2kg/m2 so the unit is not considered to be in unfavourable condition in terms of algal cover. Intertidal sediment feature: Site was characterised by a species poor assemblage consisting of the catworm (Nephtys) and high densities of oligochaete spp. And Tubificoides spp. In 2009. The presence of algal mats was recorded over these areas during the winter invertebrate surveys.
063	Brands Bay North	Littoral Rock	Unfavourable – declining	High	Condition is based on an assessment of the water environment, the saltmarsh and mudflat habitats, and wintering birds.

					Concentrations of dissolved inorganic nitrogen, measured in winter, are at less than WFD Good status across the Harbour as a whole. Encourages growth of macroalgae on mudflat and within saltmarsh although has little effect on phytoplankton abundance. The extent, density and biomass of macroalgae in Brands Bay equates to WFD Moderate class based on four years data (2008, 2009, 2011 and 2015). Green algal mats were widespread on mudflats in Brands Bay in 2016 and 2017. In most years macroalgae has a presence in this part of the Harbour at less than WFD Good class and the tubular or filamentous fronds of the algal species dominant in Brands Bay form dense impenetrable mats. Research in Poole Harbour on mudflat invertebrates and wintering birds indicates that macroalgae cause adverse biological effects. Substantial changes in saltmarsh extent, using aerial photos and geomatic data comparison (some ground truthing for selected units). Substantial loss of saltmarsh has occurred in Brands Bay however, the timing and pattern of loss is very different from other units. Most of the change occurred between 1972 and 1997 with the situation relatively stable since. Algal mats dislodged from mudflats are deposited on saltmarsh at high tide, causing smothering. The main effect in Brands Bay has been on the lower saltmarsh. For the Harbour as a whole, numbers of all wintering bird species are above the indicative level for favourable condition, apart from Shelduck. Numbers of wintering shelduck have declined in the Harbour in recent years. Data in Brands Bay itself is incomplete so does not allow a robust assessment of local changes but indicates that numbers may have held up better in Brands Bay than the Harbour as a whole. Numbers increased a little since last WeBs count but still lower than at any time since 1960s. Studies suggest decline may be linked to reduced food

					availability as a result of opportunistic algal mat cover possibly leading to a physical inhibition of feeding activity in the presence of dense algal mats. Also seen to be vulnerable to disturbance, study in Poole Harbour in 2012 found probability of a major flight being higher compared to other species.
064	Brands Bay East	Littoral Sediment	Unfavourable – declining	High	Condition is based on an assessment of the water environment, the saltmarsh and mudflat habitats, and wintering birds. Concentrations of dissolved inorganic nitrogen, measured in winter, are at less than WFD Good status across the Harbour as a whole. Encourages growth of macroalgae on mudflat and within saltmarsh although has little effect on phytoplankton abundance. The extent, density and biomass of macroalgae in Brands Bay equates to WFD Moderate class based on four years data (2008, 2009, 2011 and 2015). Green algal mats were widespread on mudflats in Brands Bay in 2016 and 2017. In most years macroalgae has a presence in this part of the Harbour at less than WFD Good class and the tubular or filamentous fronds of the algal species dominant in Brands Bay form dense impenetrable mats. Research in Poole Harbour on mudflat invertebrates and wintering birds indicates that macroalgae cause adverse biological effects. Substantial changes in saltmarsh extent, using aerial photos and geomatic data comparison (some ground truthing for selected units). Substantial loss of saltmarsh has occurred in Brands Bay however, the timing and pattern of loss is very different from other units. Most of the change occurred between 1972 and 1997 with the situation relatively stable since. Algal mats dislodged from mudflats are deposited on saltmarsh at high tide, causing smothering. The main effect in Brands Bay has been on the lower saltmarsh. For the Harbour as a whole, numbers of all wintering bird species are above the indicative level for

					favourable condition, apart from Shelduck. Numbers of wintering shelduck have declined in the Harbour in recent years. Data in Brands Bay itself is incomplete so does not allow a robust assessment of local changes but indicates that numbers may have held up better in Brands Bay than the Harbour as a whole. Numbers increased a little since last WeBs count but still lower than at any time since 1960s. Studies suggest decline may be linked to reduced food availability as a result of opportunistic algal mat cover possibly leading to a physical inhibition of feeding activity in the presence of dense algal mats. Also seen to be vulnerable to disturbance, study in Poole Harbour in 2012 found probability of a major flight being higher compared to other species.
065	Poole Harbour Channels and Open Water	Littoral Sediment	Unfavourable – declining	No identified Condition Threat	Water quality meets favourable condition requirements for dissolved oxygen and contaminants. Turbidity requires further assessment while sediment cores reveal much higher recent sediment deposition rates in the inner parts of the Harbour compared with those over the longer term in the same areas. Wider trends indicate changes in nutrient and algal signatures resulting in adverse pressures on the Harbour ecology. Nutrient status is not clearly favourable due to high mean winter concentrations of inorganic nitrogen (WFD moderate status) and an elevated presence of phosphorus. Nutrients encourage the growth of opportunistic macroalgae on bordering littoral sediments to an extent, density and biomass that is in many places unfavourable. Such growth is not recorded below mean low water and phytoplankton biomass, while meeting favourable condition, is not greatly elevated suggesting the response of these primary indicators of nutrient enrichment is moderated by other factors. The largest subtidal seagrass beds have remained stable in area between 2008 and 2015 but knowledge about seagrass extent in the Harbour over a longer term prior to current pressures on the water

					environment is limited. Evidence that seagrass was once much more widespread in the Harbour and the remaining seagrass is in a location near the Harbour entrance and so is frequently flushed by better quality water from outside the Harbour. Suggests there has been a decline in seagrass abundance which may be related to water quality. Limited monitoring of subtidal invertebrates has not revealed any major changes in recent years. Distribution of *Sabella pavonina* beds recorded in 2016 in the same as that recorded in the 1980s. The rare sponge *Suberites massa* was found to be common outside the navigation channel in a restricted area in South Deep on the northwest side of Goathorn Point. Of the wildfowl species features most reliant on the subtidal parts of the Harbour, some have declined (goldeneye and red-breasted merganser) while others have remained stable or increased (cormorant). Goldeneye and red-breasted merganser numbers have now declined below the reference level that is indicative of favourable condition. However, decreases in numbers mirror both national and regional trends which suggests the changes are driven by broad-scale shifts in distribution. Suggested that local pressures that would place these species in unfavourable condition are not responsible. Numbers of both species have been relatively stable since 2011. Although breeding sites are not within this unit, it is a key feeding area for populations of both Common and Sandwich terns. In the past five years populations of both terns have been well in excess of the population size that indicates favourable condition.

Overall, the SSSI condition assessments appear to suggest that the units considered are generally in favourable condition, except for five units, notably bays or inlets located within the southern region of Poole Harbour, who's condition is unfavourable – declining.

When examining the reasons for this, it appears as though from the condition assessment comments that unfavourable condition is caused by significant algal mat coverage, largely driven by eutrophication, saltmarsh decline and low numbers of Shelduck where studies suggest decline

may be linked to reduced food availability as a result of opportunistic algal mat cover possibly leading to a physical inhibition of feeding activity in the presence of dense algal mats. The unit of Brownsea South Shoreline is unfavourable – recovering with the removal of sea defences by the National Trust deemed to be the remedy to the unfavourable status. A number of units considered to be in favourable condition do note reductions in the overall biomass of small invertebrates (particularly worms) with respect to intertidal sediment communities, presence of algal mats and lower numbers of bird species however, these provisions do not constitute a reason to classify such units as unfavourable.

Unit 065 Poole Harbour Channels and Open Water highlights *Sabella pavonina* and *Suberites massa*, these features have been assessed against bottom towed fishing gear in a separate SSSI Assessment[11].

6.3.2 Population Trends

Population trend data, where available, can be used to identify site-specific pressures. Information on population trends comes from Natural England's Conservation advice packages available here: https://designatedsites.naturalengland.org.uk/. The setting of population abundance targets for the species is derived based on Wetland Bird Survey (WeBS) and JNCC's Seabird Monitoring Programme (SMP) population data.

Table 8: Population abundance targets for the bird species found in the Poole Harbour SPA. Please note all information presented in this table has been taken from Natural England's Conservation Advice Package available at: https://designatedsites.naturalengland.org.uk/. These do not represent condition assessments.

Species	Target	Explanation
Avocet	Maintain	Since classification, the avocet population has increased in number in Poole Harbour, with a current five-year peak mean (2012/13 to 2016/17) of 1,359 individuals. This represents 18.1% of the latest (2004/05 to 2008/09) GB wintering population estimate of 7,500 individuals. Poole Harbour ranks as the third most important wintering site in the UK.
Black-tailed godwit (Icelandic Race)	Maintain	Since classification, the black-tailed godwit population has steadily increased in number in Poole Harbour, with a current five-year peak mean (2012/13 to 2016/17) of 2,030 individuals. This represents 4.7% of the British population and Poole Harbour is ranked as the 14th most important wintering site in the UK for this species.
Common tern	Maintain	When classified in 2000 the site supported 155 pairs, representing over 1% of the British population. The number of nesting pairs of common terns during a recent five-year period (2011-2015) were: 2011 - 222 pairs, 2012 - 171 pairs, 2013 - 163 pairs, 2014 - 145 pairs. This provides a recent five year mean of 178 pairs (or 356 breeding

[11] Southern IFCA (2020), Poole Harbour SSSI Assessment for Unit 65 – Poole Harbour Channels and Open Water

		adults), representing 1.78% of the GB breeding population. This current figure is now the baseline for this breeding species in the Poole Harbour SPA.
Little egret	Maintain	The current five-year peak mean (2012/13 - 2016/17) is 179 individuals (114 at time of designation), representing 2.5% of the British population. The most recent WeBS report indicates that Poole Harbour currently ranks as the 8th most important overwintering site in the UK for this species.
Mediterranean gull	Maintain	Since classification in 1999, the number of breeding pairs of Mediterranean gulls in Poole Harbour has increased from 5 pairs to the new baseline of 64 pairs. This count represents a 10-fold increase in numbers since the site was originally classified. The most recent count of 155 pairs in 2018 represents 25.8% of the latest (2006 to 2010) GB breeding population estimate of 600 pairs.
Sandwich tern	Maintain	The most recent five-year mean (2013-2017) of 179 pairs (classified population was 181), represents 1.6% of the GB breeding population (2013 - 180 pairs, 2014 - 210 pairs, 2015 - 174 pairs, 2016 - 189 pairs, 2017 - 140 pairs).
Shelduck	Restore	Since classification, the shelduck population in Poole Harbour has declined by 64%, with a current five-year peak mean of 1,295 individuals (2012/13 - 2016/17). Poole Harbour is currently only the 16th most important site for the species in the UK, holding just 0.4% of the north-west European population. We do not have site-specific information about the cause of the decline, although a study in 2010 suggested that food availability for shelduck in Poole Harbour was borderline, and extensive algal mats may be inhibiting effective foraging (Herbert et al., 2010).
Spoonbill	Maintain	The current five-year peak mean (2012/13 - 2016/17) is 37 individuals (20 at time of designation), representing 25% of the British population. The most recent WeBS report indicates that Poole Harbour currently ranks as the most important overwintering site in the UK.
Waterbird Assemblage	Maintain	The latest five-year peak mean is 23,640 individuals (2012/13-2016/17) with the highest peak count being 26,184 individuals in 2016/17.

It is important to note that the time periods of data used to inform conservation advice packages vary and therefore this data may not have captured the effects of fishing activities that have since commenced or altered since publication. The effects of fishing activities may not necessarily be captured in the next population abundance targets due to the time lag between cause and effect. With respect to aquaculture activity, there has been very little change in fishing practice over recent years and therefore there are not likely to be any impacts of this activity on these species when compared to the numbers quoted in the Conservation Advice packages.

Additional analysis of bird count data (WeBS data) was undertaken by Natural England in 2012. This analysis highlighted declines in the numbers of overwintering birds in some sectors of the Poole Harbour. The data analysis highlighted in particular there was concern regarding declines in some species in Lytchett Bay (shelduck, redshank and dunlin), Brands Bay (shelduck, redshank, dark bellied brent geese, dunlin) and Wych (shelduck, black tailed godwit, dunlin). One of these areas (Brands Bay) concurs with the Poole Harbour SSSI which classified Brands Bay as being in an ‘unfavourable – declining’ condition.

6.3.3 Site-Specific Seasonality Table

Table 9 below indicates (highlighted in grey) when significant numbers of each mobile designated feature are most likely to be present at the site during a typical calendar year. Periods highlighted in grey are periods to be aware of with regard to planned aquaculture activity within the Poole Harbour Fishery Order 2015. The absence of overlap between the location of T2 lease beds and the areas highlighted as key for bird features of the SPA ensures that impacts from aquaculture on feeding, roosting and breeding are minimised year-round including the significant periods outlined in table 9. It is noted that the months not highlighted in grey do not necessarily indicate when features are absent, rather that features may be present in less significant numbers, however this is still mitigated by the location of T2 lease beds aware from sensitive areas.

Table 9. Presence by month of mobile designated features at the Poole Harbour SPA (updated by Natural England, March 2020). Grey indicates periods of presence in significant numbers whereas blank (white) indicates either periods of absence or of presence but only in numbers of less significance.

Common Name	Latin Name	Designated Season	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Reference
Avocet	*Recurvirostra avosetta*	Nonbreeding; Wintering													Cramp and Simmons, 1983; British Trust for Ornithology (BTO), 2014
Black-tailed godwit	*Limosa limosa*	Nonbreeding; Wintering													Wernham *et al*., 2002
Common tern	*Sterna hirundo*	Breeding													Forrester and Andrews, 2007; Pennington *et al*., 2004; Wernham *et al*., 2002; Cramp and Simmons, 1983
Mediterranean gull	*Larus melanocephalus*	Breeding													Cox, 2014; Hunnybun and Hart, 2011; Wernham *et al*., 2002;

															Cramp and Simmons, 1983
Shelduck	*Tadorna tadorna*	Nonbreeding; Wintering													Cramp and Simmons, 1977; Liley and Fearnley, 2012; British Trust for Ornithology (BTO), 2014
Little egret	*Egretta garzetta*	Nonbreeding; Wintering													WeBS data
Sandwich tern	*Sterna sandvicensis*	Breeding													Seabird Monitoring Programme
Spoonbill	*Platalea leucorodia*	Non-breeding													BTO data (analysed 13th August 2015)

6.4 Existing Management

The following management measures are currently applied to fishing activity in Poole Harbour:

- **Bottom Towed Fishing Gear 2016** byelaw – prohibits bottom towed fishing gear over sensitive features including seagrass features within the Poole Harbour SPA.
- **Prohibition of Gathering (Sea Fisheries Resources) in Seagrass Beds** byelaw. This prohibits any person from digging for, fishing for or taking any sea fisheries resource in or from the prohibited areas and does not apply to fishing/taking fisheries resources by means of net, rod and line and hook and line. It also does not apply to fishing for/taking sea fisheries resources using a vessel, provided that no part of the vessels hull in contact with the seabed. No person shall carry a rake, spade, fork or any similar tool in prohibited areas.
- **Fishing for Oysters, Mussels and Clams** byelaw states that when fishing for these species only the following methods are used; a) hand picking and b) dredging using a dredge with a rigid framed south so designed to take shellfish only when towed along the sea bed.

- **Poole Harbour Shellfish Hand Gathering** byelaw (to replace Prohibition on Using or Carrying A Shellfish Dredge, Scoop or Handrake in Certain Areas of Poole Harbour) prohibits persons from fishing for or taking shellfish by hand picking or using a hand rake or similar instrument from 1st November to 31st March in defined areas.
- **Fishing for Cockles** byelaw (to replace 'Cockles' legacy byelaw) - will describe methods by which are cockles are permitted to be fished, including hand picking, using a rake (max. 305 mm wide head and spaces of 22.5 mm between the teeth) and dredge (basket must not exceed 460 mm in width by 460 mm in depth by 300 mm high and spaces of no less than 22.5 mm).
- **Memorandum of Agreement for Bait Digging within Poole Harbour**. Bait diggers are asked to avoid conducting activity within the bird sensitive areas in Poole Harbour between 1st November and 30th March, backfill any holes which are dug and a number of general provisions, including avoiding trampling saltmarsh and reedbeds and carrying torch lights at night which may disturb roosting birds.
- **Poole Harbour Fishery Order 2015** is a Several Order which allows Southern IFCA to lease ground for the purposes of aquaculture and is achieved by granting exclusive rights to individuals to cultivate and harvest shellfish of any kind within designated lease beds, of which there are currently 31. The Order is accompanied by a Management Plan which outlines the extent of the proposed Order (837.8 hectares) and how the area within that extent will be managed, including the positioning and allocation of leased beds and the process criteria and conditions by which access to leased beds is determined. For any leased ground allocated, a number of management measures are apply including a restriction of vessel length, the persons and vessels that can operate and remove shellfish from a leased bed and a requirement that all commercial shellfish species removed are subject to minimum size restrictions, as would be the case for commercial fisheries operating within Poole Harbour.
- **Poole Harbour – Prawns Close Season** byelaw states that no person shall in Poole Harbour west of and within the line of the ferry across the mouth of the Harbour fish for any prawns or remove any prawns from the fishery between 1st January and 31st July in any year (both days inclusive)
- **Fixed Engines** byelaw prohibits the placing and use of fixed engine, other than Fyke nets, for the taking of seafish between 1st April and 30th September (both days inclusive) in any year in all parts of Poole Harbour to the west of the line of the Chain Ferry between South Haven Point and Sandbanks and all parts of any river or stream flowing into Poole Harbour which fall within the Southern Sea Fisheries District.

  Additional regulations apply to the Southern IFCA District requiring commercial fishers to hold a permit with Southern IFCA, limiting the size of vessel which can operate in the District and creating Minimum Conservation Reference Sizes for various species (these are set either in regulation EU 2019/1241 or specific Southern IFCA byelaws)

6.5 Summary of Impacts

The potential pressures, associated impacts, level of exposure and mitigation measures are summarised in table 10. Only relevant attributes identified through the TLSE process have been considered here.

Table 10: Potential pressures, associated impacts, level of exposure and mitigation measures for the issuing of leases for 2020-25

Feature	Supporting habitat(s)	Attribute	Target	Potential Pressure(s) and Associated Impacts	Nature and Likelihood of Impacts	Mitigation Measures
Avocet Black-tailed godwit Little egret Shelduck Spoonbill Waterbird assemblage Mediterranean gull Common tern Sandwich tern	All habitats	Disturbance caused by human activity	Reduce the frequency, duration and/or intensity of disturbance affecting roosting, nesting, foraging, feeding, moulting and/or loafing birds so that they are not significantly disturbed.	Aquaculture activity and dredging on the lease beds has the potential to disturb wading birds and intertidal feeders due to temporal or permanent loss of roosting and feeding habitat from altered behaviour affecting energy budgets and bodily condition. Disturbance can result from presence of vessels in areas adjacent to feeding and roosting sites. Waterbirds like shelduck are considered sensitive to visual disturbance by human activities. The species responds by being altered or conducting escape flights as a consequence of various visual stimuli. Walking and biking people are reported as a common cause of disturbance triggering stronger disturbance than vehicles. Shelduck could potentially be more sensitive to visual disturbance during moulting time at which time	Disturbance as a result of aquaculture is only likely to occur from vessels being present on the lease ground and dredge activities undertaken to harvest shellfish. The number of vessels operating on the ground is low (maximum 9 vessels) and it is anticipated that approx. 5 of these vessels at the most would be operating at any one time. The location of the lease ground is more than 1km from any of the defined bird sensitive areas and cannot occur within the Brownsea Lagoon. Recreational activities are seen to be the greatest source of disturbance. Activity has occurred on the lease grounds for over 30	Lease holders are required to submit a business plan outlining the species and activities which will be carried out over lease beds. This business plan covers the 5-year period for the lease and there is a requirement for permit holders to operate as per their business plan. The number and type of vessels must be stipulated in the business plan and therefore, over the five-year period of the lease there will not be an increase in the number of vessels operating within the scope of the Order. The extent of the Poole Harbour Fishery Order 2015 was designed to exclude the defined bird sensitive areas in the Harbour. The minimum distance between a lease bed and one of these areas is over 1km. In addition the extent of

				they form large flocks. Factors such as human disturbance may plan an important role in determining habitat quality for Shelduck. A study found that the main cause of disturbance of Spoonbills were aircrafts (37%) and humans (21%). They spent more time in flight in response to aircraft (57%) and shooting (22%) but no impact on the disturbed bird's energy budget or feeding success was found. Aquaculture activity and dredging on the lease beds has the potential to disturb Common and Sandwich terns during the breeding season although disturbance is mainly thought to be as a result of recreational activities. Common terns can be scared away from nesting sites which can lead to nearly total reproductive failure. Human disturbance has also been noted to markedly facilitate gull predation and therefore reduce the breeding success of common tern. Human disturbance of sandwich tern during the breeding season is mainly caused by recreational activities and the species is particularly sensitive to disturbance by e.g. tourism during the early breeding season. Premature nest-	years, using predominantly the same type of vessels as those proposed for 2020-25. There will therefore be a degree of habituation of the bird features of Poole Harbour to the presence of these vessels and type of activities they carry out.	the Order does not encompass any areas where Mediterranean gulls are known to breed or the area of Brownsea Lagoon. Activity therefore cannot take place in locations where the risk to bird features from disturbance is high which greatly reduces the risk of disturbance by vessels or dredging activity at any time of year or time of day. The Authority has the ability to enforce regulations for aquaculture on lease ground within the Order. Only persons and vessels named in the business plans may operate on lease ground preventing other vessels from operating in this area and preventing any activity which may be contrary to that in the business plans. The IFCA has the ability to carry out inspections to ensure that the provisions within the business plan and lease are being adhered to. No activity will be permitted to take place outside of daylight hours (08:00 to 16:00) during the period of sensitivity for the bird features (September to March).

				leaving as a result of human disturbance has been documented for Sandwich tern chicks increasing nestling mortality. When foraging at sea, Sandwich tern is reported to have a low sensitivity to disturbance by shipping activities. Surface feeding species can also be attracted to activities that may cause visual disturbance to other species i.e. Sandwich terns are reported to feed on fish trawler discards. Human disturbance to Mediterranean gulls will be a higher risk during the breeding season and is mainly attributed to recreational activities. Mediterranean gulls appear to be tolerant to human disturbance although tourist disturbance/other disturbance at breeding colonies is one of the greatest direct losses of birds. Wading and surfacing feeding bird species can be directly impacted by above water noise causing a disturbance. Depending on the sound intensity birds may react by being alerted or taking flight. Impulsive sound in particular may result in disturbance. Feeding waders are not as strongly affected as roosting		

				birds and there are species-specific tolerance levels. No species-specific evidence on above water noise impacts on shelduck was found. Common tern is reported to be displaced from colonies by the noise from personal watercrafts and motor boats but information is sparse and no specific link to noise was found. There is sparse specific information on vulnerability to noise for Mediterranean gull.		
Avocet Black-tailed godwit Little egret Shelduck Spoonbill Waterbird assemblage Mediterranean gull Common tern Sandwich tern	All habitats	Supporting habitat: landscape Connectivity with supporting habitats	Maintain the area of open and unobstructed terrain around roosting and feeding sites. Maintain safe passage of birds moving between roosting and feeding areas.	There is the potential for collision above water with vessels operating on lease ground. There are no other structures permitted on lease ground so the presence of vessels are the only potential risk for this pressure. Examples of collision studies are mostly related to wind farms or large fixed structures at sea. No studies were found where vessels posed a collision risk for bird species. Indication that activity at night, in periods of inclement weather, where there are no other landing spots available and the structure is the only source of light are the factors that contribute to increasing the risk of collision. Structures above ground affect the ability of bird species to follow migration routes and	The number of vessels operating on the ground is low (maximum 9 vessels) and it is anticipated that approx. 5 of these vessels at the most would be operating at any one time. Activity has occurred on the lease grounds for over 30 years, using predominantly the same type of vessels as those proposed for 2020-25. There will therefore be a degree of habituation of the bird features of Poole Harbour to the presence of these vessels and type of activities they carry out. Aquaculture activity proposed for 2020-25 is very similar to that carried out previously on the lease ground. This involves very limited activity at night and	Lease holders are required to submit a business plan outlining the species and activities which will be carried out over lease beds. This business plan covers the 5-year period for the lease and there is a requirement for permit holders to operate as per their business plan. The number and type of vessels must be stipulated in the business plan and therefore, over the five-year period of the lease there will not be an increase in the number of vessels operating within the scope of the Order. Lease holders are not permitted to place any structures on the seabed. There is therefore no risk of new structures appearing over the course of the five-year

				collision can result in injury or death.	activity is unlikely to take place during periods of inclement weather which would also affect the visual capabilities of bird species. Within Poole Harbour there are many landing spots and therefore the vessels on the aquaculture beds are not an attraction for bird species. Lights on vessels would not be significant when compared to other light sources around the Harbour and are also therefore unlikely to attract bird features. The risk of collision between bird features and aquaculture vessels in Poole Harbour is extremely low.	period for which the lease is granted. The Authority has the ability to enforce regulations for aquaculture on lease ground within the Order. Only persons and vessels named in the business plans may operate on lease ground preventing other vessels from operating in this area and preventing any activity which may be contrary to that in the business plans. The IFCA has the ability to carry out inspections to ensure that the provisions within the business plan and lease are being adhered to.
Avocet Little egret Eurasian spoonbill	Intertidal mud Coastal lagoons Intertidal seagrass beds	Supporting habitat: food availability within supporting habitat	Maintain the distribution, abundance and availability of key prey items (e.g. Gammarus, Corophium, flies, beetles, Nereis, Hydrobia, Cardium, gobies) at preferred prey sizes (e.g. fish or worms between 4-15 mm long).	In locations where lease ground has been identified to replace that which is closed under the T2 lease bed reallocation programme, there is the potential for removal of non-target species through clearing of the ground prior to the culture of shellfish. There is a small area of intertidal mud identified within lease ground no. 12. The area of intertidal mud is approx. 0.1 ha in size. Over this part of this specific lease ground there is the potential for aquaculture activity to cause removal of non-target species.	The extent of the Poole Harbour Fishery Order 2015 excludes all supporting habitats except intertidal mud. Within the extent of the Order lease ground does not overlap with intertidal mud except for 0.1 ha within a single bed. The use of this 0.1 ha of intertidal mud by bird features for feeding is deemed to be negligible, it is in an area which would only be fully exposed on the lowest spring tides and is also adjacent to a designated personal watersports area. The	Lease holders are required to submit a business plan outlining the species and activities which will be carried out over lease beds. This business plan covers the 5-year period for the lease and there is a requirement for permit holders to operate as per their business plan. There will therefore not be any additional activities undertaken on lease ground other than those that have been assessed under the business plans. Any additional activities over the period 2020-25, that are not covered by this assessment, will
Black-tailed godwit	Intertidal mud Coastal lagoons	Supporting habitat: food availability within supporting habitat	Maintain overall prey availability (e.g. Macoma, Cardium, Nereis)			

	Intertidal seagrass beds		at preferred prey sizes.	There is the potential for dredging activity to result in the removal of non-target species in areas where sand eels are present on subtidal sand banks. There is an area of sand bank located between the main channel and Brownsea Island where sand eels are present in the subtidal sediment. The potential for introduction of INIS and microbial pathogens by aquaculture activity poses a risk to key prey items for bird species through them being outcompeted, predated or pushed to extinction. The use of genetic modification in aquaculture introduces a risk of hybridization with native species. This can change the genetic make up of native species resulting in extinction of the original species. This has been seen in bivalve molluscs, species of which are key prey species for bird features of Poole Harbour. In locations where lease ground has been identified to replace that which is closed under the T2 lease bed reallocation programme, there is the potential for changes in water clarity from changes in	proximity of this area of intertidal mud to recreational activity and the potential for disturbance likely makes it a less desirable area for wading and surface feeding birds. The area where a subtidal sand bank has been identified is not included within any lease bed. This area is therefore available for species targeting sand eels to actively feed and there is no risk of dredging activity from aquaculture activity removing the sand eels. Where there are areas of new lease ground that will require 'cleaning' to remove weed and debris prior to farming, these areas do not overlap with any area of supporting habitat. In addition, the cleaning process will be undertaken over a short time period and will only need to occur once. Sites identified as being used by avocet, black-tailed godwit, Mediterranean gull, shelduck, curlew, redshank and greenshank in the outer Wych and Middlebere channels, Arne Bay, Ower	require a separate assessment. The extent of the Poole Harbour Fishery Order 2015 excludes all supporting habitats except intertidal mud. The T2 leased bed reallocation program involved the removal of lease ground from an area where it overlapped with intertidal mud. Within the extent of the Order lease ground does not overlap with intertidal mud except for 0.1 ha within a single bed. The use of this 0.1 ha of intertidal mud by bird features for feeding is deemed to be negligible, it is in an area which would only be fully exposed on the lowest spring tides and is also adjacent to a designated personal watersports area. The proximity of this area of intertidal mud to recreational activity and the potential for disturbance likely makes it a less desirable area for wading and surface feeding birds. The area where a subtidal sand bank has been identified is not included within any lease bed. This area is therefore available for species targeting sand eels to actively feed and there is no risk of dredging activity from
Shelduck	Intertidal mud Coastal lagoons Intertidal seagrass beds	Supporting habitat: food availability within supporting habitat	Restore availability of key prey species (e.g. especially Hydrobia, but also Nereis, Corophium, hatching midges) at preferred prey sizes.			
Spoonbill	Intertidal mud Coastal lagoons Intertidal seagrass beds	Supporting habitat: food availability within supporting habitat	Maintain the distribution, abundance and availability of key food and prey items (e.g. adult and larva of insects, especially waterbeetles, dragonflies, caddis flies, flies; also small fish, crustaceans, frogs and tadpoles, molluscs, worms, leeches) at preferred prey sizes (e.g. small fish up to 10-15cm long).			
Mediterranean gull	Intertidal mud Costal lagoons	Supporting habitat: food availability within supporting habitat	Maintain availability of key prey species (e.g. gobies, earthworm, snails, beetles,			

	Intertidal seagrass beds		lepidoptera, grasshoppers, spiders, dipteran flies) of preferred prey sizes.	sediment and organic particulate matter concentrations as a result of preparing the beds for shellfish cultivation. Dredging on lease beds to harvest shellfish also has the potential for changes in water clarity from changes in sediment and organic particulate matter concentrations. This is important for tern species which are visual feeders and rely on light in order to find, recognize and capture prey. In addition, smothering and siltation on intertidal mud, saltmarsh and seagrass can affect the ability of bird features to find food as organisms are buried by settling sediments. Removal of non-target species by any of the methods outlined above can impact bird species both through direct removal of prey species and through changes to benthic communities and changes in species diversity and population composition. A reduction in prey species can affect the ability of bird species to obtain sufficient energy, particularly in the winter and can have knock-on effects such as impacts to successful breeding.	Bay, Newton Bay, Brands Bay, Holton Mere and Keysworth are all excluded from the extent of the Order therefore it is not possible for aquaculture activity to occur in these areas. In addition, using information on species' diets, the species likely to be sensitive to changes in food availability are black-tailed godwit, shelduck, curlew, redshank and greenshank. Prey preferences exhibited by these species in particular include *Scrobicularia*, *Macoma*, *Hediste* and N*ereis*. A number of studies have reported increases in M*acoma* following disturbance from harvesting (Ferns *et al*., 2000; Clark *et al*., 2017). Studies specific to the impacts of pump-scoop dredging, a method which will be used on the lease beds, in Poole Harbour report increases in *Hediste diversicolor*, (Clark *et al*.,2018) as well as other species considered as key bird prey items including *Arenicola marina* and *Corophium* spp (Parker & Pinn, 2005).	aquaculture activity removing the sand eels. Preparation of ground not previously subject to aquaculture activity will take place over a two-day period during the summer of 2020 for 11.24 ha and periodically over a two-week period between April and September for 26.29 ha. This is therefore a short time frame over which the activity will occur and no 'cleaning' activity is proposed to occur during the winter period when bird species are more reliant on food sources. The areas in which this will be taking place do not routinely dry out at low tide therefore opportunities for feeding on these areas is reduced. Farming methods do not remove or have the potential to remove fish from the marine environment and therefore will not impact bird species with fish as their primary prey source i.e., Red-breasted merganser. The farming of the common mussel (*Mytilus edulis*) will provide a food source for a bird species identified as being in unfavourable condition (Goldeneye). The farming of this species will
Common tern Sandwich tern	Intertidal mud Water column Coastal lagoons Intertidal seagrass beds	Supporting habitat: food availability within supporting habitat	Maintain availability of key prey items (e.g. sandeel, sprat, coarse fish, crustacean, annelids) at preferred prey sizes.			

					Many small benthic organisms, including crustaceans, polychaetes and molluscs, some of which are listed above, have short generation times and high fecundities, both of which enhance their capacity for rapid recolonization (Coen, 1995). In such instances, the effect of disturbance from aquaculture activity is likely to only be short term. Affects on visual feeders as a result of suspended sediment and on surface feeders as a result of siltation are unlikely to be seen as a result of aquaculture activity in Poole Harbour. Studies on siltation and sedimentation from dredging indicate that increases in suspended sediment and settling occur within a fairly small area around dredge works. This is particularly true where dredging is small-scale and occurs over short time scales as would be the case for dredging activity to 'clean' the beds not previously subject to aquaculture activity. Evidence from estuarine environments points to a degree of adaptation by	also benefit other bird species within the Harbour including curlew and redshank (components of the waterfowl assemblage), oystercatcher and herring gull. The low frequency of dredging activity is identified as having a low risk in effecting the benthic community and thus the availability of other prey items, with more intensive dredging practices showing no change in biotope of ecological quality in intertidal sediments within Poole Harbour. The increase in certain species i.e., small polychaete worms, documented to follow more intensive dredging activity may also benefit ten of the species protected under the SPA. The extent of the Poole Harbour Fishery Order 2015 was designed to exclude the defined bird sensitive areas in the Harbour. The minimum distance between a lease bed and one of these areas is over 1km. In addition, the area of Brownsea Lagoon is not included within the extent of the Order. A condition of the lease is that certain species of clam,

					benthic species to increased sediment loads as this process is more likely to occur naturally within these areas. Smothering of intertidal seagrass beds and therefore a loss of prey items for species associated with these beds is unlikely as the intertidal seagrass beds within Poole Harbour are approx. 1km from the nearest lease bed and sediments are seen to settle over much shorter distances (8.2% of sediment remaining in suspension at 315m from a dredge site after 1 hour (Dale *et al.,* 2011)). The only form of genetic modification employed for any aquaculture species within Poole Harbour is for the Pacific oyster where individuals are made triploid or subject to another form of sterilization. This modification prevents Pacific oysters from hybridizing with other native species and thus prevents changes in genetic material for native species. There is potential for the introduction of INIS and microbial pathogens as part of aquaculture activity in	common cockle and native oyster cannot be removed from lease ground under the minimum conservation reference size (MCRS). Many of the clam species and common cockle are utilised as a food source by bird features within Poole Harbour. Farming of these species and ensuring no removal before they have reached MCRS allows individuals to breed and contribute to the wider wild populations of these species and thus maintain or even improve food resources for bird species. The 2020-25 leases are accompanied by a Biosecurity Plan which sets out measures that need to be taken by lease holders to ensure that the risk posed by INIS and microbial pathogens is removed. Individual business plans are accompanied by specific risk assessments for biosecurity which cover measures for purchase and import of seed/stock from the UK or outside, seed moved between aquaculture sites, the relaying of wild animals, exported products, the use of vessels and equipment and protocols for activity on lease ground. The Check, Clean, Dry protocol is employed by all

					Poole Harbour as stock of seed and occasionally adult shellfish will be brought into the Harbour from other domestic and European locations.	lease holders as part of the measures outlined above. There are also specific regulations for Pacific oysters, they must be triploid or subject to another method of sterilization to prevent breeding and the formation of wild populations. The combination of these measures will greatly reduce the risk of the introduction and spread of INIS or microbial pathogens within Poole Harbour. The overarching biosecurity plan is checked by Cefas and checks are also made on the inspection protocols implemented by Southern IFCA to ensure that biosecurity protocols are being adhered to by leaseholders. This provides independent verification of the suitability of biosecurity processes for aquaculture in Poole Harbour. The Authority has the ability to enforce regulations for aquaculture on lease ground within the Order. Only persons and vessels named in the business plans may operate on lease ground preventing other vessels from operating in this area and preventing any activity which may be

						contrary to that in the business plans. The IFCA has the ability to carry out inspections to ensure that the provisions within the business plan and lease are being adhered to.
Avocet Black-tailed godwit Little egret Shelduck Spoonbill Waterbird assemblage Mediterranean gull Common tern Sandwich tern	Water column Atlantic salt meadows Spartina swards Intertidal seagrass beds Intertidal mud	Supporting habitat: water quality – turbidity	Maintain natural levels of turbidity (e.g. concentrations of suspended sediment, plankton and other material) across the habitat	Dredging on lease beds to harvest shellfish has the potential for changes in water clarity from changes in sediment and organic particulate matter concentrations. Dredging on lease beds to harvest shellfish also has the potential to result in smothering and siltation rate changes due to sediment disturbed by the action of the dredge. In locations where lease ground has been identified to replace that which is closed under the T2 lease bed reallocation programme, there is the potential for suspended silt/sediments and resulting siltation as a result of preparing the beds for shellfish cultivation. Siltation and suspended sediments have the potential to affect water quality by increasing turbidity. The severity of impacts is seen to be related to increased levels of sediment being resuspended and regular exposure to such events. Increased water turbidity can	Impacts from siltation and suspended sediments are unlikely to be seen as a result of aquaculture activity in Poole Harbour. Studies on siltation and sedimentation from dredging indicate that increases in suspended sediment and settling occur within a fairly small area around dredge works. This is particularly true where dredging is small-scale and occurs over short time scales as would be the case for dredging activity to 'clean' the beds not previously subject to aquaculture activity. Evidence from estuarine environments points to a degree of adaptation by benthic species to increased sediment loads as this process is more likely to occur naturally within these areas. Smothering of intertidal seagrass beds and saltmarsh areas is unlikely as the intertidal seagrass	Lease holders are required to submit a business plan outlining the species and activities which will be carried out over lease beds. This business plan covers the 5-year period for the lease and there is a requirement for permit holders to operate as per their business plan. There will therefore not be any additional activities undertaken on lease ground other than those that have been assessed under the business plans. Any additional activities over the period 2020-25, that are not covered by this assessment, will require a separate assessment. The extent of the Poole Harbour Fishery Order 2015 excludes all supporting habitats except intertidal mud. The T2 leased bed reallocation program involved the removal of lease ground from an area where it overlapped with intertidal mud. Within the extent of the Order lease ground does not

				inhibit respiratory and feed functions as well as burring capacity for benthic organism. Smothering on the seafloor can also result in the creation of hypoxic or anoxic conditions in the sediment. This can impact benthic organisms, with sessile and immobile organisms being most vulnerable.	beds and saltmarsh within Poole Harbour are excluded from the extent of the Order and are approx. 1km and 700m from the nearest lease bed respectively and sediments are seen to settle over much shorter distances (8.2% of sediment remaining in suspension at 315m from a dredge site after 1 hour (Dale *et al.,* 2011)).	overlap with intertidal mud except for 0.1 ha within a single bed. The impact of suspended sediments and siltation is deemed to be negligible due to the size of the area. The proximity of this area to a personal watersports area means that the area is likely to be subject to a degree of anthropogenic disturbance. Therefore, benthic communities may already exhibit a degree of adaptation to disturbance which would reduce the impact of any activity from aquaculture. Preparation of ground not previously subject to aquaculture activity will take place over a two-day period during the summer of 2020 for 11.24 ha and periodically over a two-week period between April and September for 26.29 ha. This is therefore a short time frame over which the activity will occur, the degree of dredging taking place over this short time period and not on a repeated basis will result in limited suspension of sediment and rapid resettling. The Authority has the ability to enforce regulations for aquaculture on lease ground within the Order. Only persons and vessels named in the

						business plans may operate on lease ground preventing other vessels from operating in this area and preventing any activity which may be contrary to that in the business plans. The IFCA has the ability to carry out inspections to ensure that the provisions within the business plan and lease are being adhered to.
Avocet Black-tailed godwit Little egret Shelduck Spoonbill Waterbird assemblage Mediterranean gull Common tern Sandwich tern	Intertidal mud Intertidal seagrass beds	Supporting habitat: extent and distribution of supporting habitat for the breeding season; Supporting habitat: extent and distribution of supporting habitat for the non-breeding season	Restore the extent, distribution and availability of suitable breeding habitat which supports the feature for all necessary stages of its breeding cycle (courtship, nesting, feeding) to: Acidic dune slack lake 28 ha, Coastal lagoon (Brownsea Lagoon) 20.7 ha (of which 17.8 ha open water and 2.9 ha saltmarsh), Littoral and sublittoral seagrass beds 22 ha, Littoral sediment 1359 ha, Saltmarsh 424.65 ha, Water column (at high tide) 3,300 ha,	There is a small area of intertidal mud identified within lease ground no. 12. The area of intertidal mud is approx. 0.1 Ha in size. Over this part of this specific lease ground there is the potential for aquaculture activity to cause abrasion/disturbance of the supporting habitat on the surface of the seabed and penetration and/or disturbance of the substratum below the surface of the seabed, including abrasion. There is also the potential for physical change to another sediment type. Changes to the sediment can result in changes to the benthic community and the ability of certain organisms to colonise in a specific area. Impacts resulting from anthropogenic activities are most evidence where the disturbance causes changes to the sediment which are elevated above normal	There is only going to be one vessel operating at any one time over the 0.1 ha of intertidal mud contained within lease ground no. 12. The impact abrasion or penetration due to aquaculture activity is deemed to be negligible due to the size of the area. The proximity of this area to a personal watersports area means that the area is likely to be subject to a degree of anthropogenic disturbance. Therefore, benthic communities may already exhibit a degree of adaptation to disturbance which would reduce the impact of any activity from aquaculture. There is potential for the introduction of INIS and microbial pathogens as part of aquaculture activity in Poole Harbour as stock of	Lease holders are required to submit a business plan outlining the species and activities which will be carried out over lease beds. This business plan covers the 5-year period for the lease and there is a requirement for permit holders to operate as per their business plan. There will therefore not be any additional activities undertaken on lease ground other than those that have been assessed under the business plans. Any additional activities over the period 2020-25, that are not covered by this assessment, will require a separate assessment. The extent of the Poole Harbour Fishery Order 2015 excludes all supporting habitats except intertidal mud. The T2 leased bed reallocation program involved

			Wet grassland 85.6 ha. Restore the extent, distribution and availability of suitable habitat (either within or outside the site boundary) which supports the feature for all necessary stages of the non-breeding/wintering period (moulting, roosting, loafing, feeding) to at least: Acidic dune slack lake 28 ha, Coastal lagoon (Brownsea Lagoon) 20.7 ha (of which 17.8 ha open water and 2.9 ha saltmarsh), Fen, marsh and swamp (primarily reedbed) 149 ha, Littoral and sublittoral seagrass beds 22 ha, Littoral sediment 1,359 ha, Open water 3,600 ha, Saltmarsh 424.65 ha, Water column (at high tide) 3,300 ha, Wet	background changes resulting from natural disturbance. Aquaculture operations have the potential to introduce INIS and microbial pathogens. The introduction of certain species and diseases has the potential to negatively affect intertidal seagrass beds with invasive plant species outcompeting native seagrass plants. This can change the habitat type and consequently change the community associated with this supporting habitat which can have a knock-on effect for food web dependents such as bird species.	seed and occasionally adult shellfish will be brought into the Harbour from other domestic and European locations.	the removal of lease ground from an area where it overlapped with intertidal mud. Within the extent of the Order lease ground does not overlap with intertidal mud except for 0.1 ha within a single bed. The impact abrasion or penetration due to aquaculture activity is deemed to be negligible due to the size of the area. The proximity of this area to a personal watersports area means that the area is likely to be subject to a degree of anthropogenic disturbance. Therefore, benthic communities may already exhibit a degree of adaptation to disturbance which would reduce the impact of any activity from aquaculture. The 2020-25 leases are accompanied by a Biosecurity Plan which sets out measures that need to be taken by lease holders to ensure that the risk posed by INIS and microbial pathogens is removed. Individual business plans are accompanied by specific risk assessments for biosecurity which cover measures for purchase and import of seed/stock from the UK or outside, seed moved between aquaculture sites, the relaying of wild animals, exported

			grassland 85.6 ha.			products, the use of vessels and equipment and protocols for activity on lease ground. The Check, Clean, Dry protocol is employed by all lease holders as part of the measures outlined above. There are also specific regulations for Pacific oysters, they must be triploid or subject to another method of sterilization to prevent breeding and the formation of wild populations. The combination of these measures will greatly reduce the risk of the introduction and spread of INIS or microbial pathogens within Poole Harbour. The overarching biosecurity plan is checked by Cefas and checks are also made on the inspection protocols implemented by Southern IFCA to ensure that biosecurity protocols are being adhered to by leaseholders. This provides independent verification of the suitability of biosecurity processes for aquaculture in Poole Harbour. The Authority has the ability to enforce regulations for aquaculture on lease ground within the Order. Only persons and vessels named in the

						business plans may operate on lease ground preventing other vessels from operating in this area and preventing any activity which may be contrary to that in the business plans. The IFCA has the ability to carry out inspections to ensure that the provisions within the business plan and lease are being adhered to.
Avocet	All habitats	Non-breeding population: abundance	Maintain the size of the non-breeding population at a level which is above 459 individuals, whilst avoiding deterioration from its current level as indicated by the latest mean peak count or equivalent.	Aquaculture operations have the potential to introduce microbial pathogens in to the marine evnrionemtn	There is potential for the introduction microbial pathogens as part of aquaculture activity in Poole Harbour as stock of seed and occasionally adult shellfish will be brought into the Harbour from other domestic and European locations.	The 2020-25 leases are accompanied by a Biosecurity Plan which sets out measures that need to be taken by lease holders to ensure that the risk posed by INIS and microbial pathogens is removed. Individual business plans are accompanied by specific risk assessments for biosecurity which cover measures for purchase and import of seed/stock from the UK or outside, seed moved between aquaculture sites, the relaying of wild animals, exported products, the use of vessels and equipment and protocols for activity on lease ground. The Check, Clean, Dry protocol is employed by all lease holders as part of the measures outlined above. There are also specific regulations for Pacific oysters, they must be triploid or subject to another method of sterilization to prevent
Black-tailed godwit	All habitats	Non-breeding population: abundance	Maintain the size of the non-breeding population at a level which is above 1,576 individuals, whilst avoiding deterioration from its current level as indicated by the latest mean peak count or equivalent.			

Little egret	All habitats	Non-breeding population: abundance	Maintain the size of the non-breeding population at a level which is above 114 individuals, whilst avoiding deterioration from its current level as indicated by the latest mean peak count or equivalent.			breeding and the formation of wild populations. The combination of these measures will greatly reduce the risk of the introduction and spread of INIS or microbial pathogens within Poole Harbour. The overarching biosecurity plan is checked by Cefas and checks are also made on the inspection protocols implemented by Southern IFCA to ensure that biosecurity protocols are being adhered to by leaseholders. This provides independent verification of the suitability of biosecurity processes for aquaculture in Poole Harbour. The Authority has the ability to enforce regulations for aquaculture on lease ground within the Order. Only persons and vessels named in the business plans may operate on lease ground preventing other vessels from operating in this area and preventing any activity which may be contrary to that in the business plans. The IFCA has the ability to carry out inspections to ensure that the provisions within the business
Shelduck	All habitats	Non-breeding population: abundance	Restore the size of the non-breeding population to a level which is above 3,569 individuals, whilst avoiding deterioration from its current level as indicated by the latest mean peak count or equivalent.			
Spoonbill	All habitats	Non-breeding population: abundance	Maintain the size of the non-breeding population at a level which is above 20 individuals, whilst avoiding deterioration from its current level as indicated by the latest peak mean			

			count or equivalent.			plan and lease are being adhered to.
Waterbird assemblage, non-breeding	All habitats	Assemblage of species: abundance	Maintain the overall abundance of the assemblage at a level which is above 25,176 individuals whilst avoiding deterioration from its current level as indicated by the latest peak mean count or equivalent.			
Mediterranean gull	All habitats	Breeding population: abundance	Maintain the size of the breeding population at a level which is above 64 pairs, whilst avoiding deterioration from its current level as indicated by the latest mean peak count or equivalent.			
Common tern	All habitats	Breeding population: abundance	Maintain the size of the breeding population at a level which is above 178 pairs, whilst avoiding deterioration from its current level as indicated by the latest mean peak count or equivalent.			

Sandwich tern	All habitats	Breeding population: abundance	Maintain the size of the breeding population at a level which is above 181 pairs, whilst avoiding deterioration from its current level as indicated by the latest mean peak count or equivalent.			

7 Conclusion[12]

In order to conclude whether the issuing of leases for 2020-25 under the Poole Harbour Fishery Order 2015, which will allow aquaculture to take place within a defined area of Poole Harbour, has an effect on the integrity of the Poole Harbour SPA, it is necessary to assess whether the impacts of the issuing of the leases will hinder the site's conservation objectives, namely;

Ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the site contributes to achieving the aims of the Wild Birds Directive, by maintaining or restoring;

- The extent and distribution of the habitats of the qualifying features
- The structure and function of the habitats of the qualifying features
- The supporting processes on which the habitats of the qualifying features rely
- The population of each of the qualifying features, and,
- The distribution of the qualifying features within the site.

The review of research into the impacts of aquaculture and associated dredging activity (detailed in section 6.2) identifies that there is the potential for these activities to disturb bird features, cause changes in prey availability, cause a collision risk, result in changes to suspended solids, smothering and siltation rates, abrasion and/or penetration of supporting habitats and introduce INIS, microbial pathogens or genetic modifications. It is therefore recognised that these activities have the potential to lead to an adverse effect upon the following SPA attributes:

- Disturbance caused by human activity
- Supporting habitat: landscape
- Connectivity with supporting habitats
- Supporting habitat: food availability within supporting habitat
- Supporting habitat: water quality – turbidity
- Supporting habitat: extent and distribution of supporting habitat for the breeding season
- Supporting habitat: extent and distribution of supporting habitat for the non-breeding season
- Non-breeding population: abundance
- Assemblage of species: abundance

[12] If there is a conclusion of an adverse effect alone, an in-combination assessment is not required

- Breeding population: abundance

These potential impacts and risks to the integrity of the site are mitigated through a number of management measures implemented under the lease and practices outlined in business plans submitted by lease holders as follows:

Lease holders are required to submit a business plan outlining the species, activities, vessels and personnel which will be used on the ground that they will be leasing. This business plan has to cover the full period of the five-year lease and lease holders are required to comply with what is set out in their business plan. Any additional activities over the period 2020-25, that are not covered by this assessment will require a separate assessment.

By setting out the species, activities and vessels that will be used there can be an assessment of likely effort over the lease beds for the duration of the lease period. There will be a maximum of nine vessels associated with aquaculture activities and it is thought, based on current knowledge of aquaculture practices and the workings of the lease ground from 2015-20 that a maximum of five of those vessels would be in use at any one time but that this number will often be lower. There is no risk of increased effort over the period of the five-year lease. This low level of vessel effort also mitigates against collision risk above water for bird features. Research indicates that the collision risk between bird species and vessels is very low compared to fixed structures. The lease does not permit the erection of any fixed structures on the lease beds therefore there is no risk of introducing extra collision risk for the duration of the five-year lease. With regard to collision in general, risk is seen to be higher at night, during periods of inclement weather where there are no other landing areas or sources of light other than the fixed structure. In Poole Harbour, very limited aquaculture activity will be taking place at night and, given experience of practices between 2015-2020 any inclement weather which would cause an issue for bird species would result in vessels not being able to go out on to lease beds. Poole Harbour has many landing points for bird species and many sources of light, bird species are therefore extremely unlikely to be attracted toward vessels operating on aquaculture beds over and above other areas of the Harbour. The collision risk between bird features and vessels on lease beds is therefore thought to be extremely low.

The requirement to state the species that are to be farmed allows an assessment of those species to be made over the five-year lease period. Except for Pacific oysters (*Magalllana gigas*) there are no species proposed to be farmed which are classified as non-native species. The biosecurity plan and requirements of the lease dictate specific measures with regard to Pacific oysters to mitigate against the risk of this non-native species forming wild populations. Lease holders are required to farm Pacific oysters which are triploid or have been subject to another method of sterilization. If a lease holder wishes to farm Pacific oysters from any other type of stock then they must seek approval from Southern IFCA who will consult with Natural England. There would also be a requirement for a separate Habitats Regulations Assessment. Commencing in 2021, the Southern IFCA will also be undertaking a shore-based survey of wild populations of Pacific oyster in Poole Harbour in conjunction with the University of Southampton. For other species including clam species, common cockle and native oyster, any removal of individuals from lease beds is subject to the Minimum Conservation Reference Size (MCRS). Many of the bivalve mollusc species found in the Harbour are food sources for the bird features of the SPA. Manila clam has been shown to be an important food source for oystercatchers and other bird species, reducing mortality

rates. By ensuring that these species are not removed from lease ground under MCRS individuals will have had at least one chance to breed before being removed. This will help maintain stocks of these shellfish species both within the vicinity of lease beds and within the wider Harbour through spread of larvae, maintaining and enhancing stocks of prey species for bird features.

The extent of the Order was designed to exclude all supporting habitats for the SPA and there are no areas of saltmarsh, reedbed or intertidal seagrass within the extent of the Order. There is therefore no risk of aquaculture activities occurring over these habitats. In addition, the location of saltmarsh and seagrass beds in relation to the nearest lease bed is 700m and 1km respectively. In this way there is very little risk of smothering or siltation effects on these supporting habitats. Previous research has indicated that for small-scale dredging activity, such as that occurring on the lease beds within Poole Harbour, suspended sediments do not persist in the water column over extended periods of time and the majority (up to 92.8%) had resettled within 315m indicating that it is very unlikely that any suspended sediment from aquaculture activity would have an impact on these supporting habitats. The creation of suspended sediments in the water column is further mitigated by the processes outlined in the relevant business plans for the preparation of lease ground that has not previously been subject to aquaculture activity. Within these relatively small areas, dredging processes to remove weed and debris will be taking place over short time scales (2 days for one area and periodically over 2 weeks for another area) and this process will only be undertaken once. The measures, combined with the knowledge of the settling of suspended sediments, indicate that the risk of smothering, siltation and suspended sediments in the water column is low, this will not only reduce the risk on supporting habitats but also for visual feeding bird species such as the Common tern and Sandwich tern.

The risk to other supporting habitats and important areas is also mitigated. A sandbank, which has been identified as having the potential as suitable habitat for sand eels, a prey species for bird features, is not covered by any lease ground. There is therefore no risk of aquaculture activity occurring over this area. The extent of the Order also excludes Brownsea Lagoon, any risk to this lagoon as a result of pathogens or Invasive Non-Indigenous Species (INIS) in the water is covered under the biosecurity mitigation measures. The areas within the Harbour defined as Bird Sensitive Areas (Brands Bay, Newton Bay, Ower Bay, Wych and Middlebere Lakes, Arne Bay, Keysworth, Holes Bay) are excluded from the extent of the Order. The distance between a lease bed and the nearest BSA is over 1km therefore the risk of disturbance to roosting, feeding and breeding birds is mitigated. The extent of the Order also excludes the area of Seagull Island where Mediterranean gulls are known to nest. Aquaculture activity will also not be permitted to take place outside of daylight hours (08:00 to 16:00) during the period September to March, this will ensure that there is no disturbance to night time roosts of important bird features. This exclusion of BSAs from the extent of the Order and temporal restrictions coupled with the distance from any lease ground plus the effort limitation provided by a limited number of vessels authorised to operate on lease ground ensures that the risk of disturbance to bird features from aquaculture activity is as low as it can be for the whole year and over the five-year lease period.

Intertidal mud supporting habitat was identified within the extent of the Order. Under the T2 lease bed reallocation program one of the lease beds was subject to a part-closure and reallocation to remove any overlap with the intertidal mud feature. One lease bed contains a very small area of

intertidal mud (0.1 ha). This lease bed was analysed further with regard to the potential impacts of aquaculture activity (see Annex 9 for the evidence package detailing the evidence collated) and it was determined that there would be no adverse impact from aquaculture activity. In addition, with regard to removal of non-target species at the point at which this area is prepared for aquaculture activity, this will occur for a short time period within the summer months, outside of the time period when bird features have the highest requirement for energy (during the winter). The short time scale over which preparation work will occur, combined with the fact that this is a one-off occurrence will allow for any recovery to occur and be maintained for the duration of the lease period. Many of the species that would colonise this small area following preparatory dredging (i.e., annelids, small molluscs) are key prey items for the bird features of Poole Harbour. Further consideration was also given to aquaculture activity occurring over lease beds 7 and 8 given the potential for these areas to become exposed at very low spring tides. An assessment was made of these beds and the specific activities proposed to take place in these areas and an evidence package was produced (Annex 8), the results of this assessment for these two lease beds indicated that the proposed aquaculture activity would have no adverse effect on the features of the SPA.

The availability of prey species was also considered and it was determined that the low frequency of dredging activity could be identified as having a low risk in effecting the benthic community and thus the availability of other prey items, with more intensive dredging practices showing no change in biotope or ecological quality in intertidal sediments within Poole Harbour. The increase in certain species, i.e., small polychaete worms, documented to follow more intensive dredging activity may also benefit ten of the species protected under the SPA. In addition, the farming of the common mussel (*Mytilus edulis*) will provide a food source for a bird species identified as being in unfavourable condition (Goldeneye). The farming of this species will also benefit other bird species within the Harbour including curlew and redshank (components of the waterfowl assemblage), herring gull and oystercatcher. It has also be demonstrated that oystercatcher benefits from the presence of Manila clam (*Ruditapes philippinarum*) as a prey species, another species which is being farmed under The Order. Finally, farming methods do not remove or have the potential to remove fish from the marine environment and therefore will not impact bird species with fish as their primary prey source (Red-breasted merganser, foraging tern species, Eurasian spoonbill).

The biosecurity plan which accompanies the leases for 2020-25 outlines measures which need to be adopted by lease holders to ensure that the risk posed by Invasive Non-Indigenous Species (INIS) and microbial pathogens is appropriately mitigated. The overarching risk assessment is included in Annex 7. The requirement for individual business plans to be accompanied by a biosecurity risk assessment specific to the work of that particular lease ensures that measures are tailored to individual activities and species. The biosecurity plan provides mitigation for purchase and import of seed/stock from the UK or outside the UK, movement of seed between aquaculture sites, the relaying of wild animals, exported products, the use of vessels and equipment and protocols for operations on lease ground. The recognised Check, Clean Dry protocol is employed by all lease holders as part of these measures and there is a reporting process for reporting any detected biosecurity risks to the Southern IFCA as well as a national database. Details of all of these measures can be found in section 4.2.4. This combination of mitigation measures will greatly reduce the risk of introduction and spread of INIS or microbial pathogens within Poole Harbour. Additional measures for Pacific oysters outlined previously will also mitigate against the formation of wild populations by this farmed INIS species. The overarching Southern IFCA biosecurity plan is checked

by Cefas and checks are also made on the inspection protocols carried out by Southern IFCA to ensure that lease holders are complying with the mitigation measures set out in their biosecurity risk assessments. This provides independent verification of the suitability of the biosecurity mitigation measures for aquaculture in Poole Harbour.

The Southern IFCA also has a robust compliance and enforcement framework which will also be applied to lease ground under the Order. Southern IFCA will be carrying out inspections to ensure that lease holders are operating according to their business plan and the requirements under their lease. The requirement for business plans to stipulate the vessels and persons that can operate over lease ground ensures that only legitimate users can undertake activity in these areas. This removes the ability for other vessels or persons to engage in activity in these areas which may be contrary to the requirements of the lease or operate in a way which is not compatible with this assessment. The detection of any non-compliance or any intelligence of non-compliance can be fed into the compliance and enforcement framework through which assets can be assigned to deal with the risk and appropriate courses of action determined.

Taking into account all the evidence presented in this Appropriate Assessment, including scientific literature, habitat feature data and knowledge of the activities proposed to be carried out on lease ground, it is concluded that the issuing of leases for 2020-25 under the Poole Harbour Fishery Order 2015 will not hinder the site from achieving its conservation objectives and as such will not have an adverse effect upon the integrity of the Poole Harbour SPA and Ramsar site. The requirements of the lease and the biosecurity plan, and how these relate to the species, vessels and activities outlined in the individual business plans will ensure mitigation against any potential impacts of the fishery on the bird features and supporting habitats for the site. The extent of the Order excludes all defined bird sensitive areas and all supporting habitats except a small area of intertidal mud. Within the extent of the Order the T2 Leased Bed Reallocation Program has removed part of one leased bed from overlapping with an area of intertidal mud. The only remaining area of intertidal mud overlapping with lease ground is a 0.1 ha area where any potential impacts have been assessed (see table 6.5 and information contained in this section for details). Potential impacts from the introduction of INIS or microbial pathogens are mitigated through the measures in the biosecurity plan and specific risk assessments for each business plan ensure these measures are implemented appropriately for individual activities. Requirements for Pacific oysters to be triploid or subject to another form of sterilization ensures that there is no adverse effect from the farming of these species as an INIS. For any emerging activities that lease holders may wish to carry out that are not currently referred to in the business plans, methodologies must be submitted to the Southern IFCA eight weeks prior to any activity commencing. If the activity is not already considered as part of this assessment then an additional appropriate assessment will be carried out.

8 In-Combination Assessment

Based on the mitigation measures outlined in section 7, it is concluded that the issuing of leases for 2020-25 under the Poole Harbour Fishery Order 2015 alone will not hinder the site from achieving its conservation objectives and as such will not have an adverse effect upon the integrity of the Poole Harbour SPA and Ramsar site.

Under Article 6(3) of the Habitats Directive, the assessment of any plan or project likely to have a significant effect on a Natura 2000 site, must be assessed in combination with other plans or projects. Any commercial plan or project requires a Habitats Regulations Assessment in their own right and must also account for any in-combination effects with the Poole Harbour Fishery Order 2015.

Commercial plans and projects that occur within or that may affect the Poole Harbour SPA are considered below.

Project	Status	In-combination Assessment
Poole Local Plan	Ongoing	Poole Local Plan describes the requirement that Poole District must add at least 14,200 homes between 2013 and 2033. An increase in homes will directly increase the number of people living in the area. As it is well known that those who live close to the sea often take recreational visits to these areas it is likely that this will lead to an increased level of disturbance to protected overwintering birds around Poole Harbour. Therefore, one common impact pathway between this project and the Poole Harbour Fishery Order 2015 of visual disturbance/above water noise is possible. However, through this assessment of the Poole Harbour Fishery Order 2015 it is clear that these pressures have been screened out from having an adverse effect on the integrity of the site. Furthermore, each individual housing development will have to undergo a Habitats Regulations Assessment of its own as well as an in-combination assessment with fishing activity to ensure it does not cause adverse effect to the integrity of Poole Harbours MPAs. As these developments are not yet in the planning stages, and are likely to come in the form of many smaller developments over a long period of time, and with the consideration of the permits mitigating factors considered within this HRA it is unlikely that there will be a combination effect between those developments and the Poole Harbour Fishery Order 2015.

8.1 Fishing Activity In-Combination Assessment

The Poole Harbour Dredge Permit Byelaw	The Poole Harbour Dredge Permit Byelaw regulates fishing for shellfish using dredges within Poole Harbour. The byelaw permits the use, storage, transportation and retention on board of the fishing gear and 45 permits are issued annually. The permit fishery is subject to an annual Habitats Regulations Assessment. The conclusion of the 2020-21 HRA was that the dredge permit fishery would have no adverse effect on the integrity of the Poole Harbour SPA. The Poole Harbour Fishery Order 2015 is a several order and therefore the areas of lease ground are severed from the public fishery. There is therefore no potential for spatial overlap of the two activities within Poole Harbour. Based on this and the conclusion of both the HRA for the issuing of leases for 2020-25 under the Poole Harbour Fishery Order 2015 and the HRA for the issuing of permits under the Poole Harbour Dredge Fishery of no adverse effect. It is concluded that there will be no in-combination effect on the integrity of the Poole Harbour SPA from these two fishing activities.
Light otter trawl	Light otter trawls do not interact with the features. At a TSLE level no common pressures between light otter trawl and the Poole Harbour Fishery Order 2015 were screened in. Therefore, there is unlikely to be any in-combination effect between the two gear types.
Pots/creels	At a TSLE level no common pressures between static gear and the Poole Harbour Fishery Order 2015 were screened in. Therefore, there is unlikely to be any in-combination effect between the two gear types.
Handlines (rod/gurdy) & Jigging/trolling	At a TSLE level no common pressures between handline/jigging and the Poole Harbour Fishery Order 2015 were screened in. Therefore, there is unlikely to be any in-combination effect between the two gear types.

9 Summary of Consultation with Natural England

Date	Contact	Sent	Comments Received
Marine Senior Advisor	Gavin Black	21/04/20	14/07/20
Marine Senior Advisor	Gavin Black	27/11/20 19/12/20	For additional evidence packages: 20/12/20

			In addition to this HRA being submitted to Natural England for information and comment, three evidence packages concerning measures specific to lease beds 7 and 8, lease bed 12 and the farming of Pacific oysters were sent to Natural England for information and comment.

10 Integrity Test

Based on the mitigation measures, in the form of the lease and biosecurity plan and how these relate to the species, vessels and activities outlined in the individual business plans, it is concluded that the issuing of leases for 2020-25 under the Poole Harbour Fishery Order 2015 will not have an adverse effect, alone or in-combination, on the bird features and their supporting habitats within the Poole Harbour SPA.

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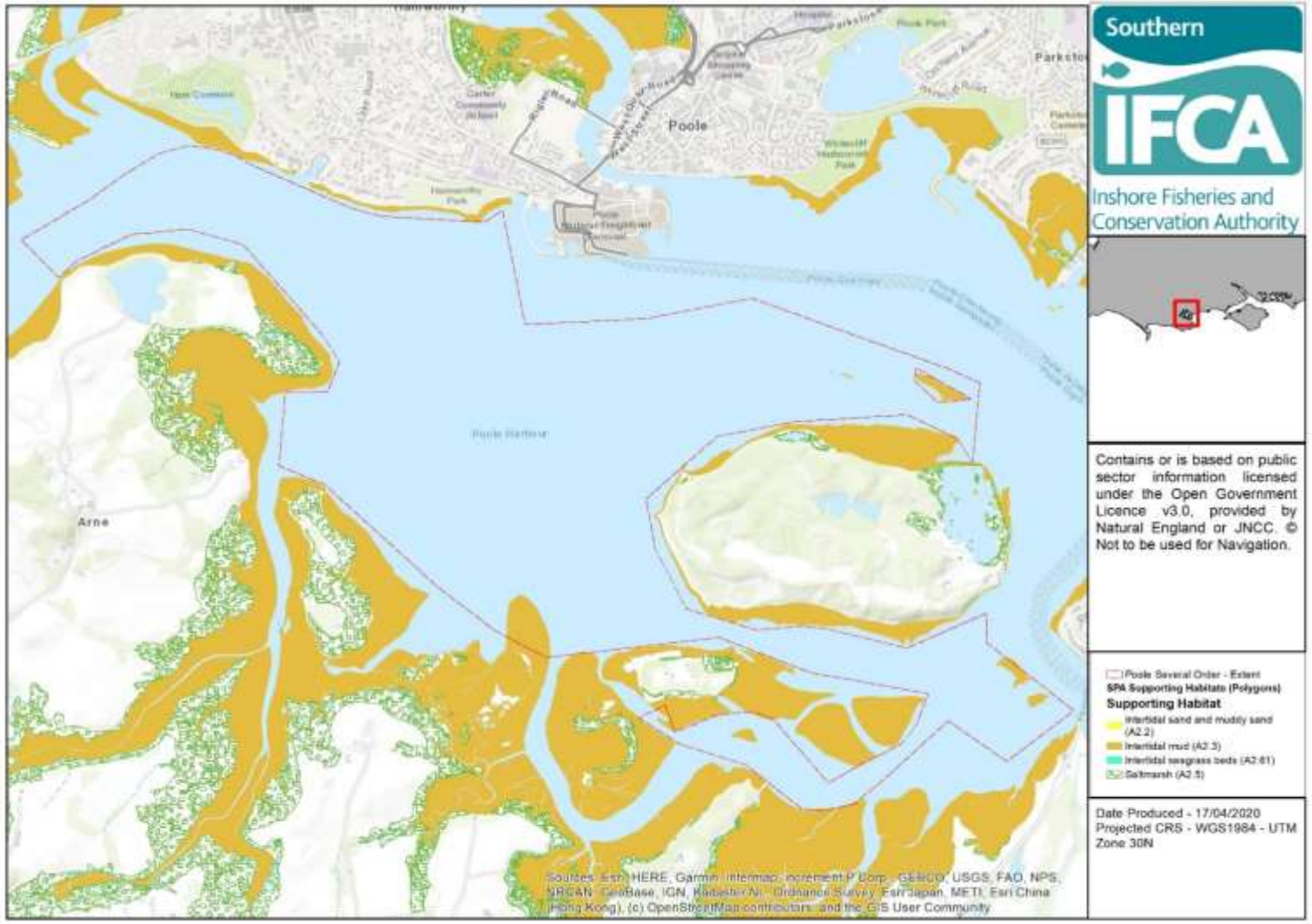
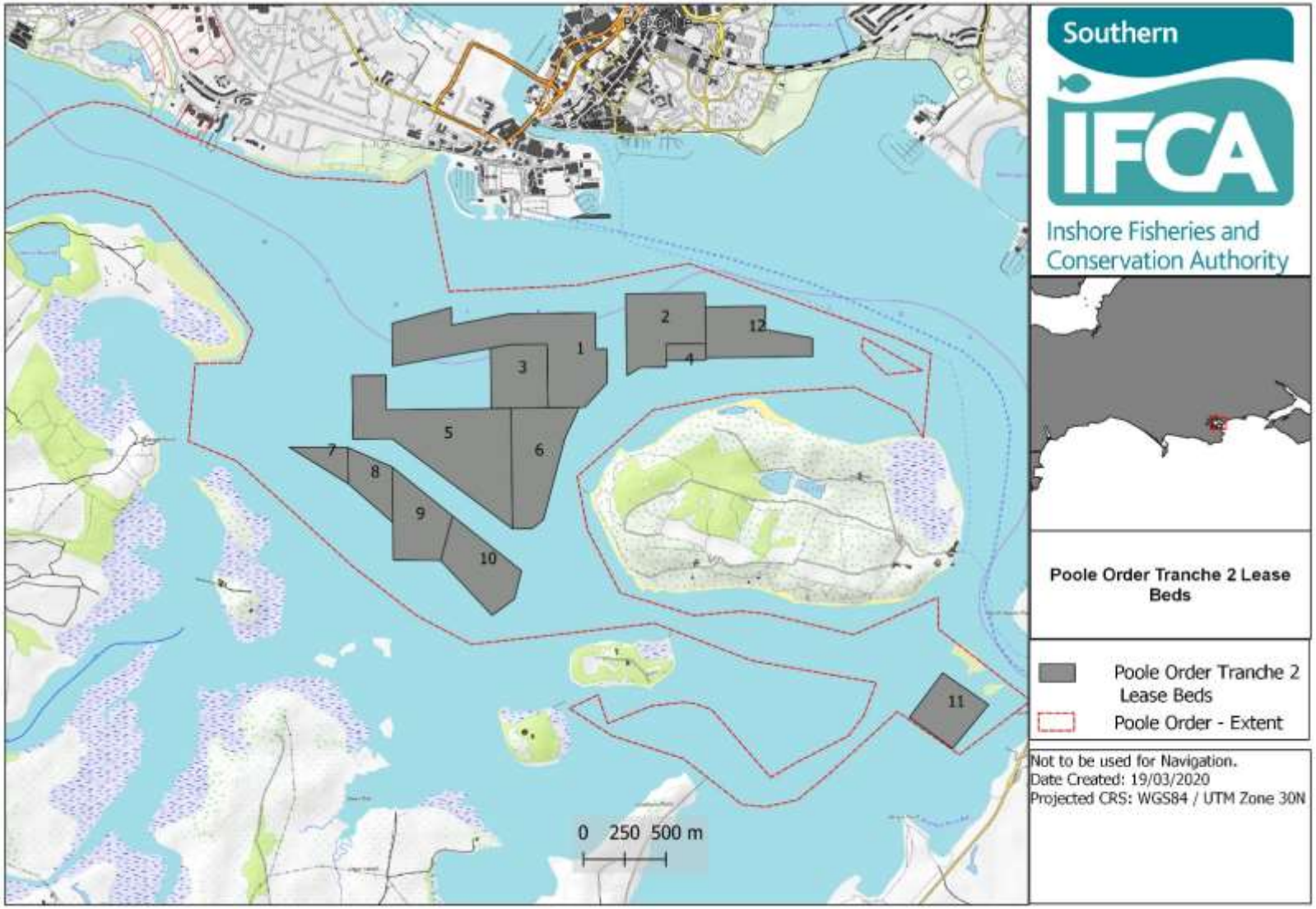
Annex 2 – Feature/Sub-Feature location and extent for Poole Harbour



 SIFCA Reference: SIFCA/HRA_PP/PooleOrder202025

Annex 3 – Extent of the Poole Harbour Fishery Order 2015 and Location of Tranche 2 Lease Beds



 SIFCA Reference: SIFCA/HRA_PP/PooleOrder202025

Annex 4 – NE Advice

Date: 3rd June 2014

Rob Clarke
Chief Executive
SIFCA
64 Ashley Road
Parkstone
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BH14 9BN

Natural England
Sunrise Business Park
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Dear Rob

Poole Harbour Several Order –

The following is Natural England's formal advice as to the potential impacts of aquaculture on the nature conservation features of Poole Harbour to inform the proposed SIFCA Several Order as to the likely environmental constraints with respect to where aquaculture can take place in the Harbour. **However a full assessment of likely impacts cannot be made until the details of each aquaculture proposal is put forward when applicants apply for a lease bed.**

1. **Legal Requirements**

Aquaculture takes place within Poole Harbour Site of Special Scientific Interest (SSSI). This SSSI is part of Poole Harbour Special Protection Area (SPA), and Poole Harbour Wetland of International Importance under the Ramsar Convention (Ramsar Site). Poole Harbour SPA and Ramsar site is afforded protection under the Habitats and Species Regulations 2010 (as amended) while Poole Harbour SSSI is afforded protection under the Wildlife and Countryside Act (1981) (as amended under the Countryside and Rights of Way Act 2000).

Natural England and S-IFCA have duties under Regulation 9 (3) of the Conservation of the Habitats & Species Regulations 2010 as competent authorities with functions relevant to marine conservation to exercise those functions so as to secure compliance with the Habitats Directive. Article 6.2 of the Habitats Directive requires appropriate steps to be taken to avoid, in Natura 2000 sites, the deterioration of natural habitats and habitats of species as well as significant disturbance of the species for which the area has been classified[1] The IFCA also need to ensure that aquaculture proposals are compatible with the conservation and enhancement of the special interest of the Poole Harbour SSSI in line with the status as a Section 28 G authority under the Wildlife and Countryside Act 1981 (as amended).

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SIFCA must therefore ensure that aquaculture is managed so as to avoid damage or deterioration to the conservation features of the European Marine Site and ensure the activity is not likely to disturb or damage any of the interest features of the SSSI.

2. **Protected Sites**

Poole Harbour was classified as a SPA for birds because it supports an assemblage of over 20,000 waterfowl, internationally important populations of overwintering shelduck and black tailed godwit and over 1% of three species listed on Annex 1 of the birds directive (overwintering avocet, breeding common tern and breeding Mediterranean gull).

It is also a wetland of international importance under the Ramsar convention because it regularly supports over 20,000 waterfowl and over 1% of populations of avocet, black tailed godwit, common tern, Mediterranean gull and shelduck while also being a good example of an estuary, supporting an appreciable assemblage of rare, vulnerable or endangered species and being of special value for maintaining the genetic and ecological diversity of a region because of the quality and peculiarities of its flora and fauna including supporting the nationally scarce plants narrow leaved eelgrass *Zostera augustifolia* and dwarf eelgrass *Zostera noltii*.

Poole Harbour is also recognised as nationally important for its extensive mudflats and marshes which together with the permanent channels support large populations of overwintering waders and wildfowl. The fringing habitats support further rare and scarce fauna and flora including nesting birds. Several rare marine invertebrates also occur within the Harbour. With respect to nesting birds Poole Harbour condition assessment in 2010 noted the harbour was nationally important for its breeding populations of common and Sandwich terns, Mediterranean and black-headed gulls, Cetti's warbler, bearded tit and water rail. In a local context, the breeding population of the amber-listed redshank and reed bunting are also important. Other relevant species recorded breeding and part of the breeding bird assemblage include shelduck, little egret, grey heron, teal, mute swan, snipe, ringed plover, oystercatcher, reed warbler (Underhill-Day et al., 2010.)

The Poole Harbour SPA, Ramsar and SSSI citation are provided in Appendix 1.

3. **Poole Harbour Special Protection Area**

a) Conservation objectives

The conservation objectives for Poole Harbour SPA are provided in Appendix 2.

In summary, the qualifying features are Common shelduck (Non-breeding), Pied avocet (Non-breeding), Black-tailed godwit (Non-breeding), Mediterranean gull (Breeding), Common tern (Breeding) and the Waterbird assemblage. In addition, little egret and aquatic warbler were identified as qualifying features by the UK SPA Review in 2001. However more recent data suggests aquatic warbler nolonger qualify in terms of numbers. Breeding sandwich terns are however now occurring in internationally important numbers and therefore qualify. http://jncc.defra.gov.uk/page-1419 Natural England recommends that as a matter of best practice these additional qualifying features should be a material consideration when assessing the impact of activities on a site.

With regard to the individual species and/or assemblage of species for which the site has been classified ('the Qualifying Features') the conservation objectives are to '*Avoid the deterioration of the habitats of the qualifying features, and the significant disturbance of the*

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qualifying features, ensuring the integrity of the site is maintained and the site makes a full contribution to achieving Favourable the aims of the Birds Directive.'

Subject to natural change, to maintain or restore:

- The extent and distribution of the habitats of the qualifying features;
- The structure and function of the habitats of the qualifying features;
- The supporting processes on which the habitats of the qualifying features rely;
- The populations of the qualifying features;
- The distribution of the qualifying features within the site.

b) *Sub Features (Supporting Habitats for the Qualifying Features)*

The key sub features (or habitats for the SPA qualifying features) are listed in the Regulation 33 advice Package for Poole Harbour:-

Internationally important populations of the regularly occurring Annex 1 species

Shallow Inshore Waters inc. Lagoons - Shallow tidal waters provide key feeding habitat for the Annex 1 species common tern. avocet, and Mediterranean gull. Brownsea Island lagoon is an essential feeding area for wintering avocet. It also provides key nesting islands for common tern, however these are above highest astronomical tide and therefore not within the European marine site boundary. Shallow inshore waters are of importance for feeding common terns and to a lesser extent, for the qualifying population of breeding Mediterranean gulls which will also occasionally feed in these areas.

Intertidal Sediment Communities - Mudflats and sandflats support rich populations of intertidal invertebrate species, which in turn provide a food source for wintering avocets and breeding Mediterranean gull. Although avocets occasionally swim, they generally feed whilst wading on the intertidal sediments in areas of very shallow water. These habitats also provide important roosting areas for both species

Saltmarsh Communities - This habitat is of importance for providing roosting, feeding and nesting habitat. Upper saltmarsh is of importance as nesting habitat for both common tern and Mediterranean gull, whilst saltmarsh habitats, and in particular the associated creeks are also used as a feeding area by Mediterranean gull. Saltmarsh provides ideal highwater roosts for all of the annex 1 species.

Internationally important assemblage of waterfowl including internationally important populations of regularly occurring migratory bird species

'Shallow Inshore Waters inc. Lagoons - Shallow tidal waters provide key feeding and roosting habitat for the internationally important populations of wintering shelduck. Shallow tidal waters also provide key feeding habitat for nationally important populations of goldeneye, red-breasted merganser and cormorant, which feed on fish and small molluscs.

Intertidal Sediment Communities Mudflats and sandflats support rich populations of intertidal invertebrate species, which in turn provide a food source for the internationally important populations of black-tailed godwit and shelduck. Nationally important populations including dunlin, teal, curlew, spotted redshank, greenshank, redshank and black-headed gull also feed on these rich populations of intertidal invertebrate species. Nationally important populations of dark-bellied brent geese feed on *Zostera* and *Enteromorpha* that grow on the intertidal sediment communities. These habitats provide important roosting areas for all of these species.

Saltmarsh Communities - Upper and lower saltmarsh provide important feeding areas for the internationally important assemblage of waterfowl and its qualifying species. Upper saltmarsh in particular also makes ideal highwater roost sites. Dark-bellied brent geese and teal feed on saltmarsh plants and their seeds.

Reedbeds - These provide feeding and roosting areas for a proportion of the internationally important assemblage of waterfowl. They are of particular importance for teal and pochard. Reed beds also play a key role in providing shelter for adjacent sub features.'

c) Summary of potential impacts of aquaculture on the attribute targets that could prevent the achievement of the conservation objectives for the SPA

The attributes listed in the tables in Appendix 3 are considered to be those most likely to contribute to this European Site's ecological integrity and towards the achievement of the European Site Conservation Objectives.

Natural England consider that shellfish dredging activity could prevent the site from achieving its conservation objectives through impacts on the following attributes:-

i) Disturbance caused by human activity (minimising disturbance)

The frequency, duration and/or intensity of disturbance affecting the foraging and roosting overwintering waterbird assemblage, avocet, black tailed godwit, shelduck and little egret should not reach levels which significantly affects the feature.

Potential Impact
Over the winter 2011/2012 a study of disturbance with respect to bird behaviour (waders and wildfowl) in relation to activities in the Harbour took place (Liley & Fearnley, 2012). The report found disturbance levels appeared to affect the distribution of birds within the harbour with bird densities lower where more people or boats were observed. The report found water based activities were generally more disturbing than intertidal activities with shore based activities the

1 Article 6.2 of the Habitats Directive requires appropriate steps to be taken to avoid, in Natura 2000 sites, the deterioration of natural habitats and habitats of species as well as significant disturbance of the species for which the area has been classified. (Article 7 clarifies that this Article should also apply to obligations arising from the Birds Directive)

least disturbing. It cannot be dismissed therefore that boat movements used for aquaculture together with other disturbance factors would not cause a significant disturbance to the features of the SPA when taking place in proximity to key feeding and roosting habitat (eg saltmarsh and shallow inshore waters).

The European Commission guidance states that any event contributing to the reduction or to the risk of reduction of the range of the species within the site or a reduction of the size of the habitat of the species within the site can be regarded as a significant disturbance[1].

Aquaculture activity could cause noise and visual disturbance (either alone or in combination with other plans and projects) to the features listed above when taking place at key times of the year for the overwintering birds and in proximity to important feeding and roosting sites. The significance of this disturbance is likely to depend on the availability of alternative undisturbed areas for birds; and the frequency and intensity at which boat movements are taking place (Liley & Fearnley, 2012).

ii) Extent and Distribution of supporting non-breeding habitat

The extent and distribution of suitable habitat (either within or outside the site boundary) which supports overwintering waterbird assemblage, avocet, black tailed godwit, shelduck and little egret for all stages of the non-breeding period (moulting, roosting, loafing, and feeding) is maintained.

Potential Impact
In addition the main eelgrass beds within the intertidal sediment communities in Poole Harbour are known to support fish eating species such as red breasted mergansers as well as providing a food source for dark bellied brent geese. Physical damage could occur from the laying of shellfish and structures supporting on aquaculture on the intertidal sediment communities including eelgrass beds if it takes place within this habitat.

Shallow inshore waters also provide important feeding and roosting habitats for species such as goldeneye, red breasted merganser and cormorant. Some aquaculture practices could potentially have an impact on the extent of this habitat eg where floating structures are causing a loss in the extent of the habitat. Distribution maps of species feeding and roosting over shallow water are attached (Appendix 5). In most instances the distribution of these species is not localised to one particular area although pochard appear to be preferentially feeding in the western part of the Harbour.

ii) Extent and Distribution of supporting breeding habitat

The extent, distribution and availability of suitable breeding habitat which supports common tern, sandwich tern and Mediterranean gull for all stages of their breeding cycle (courtship, nesting, feeding) is maintained.

Potential impact
Shallow inshore waters provide key feeding habitat for breeding common and sandwich terns and Mediterranean gull. Some aquaculture practices could potentially have an impact on the extent of this habitat eg where floating structures are causing a loss in the extent of the habitat. Common and sandwich tern distribution however is quite widespread throughout the Harbour.

ii) Breeding Population (productivity and survival)

Overall breeding productivity and adult survival is at a level which is consistent with maintaining the

[1] European Commission. 2000. **Managing Natura 2000 sites : The provisions of Article 6 of the 'Habitats' Directive 92/43/EEC.** Luxembourg: Office for Official Publications of the European Communities.

structure and abundance of the population of Mediterranean gulls at or above its current or target level, whichever is the higher or all stages of its breeding cycle (courtship, nesting, feeding) is maintained.

Potential Impact
Disturbance of Mediterranean gull nesting sites from boat movements for aquaculture taking place in proximity to Seagull Island could cause a decline in the annual productivity or breeding success of the population (i.e. the number of chicks successfully raised per breeding pair per year) and this may adversely affect the overall size and age-structure of the breeding population and its long-term viability. Common and sandwich tern nest at Brownsea Lagoon where there is no fishing access and would therefore not be exposed to disturbance.

iv) Food availability (Function and supporting processes)

Maintain the overall prey availability of key prey species of preferred prey sizes which supports overwintering waterbird assemblage, avocet, black tailed godwit, shelduck and little egret and breeding common tern, sandwich tern and Mediterranean gull

Potential Impact
Sediment disturbance as a result of aquaculture (and in combination with other activities eg baitdigging and baitdragging) can potentially impact on bird prey availability, prey size and the birds ability to forage over intertidal sediment communities and shallow inshore waters. This can be through removal (mortality) of target and non target species and impacts on non target prey availability through changes in habitat structure of the intertidal sediment communities. In addition aquaculture practices could also potentially affect the water quality which in turn could impact on the prey availability.

4. Poole Harbour Ramsar

In addition to the above overwintering waders and wildfowl, the Ramsar site is also designated for its eelgrass beds. Physical damage could occur to this habitat if shellfish or structures supporting aquaculture were laid over the eelgrass beds.

5. Poole Harbour SSSI

In addition to the bird features for which the SPA is classified the SSSI is designated for nesting birds using the fringing reedbed and saltmarsh habitats of Poole Harbour and marine invertebrates. Aquaculture has the potential to damage the breeding bird assemblage feature through disturbance to breeding birds effecting breeding productivity when taking place in proximity to their nesting and feeding sites. Unusually dense forests of the peacock worm *Sabella pavonina* were recorded in the channels of the Harbour in the 80's associated with the subtidal fine sands of the central harbour and proposals for aquaculture could potentially damage this feature when taking place in these locations.

6. Poole Harbour Aquatic Management Plan

Poole Harbour's Aquatic Management Plan serves as Poole Harbour's European Marine Site management scheme under which relevant authorities functions (including any power to make byelaws) are to be exercised so as to secure in relation to that site compliance with the requirements of the Habitats Directive *www.**pooleharbour**aqmp.co.uk*

Bird Sensitive Areas – All recreational users are asked in Poole Harbour's Aquatic Management Plan to avoid these areas at key times of the year.

These are areas where at present there is relatively little disturbance, or areas where the geographically enclosed nature of the bays means that activities such as shellfish dredging would

have the potential to disturb birds over a large area. They are also areas where birds appear to be preferentially feeding and roosting and where the key bird interests for which the Harbour is recognised as important reside (Drake, 2006).

Appendix 4 shows the Bird Sensitive Areas which have been identified as being of particular importance to overwintering and breeding birds. During the winter, principally between 1st November and 31st March, it is essential that disturbance in the 'Overwintering Bird Sensitive Areas' are kept to a minimum to ensure these migratory birds have every opportunity to feed and rest.

During the spring, between mid April and the end of June Mediterranean gulls and common terns breed at 'Gull Island' and 'Brownsea Lagoon' respectively and disturbance should be avoided to ensure the successful hatching of eggs and rearing of chicks of these rare bird species. Appendix 4

7. Poole Harbour Condition Assessment

SIFCA should also consider the current condition of the site when determining the significance of effect of aquaculture on Poole Harbour SPA, Ramsar and SSSI.

The latest analysis of data spanning over several decades by the British Trust for Ornithology (BTO) recorded declines in a numbers of some bird species in Poole Harbour. Comparison by BTO of national, regional and local trends suggest that for shelduck, curlew, redshank and lapwing these declines are likely to be due to site-specific pressures while the declining trends of the other species appear to reflect a broad-scale shift in population. . For further information see the species accounts under http://www.bto.org/volunteer-surveys/webs/publications/webs-alerts

Bird count data (WeBs data) analysed by Natural England in 2012 also highlighted declines in the numbers of overwintering birds in some sectors of the Harbour. (Appendix 6). The data analysis highlighted in particular there was concern regarding declines in some species in Lytchett Bay (shelduck, redshank and dunlin) Brands Bay (shelduck, redshank, dark bellied brent geese, dunlin) and Wych (shelduck, black tailed godwit, dunlin).

A condition assessment of Poole Harbour SSSI was compiled in 2010.The features of interest of the Ramsar and SPA were also covered in this assessment. The main concern from the assessment is the high inputs of nitrogen into the Harbour and the consequent algal mat growth which is at levels that could impact on bird prey availability and bird foraging behaviour. A further concern is the possible reduction in the abundance and variety of benthic invertebrates with a decline in biomass of some 26% between surveys in 2002 and 2009. This may be due to year to year fluctuations in variability and slight differences in the sampling methodology although the difference is of sufficient magnitude to cause concern. There is still uncertainty as to the long term effects of pump scoop dredging and other disturbances on invertebrate distribution and abundance. (Underhill-Day et al., 2010).

Generally the breeding bird community in the Harbour is retaining its interest, and scores as in favourable condition both for sand dunes and salt marshes, and for lowland open water and margins. However breeding redshank were last recorded as being in decline. (Underhill-Day et al., 2010; Chown & Cook, 2004).

8. Potential Mitigation Measures

Natural England's advice is that to protect the SPA, Ramsar interest and SSSI, the Several Order should exclude:-

- intertidal sediment (other than that already leased for aquaculture) due to the likely loss of important supporting feeding habitat for waders and wildfowl from the laying of shellfish and structures to support aquaculture
- the main eelgrass beds that provide supporting non breeding feeding habitat to the SPA features and are also a Ramsar feature due to the likely loss of supporting feeding habitat from the laying of shellfish and structures to support aquaculture
- shallow inshore waters where species appear to be preferentially feeding eg pochard in the western part of the Harbour
- 'bird sensitive areas' to avoid disturbance to birds at key times of the year (these areas are also within the intertidal sediment)

When proposals for shellfish lease beds are put forward, SIFCA will need to assess each proposal, and consult with Natural England, to consider whether they are able to conclude no likely significant effect on the SPA and Ramsar site either alone or in combination with other plans and projects. In particular it should be considered whether the proposals will impact on the features of the site through disturbance, loss of extent of habitat or impacts on food availability. SIFCA will need to consider what mitigation measures are needed to exclude any significant effect from aquaculture or commence work on an appropriate assessment in order to ascertain that the activity will not adversely affect the integrity of Poole Harbour SPA and Ramsar. Furthermore, SIFCA should also ensure that the measures proposed are compatible with the conservation and enhancement of the special interest of the Poole Harbour SSSI in line with the status as a Section 28 G authority under the Wildlife and Countryside Act 1981 (as amended).

Please do not hesitate to contact me if you would like to discuss any of the above further.

Yours sincerely

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Annex 5 – Site Management Statement for SSSI

POOLE HARBOUR

Site of Special Scientific Interest

SITE MANAGEMENT STATEMENT

This is a public statement prepared jointly by the Southern Inshore Fisheries and Conservation Authority (IFCA) and Natural England to outline the management position in relation to fishing activity operating within the Poole Harbour Site of Special Scientific Interest (SSSI). This document refers to the Poole Harbour SSSI as notified on 24th May 2018.

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2. Annexes

The following form annexes to this management statement:

Annex 1 – Poole Harbour SSSI site map

Annex 2 – Poole Harbour SSSI citation

Annex 3 – Map of presence of *Sabella pavonina* in Poole Harbour

Annex 4 – Map of leased beds under the Poole Harbour Fishery Order 2015

3. Site Description

Poole Harbour is a bar-built estuary of nearly 4,000 ha located on the south coast of the UK in the county of Dorset. The micro-tidal regime of the site allows a significant body of water to be retained throughout the tidal cycle allowing the Harbour to exhibit many of the characteristics of both an estuary and a lagoon. The Harbour is a nationally and internationally important site for estuarine habitats which in turn support large numbers of water birds and marine invertebrates. In addition to the SSSI, the Harbour is also designated as a Special Protection Area (SPA) and a Ramsar site.

Poole Harbour SSSI (as notified on 7th December 1990) is extended by the notification of additional land under section 28B of the Wildlife and Countryside Act 1981. The extension encompasses four areas of additional land, the largest of which being estuarial open water below the Mean Low Water Mark, which extends to the Harbour mouth in the east and westwards to where the estuary meets the rivers Piddle and Frome. The other three areas of additional land include saltmarsh, wetland and supporting habitats around the fringes of Lytchett Bay and in two parts of Holes Bay. A map of the site is provided as annex 1 to this Statement.

The reasons for notification of the SSSI are outlined in the notification of the Poole Harbour SSSI in 1990. A copy of the citation is provided as annex 2 to this Statement. The reasons for notification given in the 1990 citation are unaffected by the extension of the SSSI boundaries. The site is of special interest for the following:

- Estuarine habitats including marshes, mudflats and subtidal communities
- Fringing terrestrial habitats including heathlands and grasslands
- Species supported by these habitats including breeding and wintering birds, lichens, rare invertebrates and the red squirrel *Sciurus vulgaris*

The extension of the SSSI to include subtidal estuarial waters and lower shore intertidal mudflats ensures that the SSSI includes all areas within which supporting costal and marine geomorphological processes occur, essential for the maintenance of estuarine habitats. The estuarial waters support important subtidal benthic habitats in some locations, although these are not found across the whole Harbour. Subtidal benthic habitats of particular importance are as follows:

- **High density beds of the peacock work *Sabella pavonina*** – widespread within certain mid-stream areas of subtidal channels these beds are of conservation interest as a habitat for other species. The species is not rare but Poole Harbour is the best known location of where it forms high density beds.

- **The sponge *Suberites massa*** – the species has been recorded in a number of areas associated with artificial structures, for example in the Blackwater channel in Holes Bay and has been recorded as common in a restricted area in South Deep on the north-west side of Goathorn Point, associated with the American slipper limpet *Crepidula fornicata* shells.
- **Intertidal sediments** – these areas are a key estuarine habitat which comprises a range of biotopes including areas of the eelgrass *Zostera marina*. No nationally scare species or biotopes have been found within the intertidal sediments however the importance comes from the abundance and biomass of annelid worms and bivalve molluscs which form a key prey species for waterfowl.
- **Bird species** – large areas of intertidal mudflats lie below MLW providing an additional area of food resource for wintering waders and breeding water birds on certain tides. Areas of estuarial water below MLW are essential for fish-eating species to feed and rest and key roosting sites are found in saltmarsh areas across the Harbour. Common and Sandwhich terns are part of the notified breeding bird interest of the SSSI and are known to forage within the open water of the Harbour and outside the Harbour entrance.

4. Site Condition

The SSSI notified in 1990 is divided into 56 site units, the additional extension includes 3 new units. 28 units are assessed as being in 'favourable' condition, 16 are in 'unfavourable – recovering' condition, one is 'unfavourable – no change' and 11 are in 'unfavourable – declining' condition as of 5th March 2018. For the three new units, 2 are in 'favourable' condition (as of 8th October 2016) and 1 is 'unfavourable – declining' (as of 14th July 2017). The three new units created by the additional notified land are described below:

Site Unit	Interest Features	Reported Condition	Date of Last Assessment
Unit 65 (Poole Harbour Channels and Open Water) – area below MLW, all newly notified	Estuarine habitats; breeding terns and other breeding birds (foraging area); wintering birds	Favourable	8 October 2016
Unit 66 (Lytchett Fields) – comprises newly notified extension + old units 21 (Slough Lane) and 28 (Lytchett Bird Field), both now archived	Estuarine habitats; fens; grassland; breeding and wintering birds	Favourable	8 October 2016
Unit 67 (Holes Bay, Upton Lake mud and saltmarsh) – comprises newly notified extensions + old units 11 (Holes Bay West) and 12 (Holes Bay South), both now archived	Estuarine habitats; breeding and wintering birds	Unfavourable - declining	14 July 2017

*Table taken from 'Poole Harbour SSSI Dorset Supporting Information, A supplement to the notification document – Issued by Natural England's Dorset, Hampshire and the Isle of Wight Area Team on 24 May 2018'

Unit 67 is assessed as 'unfavourable – declining' due to saltmarsh loss, excessive cover of algal mats on intertidal sediments and saltmarsh, reed encroachment and declines in the numbers of wintering shelduck. These are all indicative of high nutrient loads in the water, the saltmarsh loss

may also be being exacerbated by coastal squeeze from sea level rise and shelduck declines may be partially attributed to disturbance.

5. Legislative Underpinning for SSSI Management

Section 28G of the Wildlife and Countryside Act 1981 (as amended) defines 'section 28G authorities', including Natural England and the Southern IFCA, who have a duty to take reasonable steps, consistent with the proper exercise of their functions, to further the conservation and enhancement of the flora, fauna or geological or physiological features by reason of which the site is of special scientific interest.

5.1 The Southern IFCA

The Southern Inshore Fisheries and Conservation Authority was created under the Marine and Coastal Access Act 2009. The Southern IFCA District stretches from the Devon/Dorset border in the West to the Hampshire/Sussex border in the East and covers the combined areas of the relevant councils as well as the entire Dorset, Hampshire and Isle of Wight coastline out to 6 nautical miles from baselines.

The vision of IFCAs is to lead, champion and manage a sustainable marine environment and inshore fisheries, by successfully securing the right balance between social, environmental and economic benefits to ensure healthy seas, sustainable fisheries and a viable industry.

5.2 Natural England

Natural England is responsible for advising Government and industry on marine conservation and seascape issues in England's territorial waters (from the coast out to 12 nautical miles offshore). Natural England provides advice to the IFCA as both a member of the Authority and directly to Officers on the conservation status of features within protected sites and on operations likely to damage those features.

6. Current Site Management

The Southern IFCA manages fishing activity within Poole Harbour through a suite of byelaws and other regulations. The main management measures for activities with the potential to impact the SSSI are outlined below:

The Poole Harbour Dredge Permit byelaw

The Poole Harbour Dredge Permit byelaw manages the use of a dredge within the Harbour through a permit scheme. The byelaw allows for the issue of a fixed number of permits on an annual basis with the associated permit conditions introducing spatial, temporal and other regulations on the use of the dredge within the area of the Harbour. The byelaw is subject to an annual Habitats Regulations Assessment, compiled in consultation with Natural England. The HRA defines how the measures included under the byelaw allow the fishery to continue without having an impact on the features of

the site. Since the creation of the byelaw in 2015 the annual HRA has included reference to the Harbour as a whole thereby covering both the intertidal and subtidal areas which are now included as part of the extension to the SSSI.

Natural England has previously provided advice to Southern IFCA on the potential impacts of shellfish dredging on the nature conservation features of Poole Harbour as a designated site. Natural England have indicated that they agree with the conclusions within the Southern IFCA HRA that, with the management measures proposed under the Poole Harbour Dredge Permit byelaw, the activity managed will not have an adverse effect on the integrity of the site and is compatible with the conservation and enhancement of the SSSI.

The Poole Harbour Fishery Order 2015

The Poole Harbour Fishery Order 2015 is a several Order for a defined area of Poole Harbour through which the IFCA issues leases for aquaculture activity. Within the Order there are currently 31 defined leased beds each of which operates under a business plan agreed by the Southern IFCA. The Order also has an associated Habitats Regulations Assessment which was developed in consultation with Natural England. The HRA sets out how the requirements on lease holders, as defined in the Management Plan accompanying the Order, mitigate against any adverse impacts from these activities on the site.

Bottom Towed Fishing Gear byelaw 2016

The Bottom Towed Fishing Gear byelaw 2016 defines areas where any fishing gear capable of being pushed or pulled along the seabed is banned. In Poole Harbour this covers all defined areas of seagrass.

Prohibition of Gathering (Sea Fisheries Resources) in Seagrass Beds byelaw

The Prohibition of Gathering (Sea Fisheries Resources) in Seagrass Beds byelaw defines areas where it is prohibited for persons to dig for, fish for or take any sea fisheries resource by hand or have with them in the prohibited area any rake, spade fork or similar tool. This byelaw covers all defined areas of seagrass in Poole Harbour.

Poole Harbour Shellfish Hand Gathering byelaw

The Poole Harbour Shellfish Hand Gathering byelaw defines a seasonal restriction on hand gathering activities within the Harbour prohibiting activity within defined sensitive areas during the period of 1st November to 31st March each year to provide protection for overwintering breeding and roosting bird species for which the Harbour is designated.

Other

Additional byelaws and European legislation define minimum sizes for a number of species fished within the Harbour including bivalve species.

7. Objectives for on-going and Future Management

The Southern IFCA and Natural England wish to work together to achieve the objectives of the Poole Harbour SSSI and to maintain a sustainable fishing industry in Poole Harbour. This section sets out the individual and shared objectives of the Southern IFCA and Natural England when exercising their functions within the Poole Harbour SSSI.

7.1 Management of important habitats

Within the Harbour there are a number of areas where the peacock worm *Sabella pavonina* has been mapped. These areas include the South Deep channel, the Blood Alley channel and the sub-tidal channel to the north of Brownsea Island. A map showing the presence of *S. pavonina* is included as annex 3 to this Statement.

Advice from Natural England is that towed gear could potentially damage *Sabella pavonina* beds if this activity was to take place in these areas. With the extension of the SSSI below MLW and a clearer understanding of the location of *Sabella pavonina* beds and associated important sponge communities including *Suberites massa*, the advice from Natural England is that no towed gear is allowed to operate in areas where *Sabella pavonina* is known to be located.

Currently, some of the areas where *Sabella pavonina* beds have been identified are within ground leased under the Poole Harbour Fishery Order 2015. These areas have historically not been farmed due to the presence of *S. pavonina* and their location within a leased bed has provided protection against other forms of bottom towed fishing gear. Natural England advise that aquaculture does not take place over the areas where *S. pavonina* beds and important sponge communities are present.

In light of the advice received by Natural England, the proposal is to consider the possibility of the relocation of leased bed areas which are located where *S.pavonina* is present to other areas within the boundary of the Order. The leased beds affected by *S. pavonina* are beds A, E and N, representing an area of 80 acres (32.4 hectares). A map showing the location of leased beds under the Poole Harbour Fishery Order 2015 is provided as annex 4 to this Statement. Whilst this agreement offers no reassurance that relocation of leased ground will take place it gives a consideration to areas within the Order where additional leased ground could be placed. When considering the placement of additional leased ground within the area of the Order, Natural England advise that any proposals will need to consider the impact of aquaculture on intertidal sediment below MLW to ensure no adverse effect on the integrity of the site.

Considering the advice received on management of important habitats, the areas with the potential for the location of additional leased ground are:

Area 1 – to the east of existing beds BZ, BX and BC up to the eastern boundary of the Order, extending north from the boundary of the Order at Brownsea Island to the boundary of the Order at the Middle Ship Channel

Area 2 – the area of the Wareham Channel between Patchins Point and the shore at Hamworthy up to the start of the Rockley Channel within the boundaries of the Order

(The boundaries of the Order referred to above are set out in the Poole Harbour Fishery Order 2015).

In addition to the consideration of locations for leased ground as a consequence of relocation of existing beds, consideration needs to be given to the protection of the *S. pavonina* beds should they no longer be offered protection by an area of leased ground. Protection of these areas could be

achieved by an amendment to the Bottom Towed Fishing Gear Byelaw 2016 to include these as areas prohibited to any type of bottom towed fishing gear (as defined in the byelaw). It is anticipated in 2020 that an amendment may need to be made to the Bottom Towed Fishing Gear Byelaw 2016 as a result of the need to introduce management for Marine Conservation Zones (MCZs) designated under Tranche 3. This anticipated timeframe aligns with the renewal of leases under the Poole Harbour Fishery Order 2015 and therefore it is proposed that should an amendment to the Bottom Towed Fishing Gear Byelaw 2016 be required to protect *S. pavonina* habitats in Poole Harbour then this amendment is made in line with any amendments required in 2020 as a result of the designation of Tranche 3 MCZs.

7.1.1 Costs associated with Management Options

The options of relocation of leased ground within the Poole Harbour Fishery Order 2015 and an amendment to the Bottom Towed Fishing Gear Byelaw 2016 both have cost implications for the Southern IFCA. This includes direct costs and costs incurred as a result of resource allocation to the process of delivering the management options outlined in this section.

The extension of the SSSI results in leaseholders not being able to carry out any activity which would damage habitats of importance. This necessitates changes to the management measures for activities which have occurred in this site since a time prior to the original designation of the SSSI. As outlined above, these changes result in a cost implication for the IFCA. Natural England and the Southern IFCA will explore opportunities to offset these costs.

7.2 Management of species subject to aquaculture activity

7.2.1 Pacific Oyster (*Magallana gigas*)

Within the grounds leased by Southern IFCA there are a number of beds on which the Pacific Oyster (*Magallana gigas*) is farmed. This species has been farmed in Poole Harbour since a time prior to the original designation of the site as a SSSI in a process in which the species is grown from spat at a facility before being laid directly on the seabed once individuals have reached a certain size.

The Pacific Oyster is defined as an invasive non-native species (INIS) and is categorised as ‘Medium Risk’ on the Water Framework Directive list by the UK Technical Advisory Group and a ‘Moderate’ risk by the GB non-native species secretariat (NNSS). Advice has been sought from Natural England on their position with regard to the farming of these species in Poole Harbour. A letter was received from Natural England on 31st July 2017 stating the following:

Due to the proximity of the Poole Harbour lease beds to the SSSI, SPA and Ramsar site, we believe that there is a risk that wild oyster settlement could adversely affect the features and supporting habitats of these sites. It is Natural England’s view that in most cases, the risk of wild settlement can be minimised by using triploid oysters…on this basis we would support revised management measures to prohibit the laying of diploid oysters under the terms of the Poole Harbour Several Order. The advice provided above is consistent with Natural England’s general guidance on Pacific oyster aquaculture within or adjacent to designated sites. However, in the absence of formal policy guidance, there may be circumstances where an applicant specifically requests the use of diploid oysters. In such cases, we would review the request on a site-specific basis with regard to local environmental conditions and seek assurance that any potential impacts of wild settlement are adequately mitigated.

In addition, Natural England have further clarified that their current view for Poole Harbour is that, as there has been no evidence of Pacific Oysters spreading over the intertidal mudflats in Poole Harbour as a result of current cultivation, Pacific Oysters may be laid on leased beds providing the oysters are of triploid stock or are subject to another method of sterilization including but not limited to the laying of quadriploid stock.

In order to ensure that stock of Pacific Oysters laid onto leased ground in Poole Harbour is of triploid stock or subject to another method of sterilization, an amendment will need to be made to the Poole Harbour Fishery Order 2015 Management Plan to stipulate a provision relating to the specific farming of Pacific Oysters. This amendment to the Management Plan will also state that applications to farm Pacific Oysters using a type of stock different to that stipulated will be considered on a case by case basis with the proposed method being subject to an Appropriate Assessment. Provided that these amendments are incorporated into the Management Plan for the Order Natural England do not object to the farming of Pacific Oysters within Poole Harbour.

7.2.2 Aquaculture and Water Quality

Shellfish aquaculture has been identified as providing ecosystem services in the areas in which it occurs. The filtration potential of aquaculture species is significant and, as supporting evidence becomes available, this service should help to inform future management of shellfish aquaculture in areas such as Poole Harbour.

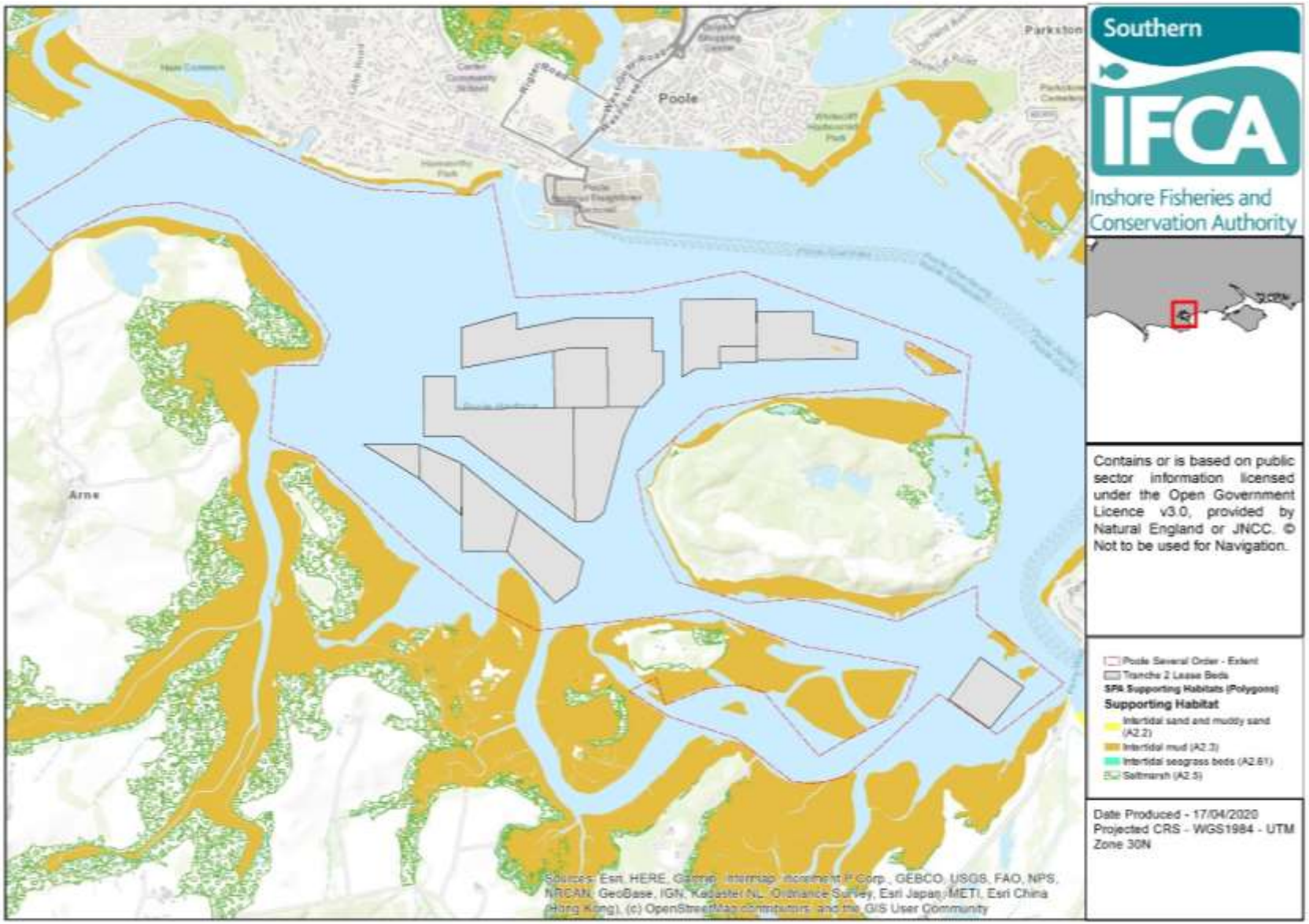
The Southern IFCA and Natural England agree to jointly explore the importance of aquaculture as an ecosystem service and the use of shellfish for bioremediation as part of the ongoing enhancement and development of Poole Harbour.

8. Ongoing Management of Wild Fishing Activity

In addition to the specific management objectives outlined above there is a need to consider the ability for existing wild fishing activity to be able to continue within the Poole Harbour SSSI. The dredge fishery for shellfish is regulated under the Poole Harbour Dredge Permit byelaw. This byelaw is subject to an annual HRA which already considers the Harbour as a whole making reference to both the intertidal and subtidal. With the process of reviewing this HRA on an annual basis already in place, with close consultation with Natural England, and the fact that the HRA already refers to the features of the SSSI as well as the SPA and Ramsar site designations it can be demonstrated that extensive consideration has been given to ensuring that this fishery does not damage or disturb the features of the site.

The Southern IFCA will continue to develop an annual environmental impact assessment for the wild fishery under the Poole Harbour Dredge Permit byelaw which will include, as has been done previously, an assessment of the potential impacts of the fishery on the features of the Poole Harbour SSSI. Natural England will be consulted on this assessment. With the extension of the SSSI below Mean Low Water (MLW) and a clearer understanding of the location of *Sabella pavonina* and important sponge communities (including *Suberites massa*) Natural England's advice is that no towed gear dredging can take place over the areas where *S. pavonina* beds are indicated to be present (annex 3). The proposed action in relation to managing this feature is outlined in section 7.1 of this Statement. The views of Natural England on other aspects of management of the wild fishery in Poole Harbour, in light of the extension of the SSSI, remains the same.

Annex 6 – Extent of the Poole Harbour Fishery Order 2015 showing location of Tranche 2 lease beds and supporting habitats of the Poole Harbour SPA



Annex 7 – Biosecurity Risk Assessment for the Issuing of Leases for 2020-25

KEY

PROBABILITY		SEVERITY		RISK FACTOR	
Probable	3	Critical	3	4 – 9	High Risk
Possible	2	Serious	2	4	Medium Risk
Unlikely	1	Minor	1	1 – 3	Low Risk

**Note INIS refers to Invasive Non-Indigenous Species*

Activity	Biosecurity Risk	Risk without control measures			Mitigation	Risk with mitigation		
		P	S	RF		P	S	RF
Import, Export and Movement of Shellfish, Stock and/or Seed								
Purchase of seed from areas outside the UK	• Seed contains a disease that is not found in Poole Harbour • Seed may have associated INIS either within the seed stock or the packing materials	2	3	6	• Seed can only be brought in to Poole Harbour for the purposes of aquaculture, every import will be supported by an application to import seed from Southern IFCA via an AAH1 form, which will be forwarded to Cefas for approval • The provenance of all incoming seed is checked by Cefas before it is excepted • Seed must come from Cefas approved hatcheries and must be accompanied by the appropriate paperwork to indicate this • Seed must come from an area with equal or higher water classification status than Poole Harbour. Leaseholders are required to keep abreast of any changes in classification with relevant local Environmental Health departments • Any seed that shows signs of disease or the presence of INIS will not be accepted on to the site • All seed imports are to be thoroughly washed and checked for INIS before any	1	3	3

					processing activity is carried out or any seed is introduced on to any lease bed • All imports must be recorded in the site diary and copies of all documentation should be kept • All imported seed must be separated from other stocks for two weeks			
Seed moved or purchased from another shellfish farming area within the UK	• Seed contains a disease that is not found in Poole Harbour • Seed may have associated INIS either within the seed stock or the packing materials	2	3	6	• There must be authorisation from Cefas for the transfer of seed between sites and seed must be accompanied by the appropriate movement documents • Seed must come from Cefas approved farms and must be accompanied by the appropriate paperwork to indicate this • An application must be made to the Southern IFCA to move seed between farms, this application will be checked with Cefas • The provenance of all incoming seed is checked by Cefas before it is excepted • Seed must come from an area with equal or higher water classification status than Poole Harbour. Leaseholders are required to keep abreast of any changes in classification with relevant local Environmental Health departments • Any seed that shows signs of disease or the presence of INIS will not be accepted on to the site • All seed imports are to be thoroughly washed and checked for INIS before any processing activity is carried out or any seed is introduced on to any lease bed • All imports must be recorded in the site diary and copies of all documentation should be kept	1	3	3
Relaying seed from wild stock	• Seed contains a disease that is not found in Poole Harbour • Seed may have associated INIS within the seed stock	2	3	6	• The provenance of all wild seed is subject to approval by Cefas • Seed must come from an area with equal or higher water classification status than Poole Harbour. Leaseholders are required to keep abreast of any changes in	1	3	3

	• Seed may introduce pathogens from an area of lower water quality than Poole Harbour				classification with relevant local Environmental Health departments • For seed coming from a lower water classification i.e. Class C, can only be relayed on to an approved relaying area as determined by BCP Council Environmental Health Department • Dependent on the source of the wild stock, seed must be separated from other stocks for two weeks • Any seed that shows signs of disease or the presence of INIS will not be accepted on to the site • All seed is to be thoroughly washed and checked for INIS before any processing activity is carried out or any seed is introduced on to any lease bed • All imports must be recorded in the site diary and copies of all documentation should be kept			
Exporting Product	• There is the potential for exported stock to transfer a disease or INIS that is found in Poole Harbour to other areas of the UK or abroad	2	3	6	• Shellfish and the bags/containers used for export must be cleaned before export Exported product can only be sent to Cefas approved and bio-secure depuration and/or processing plants • Any destination for exported product must hold the appropriate licences for shellfish • Any product that shows signs of disease or the presence of INIS should not be exported • All exports must be recorded in the site diary and copies of all documentation should be kept • Shellfish movement documents must accompany all products	1	3	3
Mixing of seed from multiple sources	• Any disease present in a single seed batch is passed between different seed batches • Any INIS present in a single seed batch is passed between different seed batches • Seed coming from different water classifications may be mixed, introducing	3	3	9	• Seed batches must come from areas subject to the same water classification. Leaseholders are required to keep abreast of any changes in classification with relevant local Environmental Health departments	1	3	3

	pathogens in to seed stocks from a higher classification				• Seed batches should be thoroughly checked for signs of disease and the presence of INIS before mixing • Any seed batch showing any sign of disease of presence of INIS should not be mixed with any other batch • Records should be kept of the origin of individual seed batches and the sources which have been mixed. Copies should be kept of all relevant documentation			
Species Farmed								
Farming of Pacific Oyster (*Crassostrea gigas*)	• Spread of a wild Invasive Non-Indigenous Species (INIS) to areas of the Harbour outside of lease ground. • Establishment of wild populations.	3	3	9	• The farming of Pacific oysters will only take place on the authorisation of Southern IFCA in consultation with Natural England • Pacific oysters must be triploid or subject to another form of sterilization • Any applications to farm Pacific oysters using a type of stock different to that stipulated above will be considered on a case by case basis by the Authority in consultation with Natural England, with the proposed methodology provided by the lease holder subject to an appropriate assessment	1	3	3
Farming of shellfish species	• Species suffer a mortality event • Species show reduced growth rate • Species show signs of poor health • The presence of an INIS is identified on lease ground • Damage to shellfish from harvesting processes	2	2	4	• Leaseholders should have an inspection procedure in place for shellfish stocks, suggested on a weekly basis • Any mortality events must be reported to the Southern IFCA and Cefas with samples provided so that the cause of mortality can be investigated and any mortality arising from disease can be identified • Where any reductions in growth rate or signs of poor health are thought to be as a result of disease, this should be reported to the Southern IFCA and Cefas with samples provided so that the presence of any disease can be determined • Any INIS identified on lease ground must be reported to the Southern IFCA. Photographs, date of discovery and precise geographic location must be provided to	1	2	2

					enquiries@southern-ifca.gov.uk. In addition, lease holders are encouraged to use INNS (Invasive Non-Native Species) Mapper https://ywt-data.org/INNS-mapper/ to record any INNS into a wider database • Harvesting processes should be optimised to be efficient and gentle on shellfish • Harvesting should be avoided during periods of spawning when shellfish are weaker and more vulnerable • Post-harvesting processes i.e. grading should only occur when necessary and post-harvesting processes should be avoided in overly hot weather			
Use of vessels and equipment, operation of farm personnel								
Use of vessels and equipment between different lease beds	• Vessels/equipment spread a disease between different lease grounds from any remaining organisms present • Vessels/equipment spread INIS between different lease grounds through attachment or remaining organisms on the vessel	3	3	9	• Where possible, vessels and equipment should only be used on the lease beds for which the leaseholder has the lease • Where vessels and equipment are required to be used across multiple leases then the vessels and equipment must be cleaned prior to moving between areas. Cleaning processes must not allow cleaning water or materials to enter the water column • Vessels and equipment must be subject to the Check, Clean, Dry procedure	1	3	3
Use of vessels and equipment from outside of Poole Harbour	• Vessels/equipment introduce a disease in to Poole Harbour from any remaining organisms present • Vessels/equipment introduce INIS in to Poole Harbour through attachment or remaining organisms on the vessel	3	3	9	• Vessels and equipment must come from areas that are disease free • Prior to arrival on site vessels and equipment must be thoroughly cleaned in a manner that does not allow cleaning water or materials to enter the water column • Vessels and equipment must be subject to the Check, Clean, Dry procedure	1	3	3
Use of processing equipment on site	• Any INIS spat or individuals are retained on processing equipment and are transferred to different batches of shellfish	2	3	6	• Processing equipment must be washed after every use • Equipment must be subject to the Check, Clean, Dry procedure • Shellfish bags should be pressure washed before use	1	3	3

Disposal of effluent water from depuration, storage or processing	• Pathogens expelled during processing and depuration may be put in to the water column • If disposal occurs in an area other than the lease ground of the particular business there may be transfer of INIS or disease between lease beds	2	3	6	• For the purposes of harvesting stock where water is required i.e. for washing shellfish etc. this should only be done over the area leased under a particular lease to avoid transfer of any organisms between lease grounds leased by different leaseholders • Any water from depuration or processing to remove pathogens etc. should be collected and disposed of via an appropriate mechanism on land, water from these sources must not be put in to the water column • Where there is concern that the washing or processing of shellfish on the deck of a vessel may introduce contamination to lease ground or the water column, the deck of the vessel should be sealed and waste water disposed of via an appropriate mechanism on land	1	3	3
Disposal of rubbish materials	• Inappropriate disposal of rubbish could introduce litter in to the marine environment • Inappropriate disposal of fuel and/or oil could result in pollution of the marine environment • Dead shellfish or shell disposed of in to the water column may introduce associated pathogens or INIS into the marine environment	2	3	6	• There should be waste separation streams for oil, fuel, metal and general waste • Refuse and litter should be stored safely prior to collection in suitable containers to avoid the possibility of any litter entering the water • Only registered contractors should be used for waste disposal • Dead shellfish should be disposed of in suitable containers via a contractor equipped to handle this type of waste i.e. VIRIDOR • Waste oil should be disposed of through an approved onshore process • Waste chemicals such as oil and fuel must be stored in secure containers designed for this purpose to prevent spillage prior to disposal • Waste materials should be disposed of at appropriate intervals and not allowed to build up on site	1	3	3

Storage of chemical, fuel and/or oil on site	• Spillage of chemicals, fuel and/or oil in to the marine environment • Spillage of chemicals, fuel and/or oil in the vicinity of seed may contaminate the seed and introduce pollutants in to the marine environment • Spillage of chemicals, fuel, and/or oil in the vicinity of harvested shellfish may contaminate export products	2	3	6	• Storage areas on site must be kept tidy • Where possible, use of chemicals to treat shellfish should be avoided • Fuel oil must be stored in bunded tanks • Oils and other lubricants must be stored in leakproof containers • There must be a spillage action plan in place for the business, this should contain processes to prevent spillage of chemicals, including fuel and oil and other contaminants and procedures that are implemented in the event of a spillage taking place • Spill kits appropriate to the chemicals used in the business must be available on site • All staff must be trained in the spillage action plan and use of spill kits • Any spillages of chemicals or other contaminants must be reported to the Southern IFCA with details of the time and date of the spillage, the chemicals involved and any processes that have been implemented in response to the spillage	1	3	3
Transfer of staff between aquaculture sites	• Contaminants including disease and/or INIS can be transferred between areas on clothing and footwear • Biosecurity protocols are not followed by staff not familiar with multiple sites	3	3	9	• Staff should have their own PPE which they are responsible for • When moving between sites all PPE should be thoroughly cleaned and disinfected, waste water and chemicals from this cleaning must not be allowed to enter the water column • At the end of each day PPE should be subject to the Check, Clean, Dry Procedure • Staff must be made aware and trained in biosecurity protocols, the site manager should make regular checks to ensure that all staff are fully trained in this area	1	3	3
Visitors/Members of the Public attending the site	• Contaminants including disease and/or INIS can be transferred between areas on clothing and footwear • Biosecurity protocols are not followed as visitors/members of the public are not familiar with protocols	2	2	4	• Visits should only happen by appointment • Visitors must be issued with appropriate PPE which has been cleaned and disinfected before use • Any PPE which belongs to the visitor should be subject to the Check, Clean, Dry	1	2	2

					procedure before the visitor is allowed on site • Visitors must be made aware of biosecurity protocols on arrival, this must be checked by the site manager • All visits to the site must be logged			

Details on the potential impacts of the biosecurity risks highlighted in this risk assessment can be found in the 'Poole Harbour Special Protection Area (SPA) Appropriate Assessment - Issue of Leases under the Poole Harbour Fishery Order 2015 for 2020-25'.

The Check, Clean, Dry Procedure referred to in the Risk Assessment is outlined below:

Clean, Check, Dry

The check, clean dry protocol is provided by www.nonnativespecies.org/checkcleandry as follows:

Check equipment and clothing for live organisms – particularly in areas that are damp or hard to inspect

Clean and wash all equipment, footwear and clothes thoroughly, use hot water where possible. If you do come across any organisms, leave them at the water body where you found them.

Dry all equipment and clothing – some species can live for many days in moist conditions. Make sure you don't transfer water elsewhere.

Annex 8 – Lease beds 7 and 8 evidence package

The Poole Harbour Fishery Order 2015

Issuing of leases for the period 2020-2025

Evidence Package and Proposed Management Measures for the farming of Leased Bed Numbers 7 and 8

Document Control and Revision History

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Author	S Birchenough
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Owner	Southern IFCA

Date	Author	Version	Status	Reason	Approver(s)
16.11.20	S Birchenough	1.0	Draft	Initial draft based on outcomes of meeting between NE and SIFCA on 03.11.20	

This document has been distributed for information and comment to:

Version Sent	Name	Date Sent	Comments Received
1.2	Gavin Black	09.12.20	20.12.20

1. Background to Document

Duties under Regulation 63 of the Conservation of Habitats and Species Regulations 2017 require Southern IFCA, as a competent authority, to make an appropriate assessment of a plan or project likely to have a significant effect on a European site (either alone or in combination with other plans or projects). As such, Southern IFCA undertakes an appropriate assessment for the issuing of leases under the Poole Harbour Fishery Order 2015 ('The Order'). The Order manages aquaculture activity within a defined area of Poole Harbour by conferring on the Southern IFCA the right of several fishery for the cultivation of shellfish of any kind for a period of twenty years from 1st July 2015. The Order covers an area of 837.8 hectares and allows for the

cultivation of aquaculture species, namely 'shellfish' as defined in the Marine and Coastal Access Act 2009 (MaCAA) as "crustaceans and molluscs of any kind". The main species harvested are Pacific oyster (*Magallana gigas*) and common mussel (*Mytilus edulis*) with other species including native oyster (*Ostrea edulis*), clam species (primarily the Manila clam, *Ruditapes philippinarum*) and common cockle (*Cerastoderma edule*) having been farmed and/or cultivated historically. The definition provided in MaCAA allows the Southern IFCA to retain flexibility for shellfish species that could potentially be the subject of future aquaculture activity within the Harbour. Leases are issued under the Order for a period of five years. At the creation of The Order in 2015 leases were issued for the period 2015-20 with a corresponding appropriate assessment. The expiration of these leases in 2020 necessitated the issuing of new leases for the period 2020-25 accompanied by an updated Appropriate Assessment to determine, whether or not in the view of Southern IFCA, the issue of leases for 2020-25 will hinder the achievement of the conservation objectives of the Poole Harbour SPA and lead to an adverse effect on site integrity. The Appropriate Assessment was submitted to Natural England and Formal Advice was received which necessitated a closer examination of certain lease beds and species being farmed. This evidence package focuses on the farming of leased bed numbers 7 and 8 and the associated shallow sediment present there.

1.1 Timeline of Correspondence

The following section outlines correspondence and feedback between Southern IFCA and Natural England on the Appropriate Assessment (AA), in relation to the farming of leased bed number 12:

- **16th June 20 – Submission of Appropriate Assessment to Natural England**
- **14th July 20 – Formal Advice received from Natural England**
    - NE provided Formal Advice regarding the location of lease beds 7 and 8 and stated that while it was understood that Southern IFCA had used the mean low water mark to determine overlaps between the aquaculture lease beds and supporting habitat i.e. intertidal mudflats there needed to be a considering of the extremely shallow nature of Poole Harbour in relation to these two areas. It was acknowledged that the boundaries of the intertidal mud habitat are accurate as shown on NE data portals such as MAGIC and that these boundaries do represent the best available evidence for mapping of features and supporting habitats. However, the shallow nature of the Harbour combined with a gently shelving shore was highlighted as potentially allowing a much greater usage of the Harbour area by bird features than is shown on the NE map layers. This was highlighted as being particularly important during periods of high pressure or spring and equinoctial tides. NE stated that one of the reasons for the recent extension of the SSSI and SPA was to encompass the littoral sediment habitat below mean low water (MLW) and that although this habitat may be used less frequently by SPA bird features than the areas above MLW, the habitat can potentially provide a very rich food source during lower tides. The Southern IFCA and NE SSSI Site Management Statement was referenced with section 7.1 stating *"When considering the placement of additional leased ground within the are of the Order, Natural England advice that any proposals will need to consider the impact of aquaculture on intertidal*

sediment below MLW to ensure no adverse effect on the integrity of the site". In their Formal Advice, NE stated that an assessment would be required of the value of the littoral sediment supporting habitat that is to be laid with shellfish, how this change to the habitat will affect the SPA features and what measures can be taken to ensure there is no impact e.g. the timings of when lease beds are laid and/or harvested.

- **22nd September 20 – Southern IFCA response letter to Formal Advice on the AA sent to Natural England**
  - Southern IFCA confirmed that, to date lease beds 7 and 8 had not been used for the purposes of aquaculture and that the beds would remain unused until any further required assessments had been undertaken and, where necessary, additional mitigation measures had been considered and resolved. Information was provided on the seasonal patterns of activity by the leaseholders for these particular beds, this is outlined in section 2 of this evidence package. It was outlined that Southern IFCA will undertake an assessment of the sediment habitat which occurs within these lease beds. Natural England were asked to consider the high-resolution seasonal information on activity on these lease beds, recognising that activity levels across the year are low in comparison to other fisheries where similar dredging practices take place over intertidal and subtidal sediments within an SPA, and that these fisheries have been subject to, and passed scrutiny, through the HRA process.
- **29th October 20 – Natural England draft feedback on Southern IFCA response letter received via email**
  - NE outlined that their advice on seasonality is clear in that the key period of the year for most of the overwintering bird features in the Poole Harbour SPA is between September and March. It was stated that, based on the information provided, there was a clear overlap in terms of presence of protected bird features and the planned 'cleaning' and harvesting operations. NE indicated that, due to the location of the lease bed, the aquaculture activity could be impacting potentially important SPA supporting habitat, removing a valuable source of available prey, if the bird features are using these areas. NE indicated that they were unclear how the bird features utilised these specific areas but felt that currently a conclusion of no adverse effect could not be drawn. It was stated that if it could be demonstrated that bird features are not feeding in this area then it could be possible to increase certainty that impacts would be insignificant.

2. Seasonal Activity on Lease Bed Numbers 7 and 8

High-resolution was provided on the proposed seasonality of activity over lease bed numbers 7 and 8 with the beds proposed to be farmed as part of a joint venture between the two leaseholders. The leaseholders for these beds have outlined that they intend to clean these beds in the period of January to March 2021 and that this activity would involve 20 hours of activity per month. This would be the only period during which cleaning would take place. The process of seeding and harvesting would also commence in 2021 and would follow the same pattern each year until the end of

the lease period in July 2025. Seeding of the ground is proposed to take place in April 2021, 2022, 2023 and 2024 for a total of 4 hours in the month and in April 2025 for a total of 10 hours in the month. Checking and turning of the seed would then take place for May to July each year with 6 hours total activity per month. Harvesting is proposed to take place for August to December each year with a total of 20 hours activity per month. For cleaning, seeding and harvesting, activity would only take place between the hours of 0800 and 1600 and would be carried out using the conveyor dredge system as described in the Appropriate Assessment.

A visual timetable of this activity is provided in annex 1.

3. Exposure of Lease Bed Numbers 7 and 8

Southern IFCA sought expert advice from one of the leaseholders who has been undertaking aquaculture in Poole Harbour for many years, prior to the introduction of The Poole Harbour Fishery Order 2015, on the area of lease beds 7 and 8 and the relationship between these areas and the species being farmed. The following response was received:

"The area…(beds 7 and 8)…falls within the approved area for aquaculture, is permanently immersed and to my casual observation of the past 35 years, is not an area in which birds congregate during the winter. This ground is a benefit to us from a husbandry point of view as we prefer to grow oysters in areas that are not exposed at low water. This is to maximise growth, as whilst they are exposed, they are not feeding. Exposure to extremes of heat and cold and potential predation are also avoided if they are permanently immersed".

Southern IFCA also carried out a verification survey to assess the ability of the area of lease beds 7 and 8 to become exposed at low tides. Officer visited the area on Monday 16th November 2020 around the period of low tide which was at 16:44 at a height of 0.36m. Prior to carrying out this work it was ascertained that this is one of the lowest tides of the 2020-21 winter period and therefore gave the best opportunity to assess the area for exposure.

Officers were present on the water at low tide, using the Fisheries Patrol Vessel Endeavour which has a very shallow draft (approximately 8-inches). It was verified that, at no point, did any of the area within lease beds 7 or 8 become exposed and that, following the point of low tide at 16:44 the tide began to flood again. Depth measurements were taken using either the vessel's transducer or a rigid pole deployed over the side at numerous intervals leading up to the point of low tide. These are given in table 3.1 below, maps of the area surveyed is shown in Annex 2 for comparison with the data in the table.

Time	Lease Bed Marker Point	Co-ordinates		Approximate Depth (ft)
		Latitude °N	Longitude °W	
15:45	8A	50° 41.588	002° 00.516	2.2
15:52	8B/7B	50° 41.706	002° 00.516	3.7
15:55	7A	50° 41.710	002° 00.819	2.1
16:04	8C	50° 41.641	002° 00.291	2.6
16:09	8D	50° 41.460	002° 00.291	2.0
16:15	8A/7C	50° 41.588	002° 00.516	1.5 to 2.0
16:17	Line between 8A and 8B			< 1.0
16:21	8C	50° 41.641	002° 00.291	2.2
16:24	8D	50° 41.460	002° 00.291	2.2
16:45	Low tide – no part of lease beds exposed			

Table 3.1: Results of depth measurements taken by Officers from FPV Endeavour over lease beds 7 and 8 around low tide on 16th November 2020.

The shallowest part of the area was found to be between points 8A/8B and 7C/7B and it was estimated that, at low tide, this part of the lease beds would have been covered by a few inches of water. The information gathered during this survey was corroborated by a WeBS counter who carries out the count for this particular area each winter as part of the WeBS survey and stated that the area under lease beds 7 and 8 does not become exposed. Information was provided on the utilisation of this area by different bird species and this is outlined in the next section.

4. Bird Features in Poole Harbour

4.1 Condition Assessment of the SPA bird features in Poole Harbour

Natural England provided a table of information on the condition of the bird features in Poole Harbour reflecting the most up to date information on these species (Table 4.1). The table shows the data for long-term change in the mean peak population abundance of wintering bird features of the Poole Harbour SSSI, SPA and Ramsar site and their associated condition, determined using the Common Standards Monitoring Guidance (CSMG) natural fluctuation method. Applying a CSMG method to the most recently available data from Poole Harbour, four bird species which qualify as interest features of the SSSI (they occurred in nationally significant numbers from the time of designation) have declined to below the CSMG baseline and are therefore classed as being in ‘unfavourable condition’. These species are shelduck, pochard, red-breasted merganser and goldeneye. The numbers of a further 10 species remain above the baseline, even though the numbers of some of these species have also declined, and therefore are identified by the methodology as being in ‘favourable condition’. The decline in shelduck numbers is seen to have added significance as the species is also a qualifying feature of the SPA and Ramsar site in its own right.

Wintering bird species feature	Mean peak winter population			Baseline count (lowest winter peak count in period 1986/87 to 1990/91)	Feature condition using CSGM natural fluctuation method
	1985/86 to 1989/90	2014/15 to 2018/19	% Change		
Brent Goose	729	1761	+142	433	Favourable
Teal	738	3265	+342	396	Favourable
Pintail	160	263	+64	84	Favourable
Shelduck	2377	1225	-48	1665	Unfavourable
Pochard	933	10	-99	633	Unfavourable
Red-breasted Merganser	382	207	-46	302	Unfavourable
Goldeneye	138	79	-43	109	Unfavourable
Cormorant	381	664	+74	339	Favourable
Avocet	59	1535	+2502	0 (lowest total of 1068 for 2006/07 – 2010/11 used for SSSI assessment)	Favourable
Grey Plover	346	164	-53	113	Favourable
Curlew	1231	1108	-10	972	Favourable
Black-tailed Godwit	1021	2336	+129	682	Favourable
Dunlin	4117	2283	-45	2055	Favourable
Redshank	1066	1059	-1	648	Favourable

Table 4.1: Data for long-term change in the mean peak population abundance of wintering bird features of the Poole Harbour SSSI, SPA and Ramsar site and their associated condition, determined using the CSMG natural fluctuation method. Table provided by Natural England.

4.2 Data on usage by bird species of the area covered by lease bed numbers 7 and 8

Information has been sought from expert sources on the potential for bird species in Poole Harbour to use the area covered by lease beds 7 and 8 for feeding. These sources include The Wetland Bird Survey (WeBS) counters and Birds of Poole Harbour. An initial analysis of the data provided for the annual WeBS survey and the Big Poole Harbour Bird Count undertaken by Birds of Poole Harbour showed that the data is not presented at a fine enough spatial scale to determine usage of the particular area in question. Further, more specific, information was therefore sought from persons who carry out the survey.

Information received indicated that the key species of interest in the area of lease beds 7 and 8 are open water species, Goldeneye and Red-breasted Merganser (both listed as part of the water bird assemblage), which use the area for feeding and roosting. Feeding will take place during the day and a roosting raft forms in this area each evening. As well as the two species mentioned above, the roost can also contain the species Great Crested Grebe, Black-necked Grebe, Common Scoter, Long-tailed Duck and occasionally Great Northern Diver. The roost has the ability to move around with changing wind direction and strength but tends to remain within the area over which the two lease beds occur. Of the species identified, Goldeneye and Red-breasted Merganser are classed as being in unfavourable condition, as shown in table 4.1.

5. Mitigation and Summary Statement

Based on the information provided on the seasonal and temporal timelines for activity and knowledge of the use of the area by bird species, a summary of mitigation measures against potential impacts to the bird features of Poole Harbour SPA is given in this section.

Feeding and Prey Availability

The potential impact to visual and surface feeders as a result of suspended sediment and siltation have been outlined in section 6.2.7 of the Appropriate Assessment. These species include Red-breasted merganser which is identified as having a primary prey preference for fish (Scott and Olson, 1973; Brenninkmeijer and Stienen, 1994; Miller, 1996; Granadeiro *et al.,* 2002; Bur *et al.,* 2008; Green, 2017). It is concluded that impacts to visual feeders are unlikely to be seen as a result of aquaculture activity in Poole Harbour. There is no potential for the removal of these prey items by the aquaculture activity occurring in this area. In addition, studies on siltation and sedimentation from dredging indicate that increases in suspended sediment and settling occur within a fairly small area around dredge works. Particle tracking models have shown that dredging through sediment using 8 dredges per side resulted in only 8.2% of suspended sediment remaining in the water column after 1 hour, figures which were comparable to naturally occurring suspension (Dale *et al.,* 2011). The same study found that it would take more than 200 dredge tows for suspended sediment levels to equal those seen during storm conditions (Dale *et al.,* 2011). This has been shown in other studies with sediment plumes and increased turbidity caused by dredging seen to disappear within 30 minutes to 24 hours of dredging taking place (Lambert and Goudreau, 1996; Maier *et al.,* 1998). Specific studies on clam dredging found that the resuspension of sediment was relatively minor compared to long-term wild-induced suspension (Auster and Langton, 1999) and the limitation of this activity to discrete areas was seen to result in these impacts occurring over a much smaller spatial scale than when suspended sediments result from natural disturbance (Wilber and Clarke, 2001). This is of particular relevance to the aquaculture activity proposed to take place over lease bed numbers 7 and 8 which, when compared to other types of dredging activity is small-scale and occurs over short time scales.

The other species identified as utilising this area is Goldeneye. While the Goldeneye is documented to have a more varied diet, comprising molluscs and polychaete worms, a consideration of the potential for removing non-target species through dredging and thus affecting the availability of prey items both generally, and specifically for the activity proposed to take place on these beds, indicates that there is unlikely to be any adverse effect on this species.

Detailed evidence is provided in in section 6.2.1 of the Appropriate Assessment on the potential impact of the removal of prey items as non-target species. Considering studies which have looked particularly at Poole Harbour, Clarke *et al.* (2018) used a Before-After-Control-Impact (BACI) sampling design to assess the impacts of pump-scoop dredging on the benthic community structure and physical characteristics of the

sediment. Whilst the gear type assessed is not the same as that proposed to be used on lease bed 7 and 8, the harvester which will be used on these beds was based on the design of the pump scoop dredge and operates in a similar way. In addition, the frequency of activity in the wild fishery using pump-scoop dredges is greater than that of the frequency of dredging proposed to take place over the sediment within lease bed numbers 7 and 8. The Poole Harbour study showed that the benthic communities of an intensively dredged site and, to a lesser extent, a newly and therefore less intensely dredged site, were characterised by high numbers of small polychaete worms (Clarke *et al.,* 2018). The study also found that species richness and abundance was significantly higher in both dredged sites when compared to the control site and, although changes in community structure were identified, there was no change in the biotope or ecological quality at either of the dredge sites (Clarke *et al.,* 2018).

Small polychaete worms are identified as preferential prey species for two of the bird species classed as unfavourable within Poole Harbour (Shelduck, Goldeneye), including the main species of concern for feeding in this area (Goldeneye), and a further eight species covered by the SPA designation (Avocet, Eurasian Spoonbill, Black-tailed Godwit, Dunlin, Curlew, Spotted Redshank, Greenshank and Redshank) (Information obtained from the SPA Tool Kit and Natural England's Poole Harbour Conservation Advice Package, specific information on prey species was taken, where available, from the draft supplementary advice on conserving and restoring site features and also from other conservation advice packages from nearby SPAs with the same bird features). Studies specifically on Goldeneye have shown that the Common goldeneye (*Bucephala clangula*), which is the species found in Poole Harbour, have polychaete worms as a large proportion of their diet (Bourget *et al.,* 2007). The species is also documented to feed on some mollusc species and small crustaceans (Olney and Mills, 1963). The results of the study by Clarke *et al.* (2018) indicate that there is no change to biotope or ecological quality as a result of dredging by pump-scoop dredges. As previously outlined, the aquaculture activity on lease beds 7 and 8 represents a much lower intensity of activity and, due to the area of the lease bed being severed from the public right to fish, will be the only activity that is permitted to take place in this area. The method of harvesting, using the specially designed harvester, involves the dredge contents being placed on a conveyor belt and then passed up to the main vessel where the target aquaculture species is picked by hand. Anything other than the target aquaculture species is returned immediately via the conveyor system to the sea. The harvester works directly over the lease bed and therefore this method ensures that no non-target species, such as other molluscs or small crustaceans are removed from the area. This is a particular practice carried out for aquaculture in Poole Harbour and needs to be considered when reviewing literature on the potential impact of removal of non-target species from the seabed by dredging.

Abrasion

Physical disturbance or abrasion at the surface of the substrate is considered with regard to cleaning of the lease beds which is proposed to take place as a one off at

the beginning of the farming process. Research has shown that the depth of penetration of dredge gear and the resulting depressions created are largely determined by the type of fishing gear used, how it is set up, fishing practice and the target species (Mercaldo-Allen and Goldberg, 2011; Wheeler *et al.,* 2014). Mobile gears are shown to penetrate from 5-30cm into the sediment with normal fishing practices (Johnson, 2002) with dredges documented to disturb the top 2-6cm (Thrush and Dayton, 2002). The depressions and tracks have been noted to persist for days to months (Manning and Dunnington, 1955; Gaspar *et al.,* 2003; Mercaldo-Allen and Goldberg, 2011; Wheeler *et al.,* 2014) depending on the depth of penetration and the intensity of activity. Relating this to the proposed activity on lease bed numbers 7 and 8, the cleaning of the beds which has been noted to have the potential to cause abrasion to the seabed however this activity will only be carried out once during the duration of the five-year lease and is targeted towards the removal of dead shell and blanketing week or algae rather than removal of sediment or other species within the benthic community. As with harvesting practice, the cleaning will be carried out using the conveyor dredge system which allows for anything removed from the ground which doesn't need to be to be returned immediately to the seabed. Because the cleaning process is the fist time that dredging will have occurred over these beds as a result of aquaculture activity it is proposed to add an additional management measure by requiring the leaseholder to amend their seasonal program of activity (Annex 1) so that cleaning of the beds does not take place during January or February. This is noted as being a period of particular sensitivity for the bird features of the Poole Harbour SPA and, given the evidence that Goldeneye will potentially be feeding in the area of these lease beds, regulating the start of the cleaning process will ensure that the beds remain undisturbed during the key period for feeding for this species. Allowing the cleaning process to take place during the spring will provide 6 months before the start of the sensitive period for the bird features during the autumn of 2021. Based on the evidence of dredging impacts, for activities where the intensity in effort of dredging is much greater than that proposed for these lease beds, it is anticipated that the area will have recovered from the cleaning process by the start of this sensitive period. After this there will be no further requirement for cleaning the beds so there will be no further potential impact.

Night-time Rafting

The open water species, Goldeneye and Red-breasted Merganser, are known to create roosting rafts during the evening and overnight. Other species are also known to make roosting rafts in this area; Great Crested Grebe, Black-necked Grebe, Common Scoter, Long-tailed Duck and occasionally Great Northern Diver. It is known that these rafts occur over the area of lease beds 7 and 8. Based on the high-resolution seasonal information on activities proposed to be undertaken over lease bed numbers 7 and 8, it can be determined that aquaculture activity will not pose a risk to the presence of roosting rafts. All activities are proposed to take place during the daytime, between the hours of 08:00 and 16:00, with no activity at night. There is therefore no potential for an interaction.

Summary

- Farming methods will not create excess suspended sediment which could impact visual feeders (Red-breasted merganser)
- The farming method does not remove or have the potential to remove fish from the marine environment and therefore will not impact bird species with fish as their primary prey source (Red-breasted merganser)
- The low frequency of dredging activity is identified as having a low risk in effecting the benthic community and thus the availability of other prey items, with more intensive dredging practices showing no change in biotope or ecological quality in intertidal sediments within Poole Harbour. The increase in certain species, i.e. small polychaete worms, documented to follow more intensive dredging activity may also benefit ten of the species protected under the Poole Harbour SPA.
- The high-resolution information on seasonal patterns of aquaculture activity shows that no activity will take place at night-time during the sensitive period September to March.
- It has been identified that the cleaning of these two lease beds should not take place during January and February to ensure that there is no disturbance to the sediment which is potentially used by Goldeneye for feeding on small molluscs and polychaete worms

The Southern IFCA has concluded, based on the best available evidence that the management measures for lease bed numbers 7 and 8, with the addition of a requirement that the cleaning of these beds must not take place during January and February, are appropriate and will not hinder the achievement of the conservation objectives of the Poole Harbour SPA and therefore will not lead to an adverse effect on site integrity.

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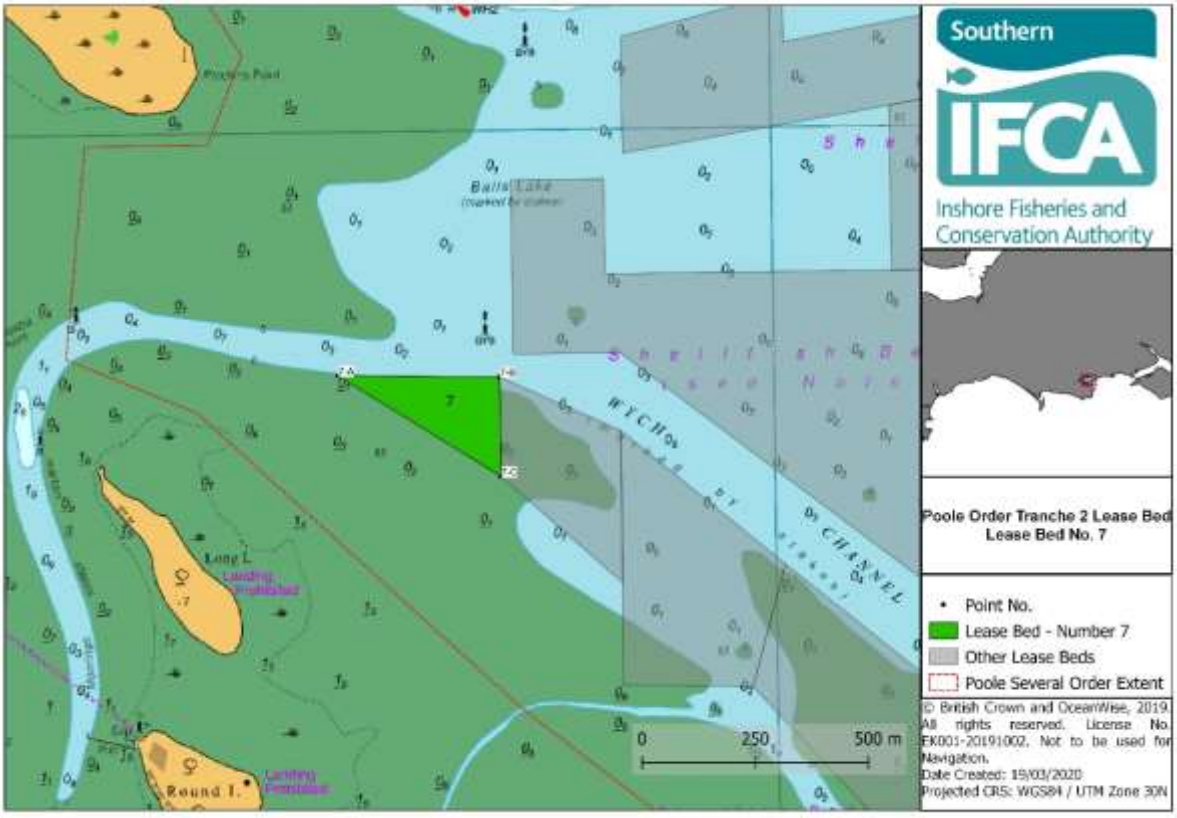
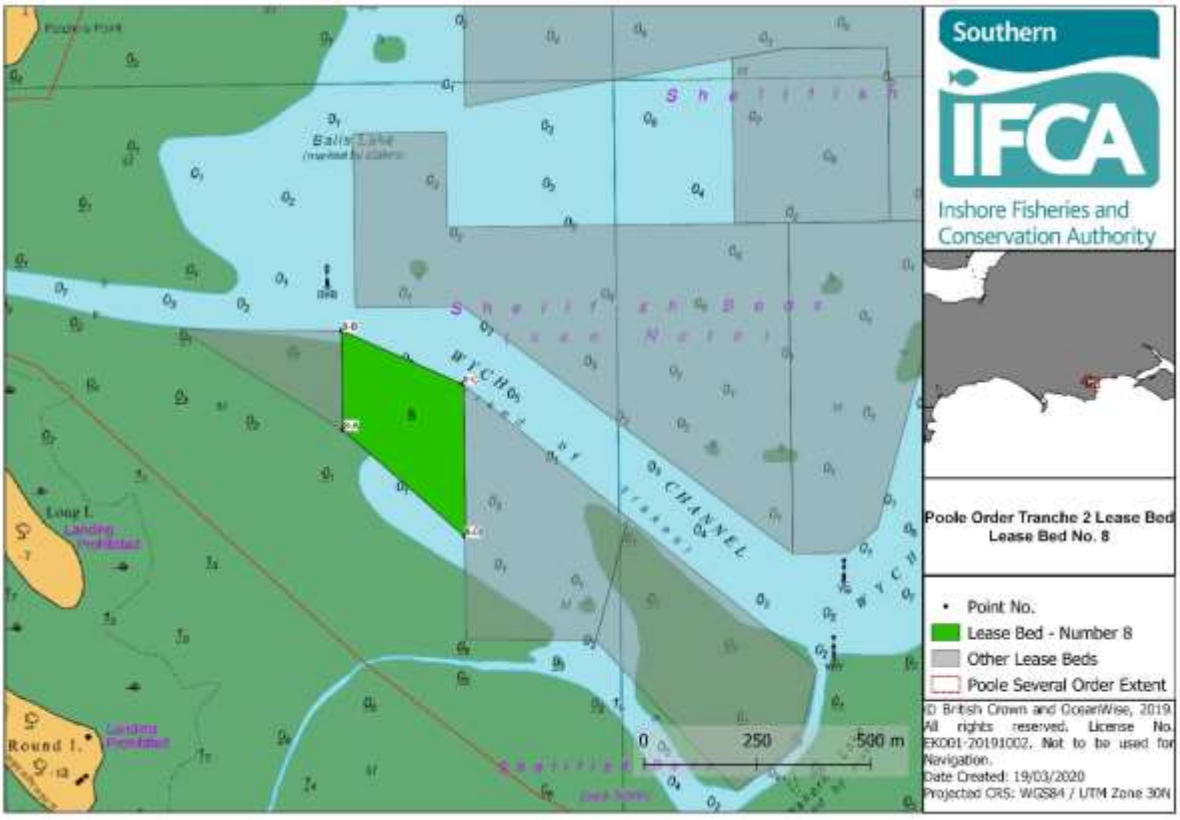
Annex 1 – High-resolution seasonal pattern of aquaculture activity on lease bed number 7 and 8

Beds 7&8	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Year 2021												
Cleaning	20 hrs/ 08:00-16:00/HW	20 hrs/ 08:00-16:00/HW	20 hrs/ 08:00-16:00/HW									
Seeding				*Lay/4 hrs/ 08:00-16:00/HW*	*Check & turn/ 6 hrs/ 08:00-16:00/HW*	*Check & turn/ 6 hrs/ 08:00-16:00/HW*	*Check & turn/ 6 hrs/ 08:00-16:00/HW*					
Harvesting								20hrs/08:00-16:00/HW	20hrs/08:00-16:00/HW	20hrs/08:00-16:00/HW	20hrs/08:00-16:00/HW	20hrs/08:00-16:00/HW
Years 2022 -2024												
Seeding				*Lay/4 hrs/ 08:00-16:00/HW*	*Check & turn/ 6 hrs/ 08:00-16:00/HW*	*Check & turn/ 6 hrs/ 08:00-16:00/HW*	*Check & turn/ 6 hrs/ 08:00-16:00/HW*					
Harvesting								20hrs/08:00-16:00/HW	20hrs/08:00-16:00/HW	20hrs/08:00-16:00/HW	20hrs/08:00-16:00/HW	20hrs/08:00-16:00/HW
Year 2025												
Cleaning				*Lay seed/10 hrs/ b/w 08:00-16:00/HW*	*Check & turn/ 6 hrs/ 08:00-16:00/HW*	*Check & turn/ 6 hrs/ 08:00-16:00/HW*						

Annex 2 – Maps of Lease Beds 7 and 8 for comparison with survey result data shown in table 3.1





Annex 9 – Lease bed 12 evidence package

The Poole Harbour Fishery Order 2015

Issuing of leases for the period 2020-2025

Evidence Package and Proposed Management Measures for the farming of Leased Bed Number 12

Document Control and Revision History

SIFCA Reference	SIFCA_T2_EP_Bed12
Author	S Birchenough
Approver	P Bateman
Owner	Southern IFCA

Date	Author	Version	Status	Reason	Approver(s)
16.11.20	S Birchenough	1.0	Draft	Initial draft based on outcomes of meeting between NE and SIFCA on 03.11.20	
25.10.21	S Birchenough	1.1	Final Draft	Inconsequential corrections made to timings of activity to align across all documents (HRA, Business Plan, Management Plan)	

This document has been distributed for information and comment to:

Version Sent	Name	Date Sent	Comments Received
1.0	Gavin Black	09.12.20	20.12.20

7. Background to Document

Duties under Regulation 63 of the Conservation of Habitats and Species Regulations 2017 require Southern IFCA, as a competent authority, to make an appropriate assessment of a plan or project likely to have a significant effect on a European site

(either alone or in combination with other plans or projects). As such, Southern IFCA undertakes an appropriate assessment for the issuing of leases under the Poole Harbour Fishery Order 2015 ('The Order'). The Order manages aquaculture activity within a defined area of Poole Harbour by conferring on the Southern IFCA the right of several fishery for the cultivation of shellfish of any kind for a period of twenty years from 1st July 2015. The Order covers an area of 837.8 hectares and allows for the cultivation of aquaculture species, namely 'shellfish' as defined in the Marine and Coastal Access Act 2009 (MaCAA) as "crustaceans and molluscs of any kind". The main species harvested are Pacific oyster (*Magallana gigas*) and common mussel (*Mytilus edulis*) with other species including native oyster (*Ostrea edulis*), clam species (primarily the Manila clam, *Ruditapes philippinarum*) and common cockle (*Cerastoderma edule*) having been farmed and/or cultivated historically. The definition provided in MaCAA allows the Southern IFCA to retain flexibility for shellfish species that could potentially be the subject of future aquaculture activity within the Harbour. Leases are issued under the Order for a period of five years. At the creation of The Order in 2015 leases were issued for the period 2015-20 with a corresponding appropriate assessment. The expiration of these leases in 2020 necessitated the issuing of new leases for the period 2020-25 accompanied by an updated Appropriate Assessment to determine, whether or not in the view of Southern IFCA, the issue of leases for 2020-25 will hinder the achievement of the conservation objectives of the Poole Harbour SPA and lead to an adverse effect on site integrity. The Appropriate Assessment was submitted to Natural England and Formal Advice was received which necessitated a closer examination of certain lease beds and species being farmed. This evidence package focuses on the farming of leased bed number 12 which is proposed to be used for the farming of the blue mussel *Mytilus edulis*.

1.1 Timeline of Correspondence

The following section outlines correspondence and feedback between Southern IFCA and Natural England on the Appropriate Assessment (AA), in relation to the farming of leased bed number 12:

- **16th June 20 – Submission of Appropriate Assessment to Natural England**
- **14th July 20 – Formal Advice received from Natural England**
  - NE provided Formal Advice that they did not agree with the conclusion in the HRA that the small area (approx. 0.1 ha or 1,000m2) of mudflat within leased ground number 12 was not significant in terms of potential pressure from abrasion and disturbance associated with aquaculture activities such as dredging. NE stated that any impact to supporting habitat should be avoided or mitigated wherever possible and that the HRA did not make it clear whether any consideration had been given to this. NE outlined that Southern IFCA would need to demonstrate that this area is not important to any of the SPA features.
- **22nd September 20 – Southern IFCA response letter to Formal Advice on the AA sent to Natural England**
  - Southern IFCA confirmed that, to date lease bed 12 had not been used for the purposes of aquaculture and that the bed would remain unused until any further required assessments had been undertaken and, where necessary, additional mitigation measures had been considered and resolved. Information was provided on the seasonal patterns of activity by the leaseholder for this

particular bed, this is outlined in section 2 of this evidence package. It was outlined that Southern IFCA will undertake an assessment of the sediment habitat (intertidal mud) which occurs within this lease bed. Natural England were asked to consider the high-resolution seasonal information on activity on this lease bed, recognising that activity levels across the year are low in comparison to other fisheries where similar dredging practices take place over intertidal and subtidal sediments within an SPA, and that these fisheries have been subject to, and passed scrutiny, through the HRA process.

- **29th October 20 – Natural England draft feedback on Southern IFCA response letter received via email**
  - NE outlined that their advice on seasonality is clear in that the key period of the year for most of the overwintering bird features in the Poole Harbour SPA is between September and March. It was stated that, based on the information provided, there was a clear overlap in terms of presence of protected bird features and the planned 'cleaning' and harvesting operations. NE indicated that, due to the location of the lease bed, the aquaculture activity could be impacting potentially important SPA supporting habitat, removing a valuable source of available prey, if the bird features are using these areas. NE indicated that they were unclear how the bird features utilised these specific areas but felt that currently a conclusion of no adverse effect could not be drawn. It was stated that if it could be demonstrated that bird features are not feeding in this area then it could be possible to increase certainty that impacts would be insignificant.

8. Seasonal Activity on Lease Bed Number 12

High-resolution was provided on the proposed seasonality of activity over lease bed number 12. The leaseholder indicated that cleaning of the bed would take place in March 2021, 2023 and 2025 for a total of 12 hours during the month. The cleaning would occur during daylight hours at periods of high water. Seeding activity was proposed to be completed during April and May 2021, 2023 and 2025 for a total of 10 hours per month between the hours of 2000 and 0800 at periods of high water. Harvesting was proposed to take place during October 2021, 2022 and 2024 over a total of six days within the month between the hours of 0800 and 1600. Additional harvesting was then proposed to take place during November and December for a total of 12 days across the two months, again between 0800 and 1600. All cleaning, seeding and harvesting would be done using a box dredge system.

A visual timetable of this activity is provided in annex 1.

9. Management Measures

Lease bed number 12 is to be used for the farming of common mussel (*Mytilus edulis*) sourced from wild seed fisheries. The seed is laid directly on the seabed where they remain until there is sufficient meat yield for markets.

Specific management measures relating to seasonal and temporal restrictions have been included on the lease for this bed. These restrictions are; the within the area of lease bed 12, no aquaculture activity of any kind will be undertaken outside of the hours 20:00 to 08:00 daily, during the calendar months of April, May, June, July, August and September.

10. Bird Features in Poole Harbour

4.1 Condition Assessment of the SPA bird features in Poole Harbour

Natural England provided a table of information on the condition of the bird features in Poole Harbour reflecting the most up to date information on these species (Table 4.1). The table shows the data for long-term change in the mean peak population abundance of wintering bird features of the Poole Harbour SSSI, SPA and Ramsar site and their associated condition, determined using the Common Standards Monitoring Guidance (CSMG) natural fluctuation method. Applying a CSMG method to the most recently available data from Poole Harbour, four bird species which qualify as interest features of the SSSI (they occurred in nationally significant numbers from the time of designation) have declined to below the CSMG baseline and are therefore classed as being in 'unfavourable condition'. These species are shelduck, pochard, red-breasted merganser and goldeneye. The numbers of a further 10 species remain above the baseline, even though the numbers of some of these species have also declined, and therefore are identified by the methodology as being in 'favourable condition'. The decline in shelduck numbers is seen to have added significance as the species is also a qualifying feature of the SPA and Ramsar site in its own right.

Wintering bird species feature	Mean peak winter population			Baseline count (lowest winter peak count in period 1986/87 to 1990/91)	Feature condition using CSGM natural fluctuation method
	1985/86 to 1989/90	2014/15 to 2018/19	% Change		
Brent Goose	729	1761	+142	433	Favourable
Teal	738	3265	+342	396	Favourable
Pintail	160	263	+64	84	Favourable
Shelduck	2377	1225	-48	1665	Unfavourable
Pochard	933	10	-99	633	Unfavourable
Red-breasted Merganser	382	207	-46	302	Unfavourable
Goldeneye	138	79	-43	109	Unfavourable
Cormorant	381	664	+74	339	Favourable
Avocet	59	1535	+2502	0 (lowest total of 1068 for 2006/07 – 2010/11 used for SSSI assessment)	Favourable
Grey Plover	346	164	-53	113	Favourable
Curlew	1231	1108	-10	972	Favourable
Black-tailed Godwit	1021	2336	+129	682	Favourable
Dunlin	4117	2283	-45	2055	Favourable
Redshank	1066	1059	-1	648	Favourable

Table 4.1: Data for long-term change in the mean peak population abundance of wintering bird features of the Poole Harbour SSSI, SPA and Ramsar site and their associated condition, determined using the CSMG natural fluctuation method. Table provided by Natural England.

3.2 Data on usage by bird species of intertidal area located within lease bed number 12

Information has been sought from expert sources on the potential for bird species in Poole Harbour to use the area of intertidal sediment mapped within lease bed number 12 for feeding. These sources include The Wetland Bird Survey (WeBS) counters and Birds of Poole Harbour. An initial analysis of the data provided for the annual WeBS survey and the Big Poole Harbour Bird Count undertaken by Birds of Poole Harbour showed that the data is not presented at a fine enough spatial scale to determine usage of the particular area of intertidal sediment in question. Further, more specific, information was therefore sought from persons who carry out the survey.

Information received indicated that the key species of interest in the area of intertidal sediment within lease bed 12 is Red-breasted Merganser. Other species seen in this area include Cormorant and Goldeneye for the winter period (all listed as part of the water bird assemblage) although Goldeneye are noted to occur in much lower numbers than other areas in the Harbour. Eurasian spoonbill has also been noted on one occasion, however expert knowledge is that this species is not normally seen in this area and on the one occasion had most likely been flushed from another area of the Harbour such as the Wareham Channel. Foraging terns which includes Common and Sandwich terns (listed as Annex 1 species) have also been seen in this area during the spring/summer and early autumn. Additional species were identified; great-crested grebe, great-northern diver and black-necked grebe, however these species are not features of the Poole Harbour SPA. Of the species identified, Goldeneye and Red-breasted Merganser are classed as being in unfavourable condition, as shown in table 4.1.

For the open water species (Goldeneye, Red-breasted Merganser) there is the potential for a raft of roosting birds to form in the evening. The roost has the ability to move around with changing wind direction and strength but tends to remain within the same vicinity of the Harbour. These species, along with the foraging tern species, will also use this area for feeding.

11. Mitigation and Summary Statement

Based on the information provided on the species to be farmed, the seasonal and temporal timelines for activity, the specific management measures included on the lease and knowledge of the use of the area by bird species, a summary of mitigation measures against potential impacts to the bird features of Poole Harbour SPA is given in this section.

Feeding and Prey Availability

The potential impact to visual and surface feeders as a result of suspended sediment and siltation have been outlined in section 6.2.7 of the Appropriate Assessment. These species include foraging terns (Common and Sandwich) and Red-breasted merganser which are identified as having a primary prey preference for fish (Scott and Olson, 1973; Brenninkmeijer and Stienen, 1994; Miller, 1996; Granadeiro *et al.,* 2002; Bur *et al.,* 2008; Green, 2017). It is concluded that impacts to these species are unlikely to be seen as a result of aquaculture activity in Poole Harbour. There is no potential for the removal of these prey items by the aquaculture activity occurring in this area. In addition, studies on siltation and sedimentation from dredging indicate that increases in suspended sediment and settling occur within a fairly small area around dredge works. Particle tracking models have shown that dredging through sediment using 8 dredges per side resulted in only 8.2% of suspended sediment remaining in the water column after 1 hour, figures which were comparable to naturally occurring suspension (Dale *et al.,* 2011). The same study found that it would take more than 200 dredge tows for suspended sediment levels to equal those seen during storm conditions (Dale *et al.,* 2011). This has been shown in other studies with sediment plumes and increased turbidity caused by dredging seen to disappear within 30 minutes to 24 hours of dredging taking place (Lambert and Goudreau, 1996; Maier *et al.,* 1998). Specific studies on clam dredging found that the resuspension of sediment was relatively minor compared to long-term wild-induced suspension (Auster and Langton, 1999) and the limitation of this activity to discrete areas was seen to result in these impacts occurring over a much smaller spatial scale than when suspended sediments result from natural disturbance (Wilber and Clarke, 2001). This is of particular relevance to the aquaculture activity proposed to take place over lease bed number 12 which, when compared to other types of dredging activity is small-scale and occurs over short time scales.

Another species which has been identified in the area on one occasion is the Eurasian spoonbill. It should be noted that this species was thought to be feeding in this area only because it had been flushed from another area of the Harbour and the location of lease bed number 12 is not known to be a common feeding site for this species. As with Red-breasted Merganser and tern species, the primary prey species of the Eurasian Spoonbill is documented as being fish (Aguilera *et al.,* 1996; Jouta *et al.,* 2018; Enners *et al.,* 2020).

The other species identified as utilising this area, albeit infrequently, and currently in unfavourable condition is Goldeneye. While the Goldeneye is documented to have a more varied diet, comprising molluscs and polychaete worms, it is well documented that the species shows a preference for common mussel (*Mytilus edulis*) as a prey item. Studies in the Baltic coastal region showed that the diet of Goldeneye was dominated by the common mussel (Nilsson, 1969) and in Scandinavia Goldeneye were documented to remain in areas where common mussel is common with juveniles in particular making up a large part of their diet (Kolthoff, 1896 – referenced in Pehrsson, 1976). Further studies in the Danish waters of the Baltic showed that 73.1% of the Goldeneyes surveyed has eaten *Mytilus* and that this food source was

particularly utilised in the winter where feeding grounds most frequented by this species were mussel grounds (Pehrsson, 1976).

The common mussel has also been shown to be an important food source for other bird species including the oystercatcher (Goss-Custard *et al.,* 1982; Ens and Goss-Custard, 1984; Laursen *et al.,* 2010) and the herring gull (Laursen *et al.,* 2010). For the oystercatcher, a preference has been shown for beds where mussels occur in denser concentrations and in one study, 31 mussel beds were shown to be utilised by this species each year for five consecutive winters (Goss-Custard *et al.,* 1982). A study looking specifically at the impacts of mussel farming on bird species has also been carried out in the Menai Strait, North Wales (Caldow *et al.,* 2003). The results of this study showed that, although there was a slight variance in the composition of the bird assemblage between farmed and wild mussel bed areas, none of the species were significantly negatively effected by the laying of mussels and the density of curlew and redshank (both components of the waterfowl assemblage under the Poole Harbour SPA) were seen to significantly increase (Caldow *et al.,* 2003). The abundance of small worms was seen in increase in farmed areas and it was postulated that the matrix created by the mussels laid down provided a refuge from water movement and desiccation which allowed invertebrates to remain closer to the surface and be more active at low water (Caldow *et al.,* 2003).

A more general consideration of the potential for removing non-target species through dredging and thus affecting the availability of prey items is given in detail in section 6.2.1 of the Appropriate Assessment. Considering impacts to Poole Harbour specifically, the study by Clarke *et al.* (2018) used a Before-After-Control-Impact (BACI) sampling design to assess the impacts of pump-scoop dredging on the benthic community structure and physical characteristics of the sediment. Whilst the gear type assessed is not the same as that proposed to be used on lease bed 12, the frequency of activity in the wild fishery using pump-scoop dredges is greater than that of the frequency of dredging proposed to take place over the intertidal sediment within lease bed number 12. The study showed that the benthic communities of an intensively dredged site and, to a lesser extent, a newly and therefore less intensely dredged site, were characterised by high numbers of small polychaete worms (Clarke *et al.,* 2018). Small polychaete worms are identified as preferential prey species for two of the bird species classed as unfavourable (Shelduck, Goldeneye) and a further eight species covered by the SPA designation (Avocet, Eurasian Spoonbill, Black-tailed Godwit, Dunlin, Curlew, Spotted Redshank, Greenshank and Redshank) (Information obtained from the SPA Tool Kit and Natural England's Poole Harbour Conservation Advice Package, specific information on prey species was taken, where available, from the draft supplementary advice on conserving and restoring site features and also from other conservation advice packages from nearby SPAs with the same bird features). The study also found that species richness and abundance was significantly higher in both dredged sites when compared to the control site and, although changes in community structure were identified, there was no change in the biotope or ecological quality at either of the dredge sites (Clarke *et al.,* 2018).

Night-time Rafting

The open water species, Goldeneye and Red-breasted Merganser, are known to create roosting rafts during the evening and overnight. The presence of these species in the area of lease bed number 12 indicates that it may be possible for rafts to be formed in this area. Based on the high-resolution seasonal information on activities proposed to be undertaken over lease bed number 12, it can be determined that aquaculture activity will not pose a risk to the presence of roosting rafts. All cleaning and harvesting activities are to take place during the daytime with no activity after daylight hours. Whilst seeding is proposed to take place at night-time, between 20:00 and 08:00, this activity will only take place during April and May, outside of the period of sensitivity for the bird features of the Poole Harbour SPA (sensitive period given as September to March).

Summary

- The farming of the common mussel (*Mytilus edulis*) will provide a food source for a bird species identified as being in unfavourable condition (Goldeneye)
- The farming of this species will also benefit other bird species within the Harbour including curlew and redshank (components of the waterfowl assemblage), oystercatcher and herring gull
- Farming methods will not create excess suspended sediment which could impact visual feeders (Red-breasted merganser and foraging tern species)
- The farming method does not remove or have the potential to remove fish from the marine environment and therefore will not impact bird species with fish as their primary prey source (Red-breasted merganser, foraging tern species, Eurasian Spoonbill)
- The low frequency of dredging activity is identified as having a low risk in effecting the benthic community and thus the availability of other prey items, with more intensive dredging practices showing no change in biotope or ecological quality in intertidal sediments within Poole Harbour. The increase in certain species, i.e. small polychaete worms, documented to follow more intensive dredging activity may also benefit ten of the species protected under the Poole Harbour SPA.
- The high-resolution information on seasonal patterns of aquaculture activity shows that no activity will take place at night-time during the sensitive period September to March.

The Southern IFCA has concluded, based on the best available evidence that the management measures for lease bed number 12 are appropriate and that the farming of common mussel (*Mytilus edulis*) in this area will not hinder the achievement of the conservation objectives of the Poole Harbour SPA and therefore will not lead to an adverse effect on site integrity.

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Annex 1 – High-resolution seasonal pattern of aquaculture activity on lease bed number 12

Bed 12	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Year 2021												
Cleaning			*12 hrs/daylight/ HW*									
Seeding				*10 hrs b/w 20:00-08:00/HW*	*10 hrs b/w 20:00-08:00/ HW*							
Harvesting										*6 days b/w 08:00-16:00*	*12 days (across Nov/Dec) b/w 08:00-16:00*	*12 days (across Nov/Dec) b/w 08:00-16:00/ HW*
Year 2022												
Harvesting										*6 days b/w 08:00-16:00*	*12 days (across Nov/Dec) b/w 08:00-16:00*	*12 days (across Nov/Dec) b/w 08:00-16:00/ HW*
Year 2023												
Cleaning			*12 hrs/daylight/ HW*									
Seeding				*10 hrs/ b/w 20:00-08:00/ HW*	*10 hrs/ b/w 20:00-08:00/ HW*							
Year 2024												
Harvesting										*6 days b/w 08:00-16:00*	*12 days (across Nov/Dec) b/w 08:00-16:00*	*12 days (across Nov/Dec) b/w 08:00-16:00/ HW*
Year 2025												
Cleaning			*12 hrs/daylight/ HW*									
Seeding				*10 hrs/ b/w 20:00-08:00/ HW*	*10 hrs/ b/w 20:00-08:00/ HW*							

Annex 10 – Pacific oyster evidence package

The Poole Harbour Fishery Order 2015

Issuing of leases for the period 2020-2025

Evidence Package and Proposed Management Measures for the farming of Pacific oyster (*Magallana gigas*)

Document Control and Revision History

SIFCA Reference	SIFCA_T2_EP_PacificOysters
Author	S Birchenough
Approver	P Bateman
Owner	Southern IFCA

Date	Author	Version	Status	Reason	Approver(s)
16.11.20	S Birchenough	1.0	Draft	Initial draft based on outcomes of meeting between NE and SIFCA on 03.11.20	P Bateman
27.11.20	S Birchenough	1.1	Final Draft		P Bateman

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1.1	Gavin Black	27.11.20	20.12.20

13. Background to Document

Duties under Regulation 63 of the Conservation of Habitats and Species Regulations 2017 require Southern IFCA, as a competent authority, to make an appropriate assessment of a plan or project likely to have a significant effect on a European site (either alone or in combination with other plans or projects). As such, Southern IFCA undertakes an appropriate assessment for the issuing of leases under the Poole Harbour Fishery Order 2015 ('The Order'). The Order manages aquaculture activity within a defined area of Poole Harbour by conferring on the Southern IFCA the right of several fishery for the cultivation of shellfish of any kind for a period of twenty years from 1st July 2015. The Order covers an area of 837.8 hectares and allows for the cultivation of aquaculture species, namely 'shellfish' as defined in the Marine and Coastal Access Act 2009 (MaCAA) as "crustaceans and molluscs of any kind". The main species harvested are Pacific oyster (*Magallana gigas*) and common mussel (*Mytilus edulis*) with other species including native oyster (*Ostrea edulis*), clam species (primarily the Manila clam, *Ruditapes philippinarum*) and common cockle

(*Cerastoderma edule*) having been farmed and/or cultivated historically. The definition provided in MaCAA allows the Southern IFCA to retain flexibility for shellfish species that could potentially be the subject of future aquaculture activity within the Harbour. Leases are issued under the Order for a period of five years. At the creation of The Order in 2015 leases were issued for the period 2015-20 with a corresponding appropriate assessment. The expiration of these leases in 2020 necessitated the issuing of new leases for the period 2020-25 accompanied by an updated Appropriate Assessment to determine, whether or not in the view of Southern IFCA, the issue of leases for 2020-25 will hinder the achievement of the conservation objectives of the Poole Harbour SPA and lead to an adverse effect on site integrity. The Appropriate Assessment was submitted to Natural England and Formal Advice was received which necessitated a closer examination of certain lease beds and species being farmed. This evidence package focuses on the farming of the Pacific oyster (*Magallana gigas*) and provides information on proposed management measures and monitoring for the period 2020-25.

1.1 Timeline of Correspondence

The following section outlines correspondence and feedback between Southern IFCA and Natural England on the Appropriate Assessment (AA), in relation to the farming of Pacific oyster:

- **16th June 20 – Submission of Appropriate Assessment to Natural England**
- **14th July 20 – Formal Advice received from Natural England**
  - NE provided Formal Advice that it was reviewing its advice regarding this species with more evidence coming to light that if a feral population were to become established it can lead to the significant deterioration of important wildlife habitats and can therefore represent a threat to the condition of a Marine Protected Area (MPA). It was stated that research indicates that farming triploid stock does not offer complete sterility and therefore using this type of stock in new farming operations does not offer certainty that spawning, subsequent settlement and potential impact on designated sites will not occur. NE's view is that, since the operations in Poole Harbour have been going on for some time and that annual robust monitoring has not identified any feral populations as becoming established then the existing paradigm is acceptable. Robust monitoring to ensure that no feral population of Pacific oysters is becoming established in Poole Harbour is critical to allowing the aquaculture activity to continue. NE advised that results of monitoring to date should be included in the AA and that a requirement for future monitoring is listed as a specific measure to ensure no adverse effect on site integrity. NE suggested that results of annual monitoring for feral oysters should be reviewed each year and that any more than one or two oysters in a single sample should trigger a review.
- **22nd September 20 – Southern IFCA response letter to Formal Advice on the AA sent to Natural England**
  - Southern IFCA requested a written copy of any advice received by NE from Defra which had informed NE's current position regarding this species. It was outlined that Southern IFCA intended to align management of Pacific oysters with National Policy and clarity was requested on the advice regarding the use of Pacific oysters by leaseholders who do not currently farm this species. Southern IFCA asked if NE would be happy to agree to the Authority continuing to manage Pacific oysters as per The Poole Harbour Several Order 2015 Management Plan (2020 Revision) in that any leaseholder who wishes to farm Pacific oysters as a new species must submit this intention to the Authority 8 weeks before any planned activity occurs on the lease bed so that consideration can be given to their request by both Southern IFCA and NE and a separate AA could be undertaken for the proposal if required. It was outlined that at present there was not sufficient data to make a baseline assessment of any wild population of Pacific oyster which may exist in Poole Harbour as the annual Poole Harbour Bivalve Stock Assessment focuses on stocks of bivalve species fished by the

commercial fishery, of which Pacific oyster is not one. It was suggested that a baseline survey be carried out in 2021 as part of the Poole Harbour Bivalve Survey to inform that baseline with a consideration of how to present the data encompassing scientific advice on natural rates of change in this species as seen in other areas where aquaculture is not present.

- **29th October 20 – Natural England draft feedback on Southern IFCA response letter received via email**
  - NE outlined that advice on Pacific oysters had been developed based on evidence gathered from around the country and that the high-risk casework panel had agreed the current stance. NE has provided advice to Cefas on Pacific oysters which has been viewed by Defra who have instigated a programme of work to inform a ministerial submission outlining future potential policy options. NE stated that due to increasing evidence that triploid stock can establish feral populations, a cap in effort in Poole Harbour would be required alongside robust monitoring to be confident that, at the current level of farming, Pacific oysters are not becoming established in feral populations and impacting the site. With specific regards to the monitoring survey, NE welcomed a discussion on methodology and existing sources of data with a recognition that a number of difference data sources may need to be used as indicators.

14. The Species: *Magallana gigas*, the Pacific Oyster

The following is a summary of information on the ecology and geographical distribution of the Pacific oyster which is relevant to the question of farming this species for the purposes of aquaculture. A detailed literature review of the Pacific oyster can be found in the PhD thesis 'Population structure and ecology of wild *Crassostrea gigas* (Thunberg, 1793) on the south coast of England' (Mills, 2016)[13].

The Pacific oyster (*Magallana gigas*) (Thunberg, 1793) is a filter feeding bivalve native to Japan and Korea (Mills, 2016). It is considered to be a cosmopolitan species with a global distribution and was originally imported in to Europe for the purposes of aquaculture in response to declines in the native oyster *Ostrea edulis* (Ruesink *et al.,* 2005). The species has been used for aquaculture in a number of European countries including the UK, the Netherlands, Germany, Denmark, Sweden, France and Norway (Mills, 2016). The emergence of wild populations has also been noted both in areas where aquaculture activity has taken place and also in its absence. In 1970, Pacific oysters were noted in New Zealand for the first time with the nearest established population some 1200 miles away in Australia (Dinamani, 1971). It was determined that the species had been introduced via the movement of ships, larval presence in ballast waters and discarding of oysters intended for food (Dinamani, 1971). It is noted that global proliferation of feral Pacific oyster populations has largely occurred independently from dates of introduction and instead tends to coincide with uncharacteristically warm summers (Minchin, 2007; Sorte *et al.,* 2010; Troost, 2010).

In the UK, the Pacific oyster was first imported in 1890 and it has now been determined that this first import was into Poole Harbour in Dorset (Humphreys *et al.,* 2014). There were no recorded incidences of wild recruitment in the UK between this time and 1962 when, for a period, imports of the species ceased (Spencer *et al.* 1994; Humphreys *et al.,* 2014). Since the 1990s, across the UK, small clusters of the species have since been recorded with aggregations noted in close proximity

[13] Note that this thesis was published prior to the change in nomenclature for the Pacific oyster where *Crassostrea gigas* became *Magallana gigas*. Whilst *Magallana gigas* is used in the scientific community, to date commercial movements of the species still often retain the name *Crassostrea gigas*.

to Pacific oyster aquaculture (Mills, 2016). It is noted however that there is considerable regional variation with some areas now showing dense reefs such as the River Yealm (anecdotally 1000 oysters counted within a 30-minute period) (Couzens, 2006) but others such as Portland Harbour and the Fleet, where there is cultivation, there is an absence of recruitment (Herbert *et al.,* 2012). It appears that wild aggregations are becoming increasingly dissociated from culture plots and distribution along the south coast in particular does not conform to a pattern of association with culture plots (Mills, 2016).

Pacific oyster colonises on hard substrates in the intertidal zone of estuaries and in sheltered coastal marine habitats (Mills, 2016). Throughout Europe the species has been noted to colonise littoral rock, chalky shores, boulders and muddy intertidal sediments (Herbert *et al.,* 2012). Where the species exists on rocky shore types, individuals tend to be found between mean high water and mean low water, and are not found at extreme low water or subtidally (Herbert *et al.,* 2012). Where the species is found on softer intertidal habitats, individuals are more likely to be found from approximately mean low water down to the shallow subtidal (Herbert *et al.,* 2012). The species feeds by filtering plankton, bacteria and particular organic matter (Mills, 2016). Along with other bivalve species there is the potential for these organisms to filter significant volumes of water providing a benefit in the removal of nitrogen and other nutrients, increasing water clarity and thus improving overall water quality (Gravestock *et al.,* 2019). A study in 2019 showed that the filtration potential and chlorophyll a removal resulting from the aquaculture of Pacific oysters in Poole Harbour could be significant with a filtration rate (combined with blue mussel *Mytlius edulis*) of up to 42.3×10^6 m^3 day^{-1} or 62% of the total volume of the Harbour on a neap tide (Gravestock *et al.,* 2019). At the highest filtration rate the entire volume of Poole Harbour could be filtered within 1.6-2.4 days depending on the tide (Gravestock *et al.,* 2019). On this basis it has been postulated that the farming of these species can be done sustainably and also provide benefit to an MPA, with Poole Harbour used as one of the first case studies aiming to demonstrate this (Gravestock *et al.,* 2019).

Pacific oysters are successive and irregular protandrous hermaphrodites reaching sexual maturity as a male one winter after initial settlement before potentially switching to become female (Mills, 2016). This is a rare reproduction strategy with spawning noted to occur at lower water temperatures of 17-20°C compared to the temperature required in their native region (Mills, 2016). Fertilisation takes place in the water column with the larvae remaining pelagic until they become pediveligers and settle out of the water column in response to chemical cues released by mature oysters (Mills, 2016). A suitable substrate is required for the pediveliger to settle using their foot and, following identification of a suitable settling place the larvae metamorphose into a sessile oyster (Mills, 2016). The use of triploid oysters was initially believed to result in complete sterility; however, it has been found that triploid oysters can produce gametes which are capable of fertilisation (Guo and Allen, 1994). The quantity of gametes produced per individual triploid oyster has been found to be fewer than in a diploid Pacific oyster and the survival rate for fertilised eggs through metamorphosis and settlement is considerably lower (Allen Jr. and Downing, 1990; Guo and Allen, 1994; Normand *et al.,* 2008). The reproductive output of a triploid oyster is variable; however, the source of the variation is not fully known (Mills, 2016).

15. Existing Data

3.1 A 2013 Study on the Abundance of wild Pacific Oysters in Poole Harbour

Data on the location and abundance of wild Pacific oysters in Poole Harbour was collected in 2013 as part of a PhD thesis (Mills, 2016). The below methodology is a summary of that provided in Chapter 3 of this thesis.

The survey was carried out in two phases, firstly a shore-based survey of the intertidal where there was some form of hard substrate present. Data was collected within an hour either side of low water on a spring tide combining both parallel and transverse survey patterns depending on the amount of shoreline that was available. When an oyster was located, the position was recorded using a hand-held GPS unit and the length of the oyster shell was recorded to the nearest mm. The sediment type was also classified.

If oysters were found at greater densities than 1 m^{-2} and, if the number of oysters occurring at this density were found within 10m of each other, belt transects were used to estimate population density with a 1x1m quadrat laid either side of the transect and any oysters counted and measured for shell length. Where a density of > 5 oysters m^{-2} was recorded, an additional 50m transect, parallel to the shore was also surveyed.

3.1.1 Results from Poole Harbour

Sites were classified using a scale which was developed for a Pacific oyster survey commissioned by Natural England to assess north Kent European Marine Sites (McKnight, 2009). The total area surveyed in Poole Harbour was approximately 430ha.

Pacific oysters were found in low abundances (≤1 oyster m^{-2}) at sites along the northern shore and only 1 oyster was identified at a single site along the southern shore. Blue lagoon was the only location in Poole Harbour where Pacific oyster was found at a density of more than 1m^{-2}. The full results and the associated site classification information are presented in tables 3.1 and 3.2. A visualisation of the data taken from Mills (2016) is reproduced in figure 3.1.

Site Classification	Figure Colour	Pacific oyster m^2	Description
Absent		0	Oysters absent from site
Solitary Site		1	A single oyster observed. No others in a 10m radius.
Solitary Zone		1	More than 1 solitary oyster observed within a site (site boundary determined by tide line, physical barriers such as sea defences or a change in substrate type) i.e. there is >10m between oysters.
Cluster Site		2-10	A group of oysters, where individuals are within a 10m range of any neighbour but density <10 oysters m^{-2}.
Cluster Zone		2-10	2 or more clusters within a site i.e. most oysters have <10m between them, however there may be areas of uncolonized substrate resulting in larger gaps. Density <10 oysters m^{-2}.
Colony		>10	All oysters within the site have <10m distance between them, with areas of settlement that exceed 10 oysters m^{-2}.

Table 3.1: Site classifications for Pacific oysters taken from Mills (2016) based on a survey conducted by McKnight (2009).

Site Name	Location of Start of Transect		No. of oysters m^{-2}	Site Classification
	Lat °N	Long °W		
Rockley Point	50.718767	-2.040006	4	Solitary Zone
Hamworthy West	50.713547	-2.025103	0	Absent
Moriconian Quay	50.713475	-2.024925	0	Absent
Lake Drive	50.711264	-2.016947	4	Solitary Zone
Hamworthy East	50.710481	-2.01055	6	Solitary Zone
Holes Bay W	50.717797	-2.004442	0	Absent
Holes Bay E	50.722708	-1.991478	0	Absent
Blue Lagoon	50.700486	-1.991478	541	Colony
Sandbanks	50.700944	-1.940678	0	Absent
Cleavel Point	50.674492	-1.998667	1	Solitary Site
Arne (RSPB)	50.692183	-2.026136	0	Absent

Table 3.2: Data taken from Mills (2016) on the number of Pacific oysters m-2 at sites around Poole Harbour and the associated site classification from table 1 (classification applied in Mills, 2016).

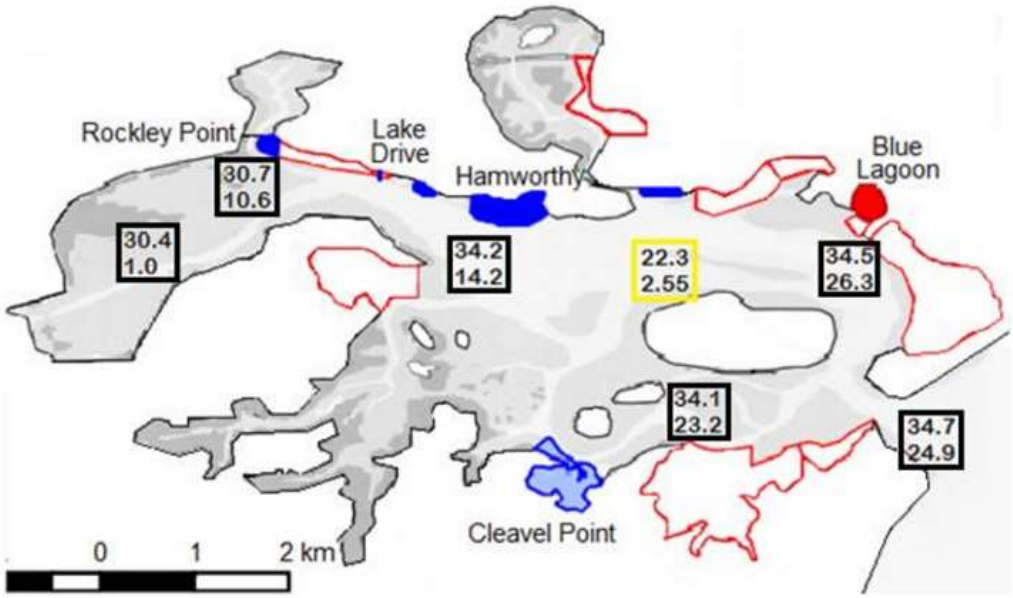

Figure 3.1: Reproduced from Mills (2016). Classification of Pacific oysters in Poole Harbour according to abundance. Colour refers to figure colours shown in table 3.1. Black boxes show maximum and minimum near surface salinity recorded by the Environment Agency as reported by Cefas (2009). Yellow box shows maximum and minimum water temperatures 1m below sea level in 2012 (data taken from Chapter 2.3 of Mills, 2016).

3.1.2 Comparison to data from Southampton Water

The survey by Mills (2016) also looked at the area of Southampton Water, another estuary on the south coast of the UK but without the presence of any Pacific oyster aquaculture. The same survey methodology was used and the results were presented in the same way. The data for Southampton Water is visualised in figure 3.2, taken from Mills (2016) (tabulated data not available for this site).

Figure 3.2: Reproduced from Mills (2016). Classification of Pacific oysters in Southampton Water according to abundance. Colour refers to figure colours shown in table 3.1, additional areas with a green outline and no fill are areas where Pacific oysters were identified on walk-over surveys but abundance was not quantified. Black boxes show maximum and minimum near surface salinity recorded by the Environment Agency as reported by Cefas (2009). Yellow box shows maximum and minimum water temperatures 1m below sea level in 2012 (data taken from Chapter 2.3 of Mills, 2016).

The data shows that, at the time of the survey, Pacific oysters were generally more abundance in Southampton Water than in Poole Harbour with the distribution in Southampton Water spread over a larger area. Poole Harbour in contrast was characterized by sparsely distributed solitary zones. The data corresponded with similar data from previous years (pre-2013) on the east and west of England's south coast. Comparisons were made to sites in the east of England where Pacific oyster abundance in 2009 was seen to be present as cluster zones on natural substate, similar to Southampton Water in 2013 (Mills, 2016). In the east of England sites areas of overlaid recruitment were also present indicating that Pacific oysters were in the advanced stages of reef building (McKnight, 2009). This pattern was not observed for Poole Harbour. The lack of recruitment noted in the Harbour was thought to be a result of several different factors. While the growth rate in adult oysters in Poole Harbour was noted to be strong, the conditions required for augmenting growth at the larval stage may not be present thus inhibiting initial recruitment and therefore settlement of larvae (Mills, 2016). The study also postulated that strong tidal currents within Poole Harbour are potentially acting as hydrographic barriers to the northern shore and results in the majority of any larvae being flushed out of the Harbour (Mills, 2016). It is observed that whilst the south side of the Harbour may receive larvae, there is a lack of suitable settlement structure (Mills, 2016).

3.2 Pacific Oyster Aquaculture in Poole Harbour

Farming of pacific oysters in Poole Harbour is currently undertaken by two leaseholders. As outlined previously, the species has been present in the Harbour since the original introduction in 1890 (Humphreys *et al.,* 2014). The activity has been managed through the use of fishery orders, namely The Poole Fishery Order 1985 (1985-2015) which was a hybrid several/regulating order and more recently The Poole Harbour Fishery Order 2015 (2015-2035) which is a stand alone several order and was introduced on 1st July 2015 following the expiration of the 1985 Order.

Poole Harbour is the largest pacific oyster production area in England (Williams and Davies, 2018). An assessment of the economic value of the species to the UK aquaculture industry was undertaken and, based on 2011/12 data, it was estimated that the Annual Gross Output (five times the first sale

value) was £13 million and the Gross Value Added was over £10 million (Williams and Davies, 2018). The economic value specifically for Poole Harbour aquaculture (Pacific oyster and mussel) was also estimated using a model developed for the harvesting of shellfish in the Solent (Williams and Davies, 2018). The model made an assessment of Gross Output as the direct economic turnover from aquaculturists selling catch upon landing and the Indirect Output representing expenditure in the supply chain as a consequence of the activity (Williams and Davies, 2018). The Gross Output was estimated at £1,590,000 and the Indirect Output at £1,025,250 which gives a total Economic Activity Value for the Pacific oyster in Poole Harbour of £2,615,250.

The Pacific oyster in Poole Harbour is farmed through a process by which seed is brought in and grown on at the oyster production barge in the Harbour until they are of sufficient size to minimise predation. Following this the oysters are laid directly on the seabed to grow to market size which is determined by weight rather than a length measurement. The weight of the oysters harvested will depend on the intended market. The harvesting and processing of the oysters from the seabed happens directly over the lease bed therefore any oysters which are not harvested are returned directly to the same area of lease bed from which they came (information on farming practices taken from www.othniel.com). Farming of triploid oysters started in early 2016 and a complete transition to the farming of triploid oysters had taken place by 2018. The hatcheries used to supply the oyster seed farm exclusively triploid oysters.

16. Legal Status

The Pacific oyster is currently classified as an invasive non-native species (INNS) and has be classed as presenting a 'medium' risk to the environment by an independent assessment in the UK. Despite this classification, current EU legislation does not prohibit aquaculture for this species but instead promotes the use of sustainable management practices (Herbert *et al.*, 2012). The current view is that management measures should be proportionate to the level of risk which exists in a specific area at a specific time. A study carried out in 2012 concluded that a specific approach is more likely to be effective than broad-scale national measures which will not be necessary or applicable to all areas.

17. Proposed Management Measures, Monitoring and Control

Based on correspondence with Natural England as documented in section 1.1, a consideration of best available evidence and a subsequent meeting between Natural England and Southern IFCA, the Southern IFCA proposes to use the following management measures with regard to the farming of Pacific oysters in Poole Harbour:

- Farming of Pacific oysters will be undertaken in Poole Harbour by the two leaseholders who have historically farmed this species at this site. Under The Poole Harbour Several Order 2015 Management Plan (2020 revision) and accordingly, the Terms of the Leases, any leaseholder who does not currently farm Pacific oysters must provide the Authority with a request to do so and associated methodology, in writing, 8 weeks before the intended date at which this activity would commence. During this 8-week period, Southern IFCA will assess the request and liaise with Natural England to determine if the request can be granted. This process may also involve the undertaking of a separate HRA specific to the request. Leaseholders will understand that their request may not be granted.
- In 2021 Southern IFCA will commence a survey to assess the population of wild Pacific oysters within Poole Harbour. This survey will be shore based and will build on the work carried out in

2013 (Mills, 2016) using similar methodologies. This survey will be run in conjunction with the University of Southampton and expert advice will be sought on the finalisation of the methodology to be used and the methods of data analysis. The aim is to carry out this survey for the first time during the summer of 2021 as part of a Masters project with data analysis, results and a final report provided by autumn 2021. The data produced by this survey will be considered alongside any other available relevant data sources including but not limited to data on the sources of wild populations of Pacific oysters in the UK and any indication of a level of natural change which would be expected regardless of the presence of aquaculture activity on the site. From this the Southern IFCA will liaise with Natural England to discuss the survey results and develop an on-going survey program and Monitoring and Control Plan for the fishery, where the results will feed into reviews of management measures for The Poole Harbour Fishery Order 2015.

- Southern IFCA will continue to monitor any developments in National Policy relating to Pacific oysters. As outlined in The Poole Harbour Several Order 2015 Management Plan (2020 revision) Southern IFCA will align their management of this species with this National Policy. The indication from Defra as of 25th November 2020 (information provided at the SAGB Mollusc Committee Meeting) is that they are aiming to review the National Policy for Pacific oysters in spring 2021. At this time the SAGB Mollusc Committee is proposing to hold a meeting specifically about Pacific oysters which the Southern IFCA will attend. Once the updated National Policy is published Southern IFCA will review this alongside the management of this species in Poole Harbour.

18. Summary Statement

The Southern IFCA feels that the proposed management measures outlined in section 5 appropriately address the potential impacts associated with the farming of Pacific oysters under The Poole Harbour Fishery Order 2015 based on current best available evidence. At present, farming effort for this species, in terms of the number of leaseholders actively farming, is capped at historic levels. Information provided by these leaseholders indicates a significant reduction in stock to be laid down on lease beds over the next five-year lease term (2020-2025) when compared to historic farming effort. There has also been no expansion in the area over which the farming of this species will take place as the hectarage for the two leaseholders in question under Tranche 2 is the same as that which was leased under Tranche 1. Farming of this species by leaseholders who have not historically farmed Pacific oysters in Poole Harbour will not be allowed without a rigorous assessment of the proposed methodology and Southern IFCA will be consulting with Natural England during this process. If required, additional Habitats Regulations Assessments will be carried out and leaseholders will be aware that their request may not be granted.

With regard to current farming practices, the Pacific oyster has been present in Poole Harbour since 1890 and yet survey work has shown that quantities of wild oysters within the Harbour are low and are also lower than those found in areas where aquaculture for this species does not take place (Mills, 2016). Pacific oyster farming in Poole Harbour uses exclusively triploid stock and while it is recognised that this does not guarantee sterility, studies have shown that the quantity of gametes produced by an individual oyster is lower in triploids and the survival rate for fertilised eggs is considerably lower (Allen Jr. and Downing, 1990; Guo and Allen, 1994; Normand *et al.,* 2008). A lack of recruitment of wild Pacific oysters has been noted in Poole Harbour with the conditions of the Harbour potentially impacting recruitment and larval settlement as well as tidal currents being postulated to inhibit larval settlement on the northern shore and sediment characteristics inhibiting settlement on the southern shore (Mills, 2016).

The benefits of the Pacific oyster should also be noted with the species being demonstrated to filter significant volumes of water aiding in the removal of nitrogen and other nutrients and thus improving

water quality (Gravestock *et al.,* 2019). In addition, there is increasing work to look at the potential for bivalve aquaculture in carbon sequestration (van der Schatte Olivier *et al.,* 2020). The uptake of carbon in the form of calcium carbonate for shell production has been shown to be a potential long-term sink of carbon with carbon sequestration per year in oyster farms measured at between 3.81 and 17.94 t C ha^{-1} yr^{-1} in one study (Hickey, 2009) and 13.47 ± 1.00 t C ha^{-1} yr^{-1} at a density of 286 oysters m^{-2} (Higgins *et al.,* 2011). This links to the UK Government's 25 Year Environment Plan which sets targets for both improving water quality and combating the effects of climate change.

The Southern IFCA has concluded, based on the best available evidence that the management measures provided in section 5 of this document provide appropriate management for the farming of Pacific oysters in Poole Harbour to ensure that the activity does not hinder the achievement of the conservation objectives of the Poole Harbour SPA and lead to an adverse effect on site integrity

19. References

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