Document Control

Title	**Poole Harbour Special Protection Area (SPA) Appropriate Assessment - Issue of Permits Under Poole Harbour Dredge Permit Byelaw (2023-24 Season)**
SIFCA Reference	SIFCA/HRA_PP/PHDPByelaw202324
Author	S Birchenough
Approver	
Owner	Southern IFCA
Template Used	HRA Template Plan/Project v1.0

Revision History

Date	Author	Version	Status	Reason	Approver(s)
23/01/2023	S Birchenough	1.1	Initial Draft		P Bateman
17/03/2023	S Birchenough	1.1	Final Draft	No amendments required following NE advice, version 1.1 maintained	P Bateman

This document has been distributed for information and comment to:

Organisation	Name	Date sent	Comments received
Natural England	Gavin Black / Eleanor James	26th January 2023	17th March 2023 Conclusions agreed, no changes required

Southern Inshore Fisheries and Conservation Authority (IFCA)

Habitat Regulations Assessment for Plans/Projects

European Marine Site: Poole Harbour SPA

Plan/Project: Issue of permits under Poole Harbour Dredge Permit byelaw for 2023-24 season

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 9 of the Conservation of Habitats and Species Regulations 2017 and the Conservation of Habitats and Species (Amendment) (EU Exit) Regulations 2019 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 site that is part of the National Site Network (either alone or in combination with other plans or projects). As such, Southern IFCA undertakes an annual appropriate assessment for the issue of permits under the Poole Harbour Dredge Permit byelaw which regulates dredge fishing within the Poole Harbour Special Protection Area (SPA). The byelaw regulates the wild shellfish fishery in the Harbour through the annual allocation of a fixed number of permit entitlements (45). The permit allows the use of, retention on board, storage and transportation of a dredge within Poole Harbour and under each permit a number of conditions are applied. The purpose of the assessment is to determine, whether or not in the view of Southern IFCA, the issuing of permits 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 shellfish dredging impacts identifies the permitted activity has the potential to disturb bird populations and lead to changes in prey availability. These potential impacts and risks to the integrity of the site are however mitigated through a number of conditions applied under the permit. These include the exclusion of shellfish dredging all year round in a number of key sites which represent important areas for feeding and roosting, prohibition of shellfish dredging during key sensitive times (1st November-23rd December & 25th May-30th June) in a series of areas also important for feeding and roosting, the timing of the closed season (24th December to 24th May) which largely corresponds to the overwintering period, a cap on fishing effort through the allocation of a set number of permits and a number of restrictions on gear configuration. Additional mitigation is afforded to saltmarsh habitats, which are a supporting habitat for the features of the SPA, through four areas where shellfish dredging is prohibited all year round, three at Seagull Island and one at Green Island, and through the Southern IFCA ‘Poole Harbour Saltmarsh Protection Code of Practice’ which sets out guidelines to avoid disturbance to nesting and roosting birds and promote the protection of supporting breeding habitat.

Based on these mitigation measures, in the form of permit conditions and additional protection from the Code of Practice, it was concluded that that issuing of permits for the 2023/24 season under the Poole Harbour Dredge Permit Byelaw will not hinder the site from achieving its conservation objectives and as such will not have an adverse effect upon on the integrity of the Poole Harbour SPA and Ramsar site. As in previous years (2015/16, 2016/17, 2017/18, 2018/19, 2019/20, 2020/21, 2021/22, 2022/23) it is therefore proposed the number of permits issued should remain at 45.

Table of Contents

2 Introduction

2.1 Need for a Habitats Regulations Assessment (HRA)

The National Site Network[1] 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. The Conservation of Habitats and Species Regulations 2017[2], as amended by The Conservation of Habitats and Species (Amendment) (EU Exit) Regulations 2019[3], transposes the land and marine aspects of the Habitats Directive and the Wild Birds Directive into domestic law, and outlines how the National Site Network will be managed and reflect any changes required by EU Exit.

Southern IFCA has duties under Regulation 9 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 European site (SPA or SAC) within the National Site Network, 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 63 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 that forms part of the National Site Network (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 permits under the Poole Harbour Dredge Permit byelaw for the 2023/24 season. The purpose of this document is to assess whether or not in the view of Southern IFCA, the issue of permits under the Poole Harbour Dredge Permit byelaw will have a likely significant effect on the bird features and supporting habitats (saltmarsh and intertidal sediment) of the Poole Harbour SPA alone, and in combination with other plans or projects. The assessment ensures Southern IFCA meets its responsibilities as a competent authority by ensuring that the conservation objectives of the Poole Harbour SPA will be met and the integrity of the site is not adversely affected.

[1] The National Site Network is the network of sites in the United Kingdom's territory consisting of such sites as immediately before EU Exit day formed part of the Natura 2000 site network.
[2] The Conservation of Habitats and Species Regulations 2017 (legislation.gov.uk)
[3] The Conservation of Habitats and Species (Amendment) (EU Exit) Regulations 2019 (legislation.gov.uk)

2.2 Documents reviewed to inform this assessment

- Reference list[4] (Annex 1)
- Natural England's Conservation Advice[5]
- Site map(s) – sub-feature/feature location and extent (Annex 2)
- Fishing activity data (map(s), etc) (Annex 3)
- Natural England's advice on the potential impacts of shellfish dredging on the nature conservation features of Poole Harbour SPA, Ramsar and SSSI (received 3rd June 2014) (Annex 4)
- Fisheries Impact Evidence Database (FIED)/SPA Tool Kit

3 Information about the Special Protection Area

- 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

[4] 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)

[5] https://designatedsites.naturalengland.org.uk/Marine/MarineSiteDetail.aspx?SiteCode=UK9010111&SiteName=Poole%20harbour&countyCode=&responsiblePerson=&SeaArea=&IFCAArea=

- 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[6] 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 mudflats 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. 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.

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

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

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

3.2 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 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*

3.4 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' for the Poole Harbour SSSI. This importantly includes the ongoing management of Wild Fishing Activity of which clam dredging is a part. In the site management statement, it was agreed that the current process of reviewing the Poole Harbour Dredge Permit Byelaw HRA in consultation with Natural England will ensure that the fishery does not damage or disturb the features of the site.

4 Plan/Project Description

The Poole Harbour Dredge Permit (PHDP) byelaw[7] regulates the wild shellfish fishery in Poole Harbour through the annual allocation of permit entitlements and as such requires an annual HRA for the issuing of permits.

4.1 Poole Harbour Dredge Permit

The permit allows the use of, retention on board, storage and transportation of a dredge within Poole Harbour.

Under the permit, a series of conditions are applied, relating to catch restrictions and reporting; gear types; gear construction and restrictions and spatial and temporal restrictions (see Annex 5 (Map) and Annex 6 (Permit Conditions)). The permit also allows for a requirement to fit specified equipment to vessels.

The permit is flexible and allows Southern IFCA to review the suitability of the permit conditions, attach conditions to the permit and vary or revoke conditions attached to the permit at any time after the permits have been issued, following a set process. As such, any changes will have regard to the Authority's duties and obligations under section 153 and 154 of the Marine and Coastal Access Act 2009, advice from Natural England, new evidence in the form of scientific data or literature and/or any Habitats Regulations Assessment. This flexibility allows proportionate management of the dredge fishery in Poole Harbour whilst achieving the conservation objectives of the site.

[7] https://secure.toolkitfiles.co.uk/clients/25364/sitedata/Redesign/Poole_Hrbr_D_Permit/Poole-Hrbr-D-Permit-Byelaw.pdf

As in previous years (2015/16, 2016/17, 2017/18, 2018/19, 2019/20, 2020/21, 2021/22, 2022/23) it is proposed there will be a maximum of 45 permit entitlements. This reflects the current level of effort which is considered to be sustainable.

4.1.1 Permit Conditions

The spatial and temporal restrictions (Annex 5 & 6), which are part of the permit conditions, are designed to mitigate any potential impacts of dredge fishing activity on the nature conservation features of the Poole Harbour SPA and ensures there will be no adverse effect on site integrity. They reflect advice received from Natural England received prior to the introduction of the PHDP byelaw (June 2014) and an ongoing assessment of evidence relating to the marine environment in Poole Harbour and fishing activity under the Poole Harbour Dredge Permit Byelaw. The permit conditions:

Provide a network of areas where there is little or no noise and visual disturbance and sediment disturbance, including in the following specific areas:

- bird sensitive areas, areas where declines in some bird species have been observed (Brands Bay, Wych Lake, Lytchett Bay) that are likely to be in part attributable to site specific pressures
- Mediterranean gull nesting sites at Seagull Island
- areas where sediment recovery is likely to be slow (low energy sites)
- fringing saltmarsh, reedbed and lowland water habitats that support breeding birds

This is reflected in the permit conditions through the following measures:

- Shellfish dredging is excluded in Bird Sensitive Areas in Lytchett Bay, Holes Bay, and the inner regions Wych Lake and Middlebere Lake all year round.
- Shellfish dredging is excluded in sensitive saltmarsh habitat areas at Seagull Island and Green Island all year round.
- Shellfish dredging is excluded from overwintering, feeding and roosting bird sensitive areas at Wych Lake, Middlebere Lake, Newton Bay, Ower Bay, Keysworth Bay and parts of Arne Bay and Brands Bay (Annex 5) during key sensitive times of the year for bird species between 25th May and 1st July, 1st November and 23rd December.

Exclude or manage intensity where high levels of sediment disturbance could result in release of contaminants

- The area of Holes Bay is noted to pose a risk to release of contaminants

This is reflected in the permit conditions through the following measures:

- Shellfish dredging is excluded in Holes Bay all year round

Manage shellfish dredging throughout the Harbour in a way that minimises its impact on prey availability and disturbance

This is reflected in the permit conditions and Byelaw through the following measures:

- Restrictions in the number of permits (45)
- The design of the pump and dredge used
- Restrictions in the timing of when the fishery takes place (closed from 24th December to 24th May). The prohibition on dredge fishing activity from 24th December to 24th May mitigates over-wintering bird disturbance during this lean period.

Provide an ability to monitor catch levels, particularly for the main commercial species (Manila clam and common cockle) that are also prey species for some of the designated bird species.

This is reflected in the permit conditions and Byelaw through the following measures:

- There is requirement for fishers to provide monthly catch return data indicating, for each day of the month, the hours fished, the quantities of shellfish taken, the buyer(s) and the zone of the Harbour from which the catch was taken. This data allows the Southern IFCA to monitor trends in fishing activity and relate catch data to the data from the Poole Harbour Bivalve Stock Assessment[8] to ensure that fishing activity continues to remain sustainable with respect to shellfish stocks.

4.1.2 Changes to Permit Conditions

There have been no changes to permit conditions since the end of the 2022 fishing season. The last review of permit conditions took place following the end of the 2021/22 season, this review was underpinned by a need to consider a long-term management solution for the protection of saltmarsh habitat at Green Island and the wider harbour as well as considering the cost implication for the re-certification of the dredge fishery under the Marine Stewardship Council (MSC) Certification. The details of this review and associated outcomes are provided in the 2021/22 Appropriate Assessment for this fishery (https://secure.toolkitfiles.co.uk/clients/25364/sitedata/Redesign/Poole-Dredge-Permit-Fisheries/HRA-PHDPByelaw-2022-23.pdf). The changes to management which resulted from this review are incorporated into this Appropriate Assessment as they were for the 2022/23 Appropriate Assessment.

4.1.3 Additional work in the Permit fishery

During the 2021/22 fishing season, additional work was carried out in the fishery through 'The Poole Clam and Cockle Fishery Partnership Project' a project funded by the Marine Stewardship Council's Ocean Stewardship Fund which ran from March 2021 to February 2022. The project centred around progressing the condition placed on the fishery by the Marine Stewardship Council (MSC) certification relating to the management of the fisheries with regard to Endangered, Threatened and Protected (ETP) species. Progress had been made in this regard within the fishery following the initial Certification, and the Poole Harbour Clam and Cockle Fishery Group (consisting of the Poole and District Fishermen's Association, the Southern IFCA and Dorset Wildlife Trust) saw that there were shared benefits in continuing the partnership in order to address the condition and improve the fishery. The project was designed to drive performance, promote further innovation in the fishery and enable this work to be communicated widely with others so that the benefits of co-management and MSC certification can be replicated and enjoyed by others.

The aims of the project were to:

- Establish a co-management system to support fishers in minimising interactions with ETP species
- Widen knowledge of ETP species in Dorset
- Improve awareness of the positives of fishermen as sentinels
- Provide a blueprint and supporting information for other fisheries aiming for MSC certification

[8] Reports for the Poole Bivalve Stock Assessment can be found on the Southern IFCA website at https://www.southern-ifca.gov.uk/poole-harbour-fisheries. Note that there was no stock assessment carried out in 2020 due to the COVID-19 pandemic.

As part of the project the following outputs were produced:

4.1.3.1 Educational materials

Permit fishers were provided with an updated guide to the most common ETP species (Figure 3) with a link to the Southern IFCA website where more detailed information is provided on these and other ETP species that are found within the Harbour and wider area (https://www.southern-ifca.gov.uk/etp-species). Similar information was also placed on two interpretation boards which were installed at Fisherman's Dock and Rockley Marina.

Figure 3. Waterproof guide to ETP species provided to fishers in the Poole Harbour Dredge Permit Fishery their permit pack.

4.1.3.2 Observer Program

An observer program was carried out between July and October 2021. On-board observations were carried out for 18 permitted vessels over 19 fishing trips in Poole Harbour between July and October 2021. The observer worked covered a total of 37 hours of fishing activity and 424 dredge hauls as follows:

- A 3-4 hour period of observation was caried out for each vessel
- The hauling of the dredge was photographed on each occasion at the point where the dredge reached the sorting riddle
- From this point the haul was continually observed for the presence of ETP species until the dredge was returned to the sea
- Each image was given a GPS coordinate

The locations where dredge hauls were observed are shown in Figure 4. The results showed that there was no gear interaction with ETP species for any of the observer trips, representing 42% of the active fishery participants.

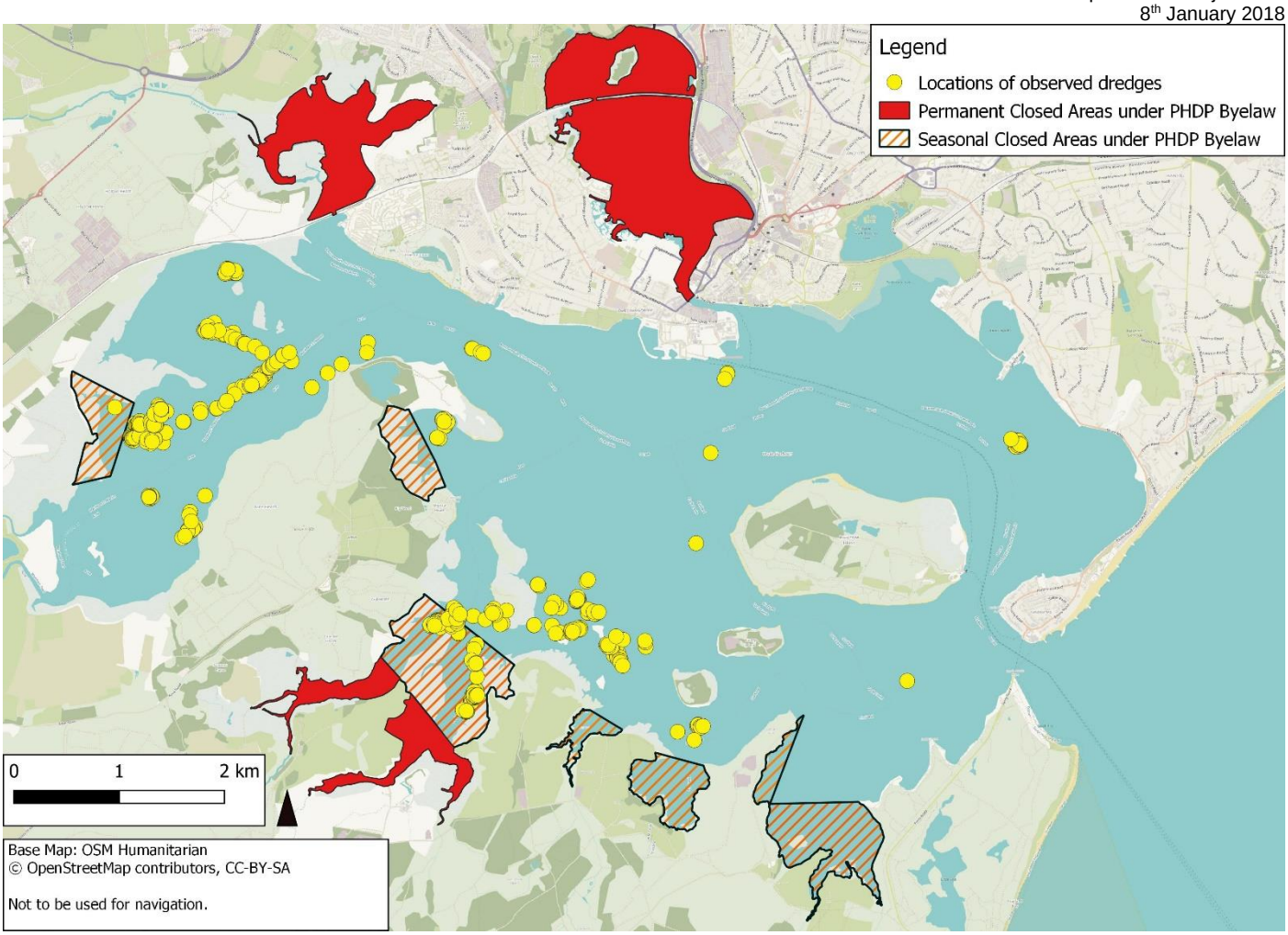


Figure 4. Locations where hauls were observed for permitted fishing vessels in the Poole Harbour Dredge Permit fishery as part of the observer program. Also shown are permanent and seasonal closed areas under the permit conditions.

4.1.3.3 Fishing Gear

Over the last two years, innovations have been made to fishing gear in the Poole Harbour dredge fishery which have added benefits in helping to mitigate potential impacts to ETP species. These innovations fall under three categories; developments to engines and water pumps, developments to fuelling mechanisms, developments to dredges and sorting equipment. Examples are shown in Figure 5.

i) Developments to engines and water pumps

The method of fishing in the dredge fishery has evolved so that the dredge can be operated whilst the vessel is on tick-over rather than running in gear. This has reduced the noise created by the engine whilst fishing is taking place which is in closer proximity to areas where ETP species would be likely to be disturbed by increased noise for example Bird Sensitive Areas. Noise reduction is also seen on larger catamaran style vessels which are being used in the fishery through the need to only use one of the twin engines, again on tick-over, during fishing practice.

Modifications to the water pumps, used to power the hydraulic aspect of the dredge equipment, have also resulted in a reduction in the noise produced from fishing activity. Water cooled exhausts are being used on water pumps which reduces the noise output. In addition, the newer catamaran style vessels and some of the dory style vessels run the water pump using the inboard diesel engine which powers the vessel rather than a stand-alone generator which greatly reduces the noise previously created by requiring a secondary generator which would sit on the deck of the vessel.

Finally, water pumps that are run using a separate petrol generator have been modified to also drive the hydraulics that operate the dredge which has removed the need for a separate power source for the hydraulic system. This reduction in the number of power sources across all modifications has resulted in a reduction in noise in the dredge fishing process. As with engine modifications, the use of this equipment will occur when in fishing locations which are likely to be in closer proximity to areas where ETP species will be located, the reduction in noise will therefore greatly reduce the potential for disturbance impacts to these species both above and below water.

ii) Developments to fuelling mechanisms

The installation of in-board auxiliary water pumps on the newer catamaran style vessels and some existing larger vessels in the permit fishery have resulted in the use of diesel as the fuel source rather than petrol which is less flammable and creates less of a risk of fire on-board vessels. Re-fuelling of the in-board pumps is also required less frequently removing the need to re-fuel in-situ during fishing activity and the location of the pump, in-board, makes the re-fuelling processes easier and, should a spill occur, it is much easier to contain the spill without any risk to the marine environment. All of these modifications reduce the risk of introducing a pollutant into the marine system which can have negative impacts on many ETP species (and the wider marine environment).

iii) Developments to dredges and sorting equipment

Innovations in the fishery have been seen in the pump-scoop dredge used to harvest shellfish. A fisher has been trialling a vibrating pump-scoop dredge which vibrates during the dredging process. This assists in moving material through the dredge whilst it is in the water, meaning that the dredge does not become full of additional sediment and detritus as quickly therefore increasing the retention of the target species which can otherwise be blocked from entering the dredge and minimising the retention of target species under the minimum conservation reference size as they are able to pass more easily through the dredge bars during the fishing process.

Fishers in this fishery also use secondary sorting equipment in the form of a riddle, which is a table with spaced metal bars that aims to minimise retention of target species below

the minimum conservation reference size. Fishers have voluntarily increased the bar spacing on both the riddle and the pump-scoop dredge to greater than that which is required by the Poole Harbour Dredge Permit of 18mm, to either 19mm or, in some cases, 20mm. This increase in bar spacing ensures that material retained by the dredge which is not the target species can be returned more quickly to the seabed and any target species under the minimum conservation reference size can also be returned quickly to the seabed.

Further innovations in the sorting equipment is seen in the use of a mechanised riddle, operated by a computer system which has varying levels each set at a different bar spacing down to the required spacing of 18mm at the lowest level. This improves fishing efficiency and helps to ensure the maximum amount of legal catch can be retained from a single dredge. This method also helps to minimise the quantity of target species under the minimum conservation reference size which would have to be hand gauged by the fisher as there is more opportunity for undersized individuals to pass through the riddle given the several different layers.

All of the modifications to dredges and sorting equipment are designed to reduce the amount of time that a fisher needs to spend gauging catch to ensure compliance with minimum conservation reference size regulations. Whilst some gauging will still be required, the degree to which this is needed between dredges will be reduced. This gives fishers more time to be aware of the area they are fishing in and observe any potential ETP species which may be in the same area thus enabling them to take action to mitigate any potential interaction. In addition, the target species for the fishery are identified as food sources for many of the ETP bird species in the Harbour. By reducing the time that undersized individuals are removed from the sediment and minimising accidental retention there will be benefits to the target species populations which help to support certain ETP species as a food source.

4.1.3.4 Risk Management Strategy

As part of the project a Risk Management Strategy was produced to outline how ETP species management can be approached in an adaptive manner which incorporates significant stakeholder involvement and elements of co-management through the promotion of fishery-dependent data collection. The Strategy presents the outcomes of the Poole Partnership Project and provides a process to follow for management development which aims to be applicable to other fisheries, particularly in the small-scale (<10m) inshore sector where fishing activity overlaps with conservation features. The Strategy also aims to provide guidance to fisheries in the process of or looking to start the process of becoming certified under an ecolabelling scheme such as the Marine Stewardship Council Certification. The Risk Management Strategy can be viewed on the Southern IFCA website (ETP Species : Southern IFCA (southern-ifca.gov.uk)).

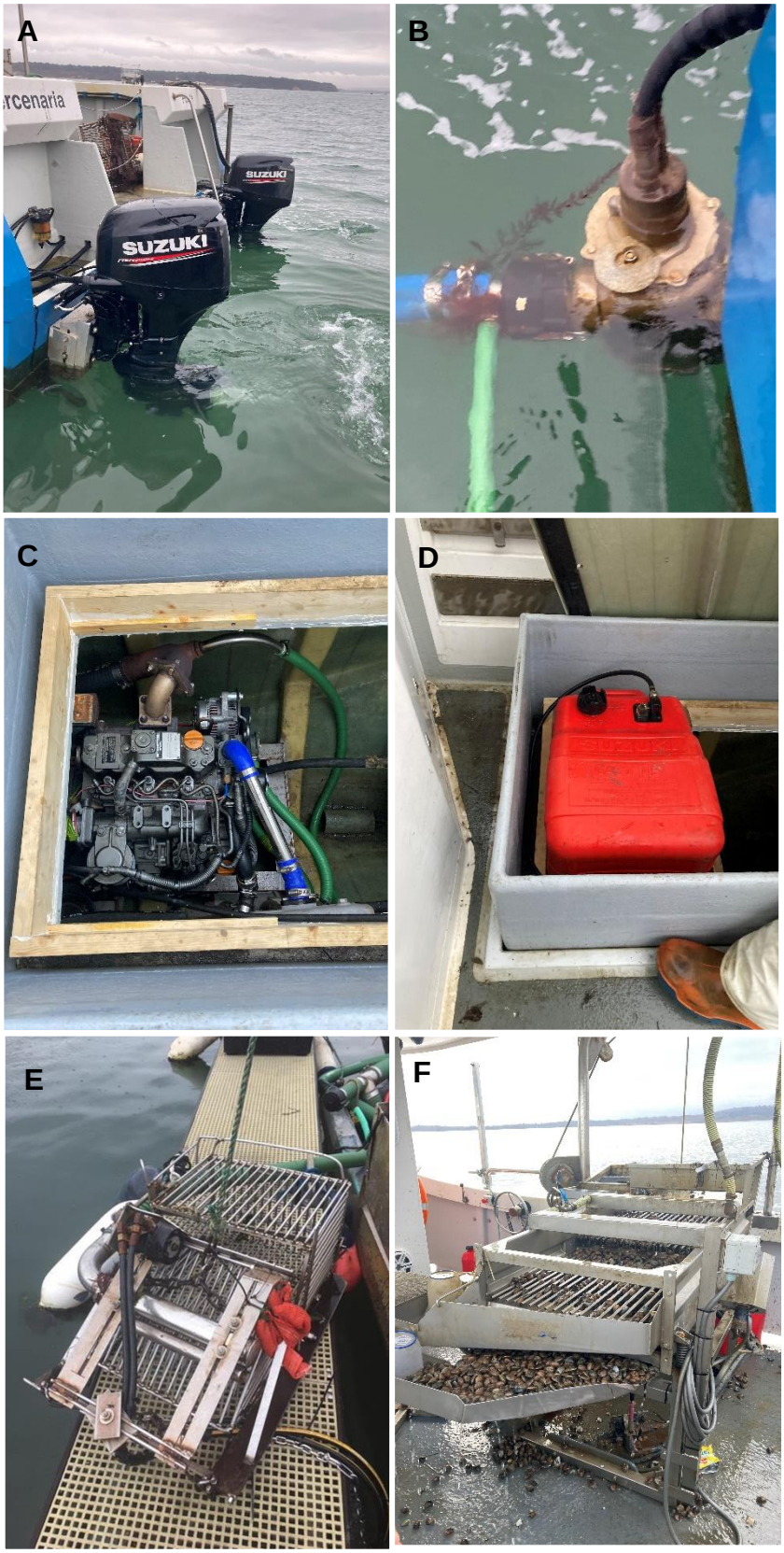


Figure 5. Examples of fishing gear innovations in the Poole Harbour dredge fishery; A) use of a single engine on tick-over during fishing, b) water cooled water pump, c) use of vessel's inboard engine to power water-pump, d) inboard fuel supply for dredge hydraulics and water pump, e) vibrating pump-scoop dredge and f) mechanised riddle table.

4.1.4 Poole Harbour Dredge Permit Access Policy

The Access Policy[9] outlines the way in which the Authority administers the allocation of permits under the byelaw and sets out criteria for applicants based on whether they have held a permit during the previous season or are a new entrant. In either case, the vessel for which an application is made must be a relevant fishing vessel as defined in the byelaw and the applicant must be a majority shareholder in that vessel or nominated for that purpose by a majority shareholder of the vessel provided that the applicant is also named as a shareholder on the vessel's certificate of registry.

This ensures that in order to gain a permit there is a rigorous process and set of criteria which will be tested by the Authority. The specified criteria are designed to ensure that permit entitlements are used during the season and that the fishery is open to those with a genuine desire to engage in the commercial shellfish fisheries within the Harbour. The process also prohibits unregistered/unlicensed fishing and creates a robust regulatory mechanism against illegal activity. The current version of the Access Policy was adopted by the Authority at their meeting on 21st March 2019.

4.2 Technical Gear Specifications

Fishing for shellfish in Poole Harbour is carried out using pump-scoop dredge. 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 6). 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; Clarke *et al*., 2018). 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).

A comparison between the pump-scoop and hand-held dredge revealed no differences in the areas fished in terms of proximity to the shore (i.e., potential displacement of birds) or sediment penetration (i.e., likelihood of impacting on infaunal communities). Further observations also showed no increase in fishing intensity when comparing both dredge types.

The pump-scoop dredge is towed in a circular motion with each tow lasting from 2 to 5 minutes depending on the nature of the seabed. After each tow the pump-scoop dredge is lifted into the vessel and the contents of the dredge basket are emptied directly onto the riddle for sorting. Fishers must sort their catch immediately and return all shellfish under minimum size restrictions, as well as bycatch, to the water. The configuration of the pump-scoop dredge is 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. Bar spacing is designed to allow young spat and infauna to go through the dredge basket (Jensen *et al*., 2005). A riddle with bar spacing of 18 mm is mandatory for the sorting of shellfish.

[9] https://secure.toolkitfiles.co.uk/clients/25364/sitedata/Redesign/Poole_Hrbr_D_Permit/Poole-Hrbr-D-Permit-Access-Policy.pdf

Figure 6. Typical pump-scoop dredge set up with basket dredge, water jets, davit arm and sorting riddle.

4.3 The Poole Harbour Shellfish Fishery: Location, Effort and Scale of Fishing

Prior to the introduction of the PHDP byelaw, commercial shellfish dredging within Poole Harbour was regulated through a combination of the Poole Fishery Order 1985, a hybrid Regulating and Several Order that licensed the wild clam fishery and provided leased ground for shellfish aquaculture, and the 'Cockle' byelaw, which regulated commercial cockle fishing. There was additional clam fishing in areas which fell outside of the Poole Fishery Order 1985, namely Brands Bay and Lytchett Bay. There was also a level of unlicensed/unregistered fishing activity for both clam and cockle, with 18 unlicensed vessels recorded by SIFCA between 1st January 2012 and 1st September 2014.

On 1st July 2015, the Poole Harbour Dredge Permit byelaw was introduced to regulate the use, retention on board, storage and transportation of a dredge through the allocation of permit entitlements. Simultaneously, the Poole Harbour Fishery Order 2015 was also introduced on 1st July 2015 to regulate shellfish aquaculture within the Harbour. Since the introduction of the PHDP byelaw, 45 permit entitlements have been allocated each season (2015/16, 2016/17, 2017/18, 2018/19, 2019/20, 2020/21, 2021/22, 2022/23). During the most recent season (2022/23), 45 out of 45 permit entitlements were taken out.

4.3.1 Fishing Effort and Landings

During each fishing season, under the permit conditions, permit holders are required to submit a monthly catch return form indicating, for each day of the month:

- The hours spent fishing; and
- The quantity in kilograms of each species caught that day; and
- The number of zone(s) in which the quantities of species caught that day have been taken according to the zonation map provided with the catch return form; and
- The name(s) of the company or individual to whom all parts of the catch was sold or declare that no catch was taken on that day by entering the word 'nil' in the column for "Species caught and Quantity"

If no fishing has taken place during a month, the permit holder must indicate this to the Southern IFCA by submitting a 'nil' catch return.

The data from these catch returns is used to analyse trends in fishing activity and is presented in figures 7-12. Statistical analysis has been carried out on the catch data using a non-parametric Kruskal-Wallis test and, where required post-hoc Dunn's method to look for significance between years.

For the 2022/23 season, the number of permit holders actively fishing per month varied from 27 in May to 40 in September. In all years, the number of active fishers generally increases throughout the months of the season, except for the 2016/17 season where a decline in active fishers was seen in August. For all seasons from 2018/19 to 2021/22 the number of active fishers in the last three months of the season (October to December) was at least 40 out of the 45 permit holders, however numbers of active fishers were seen to be lower in the 2022/23 season with 39, 37 and 35 active fishers for October, November and December respectively. Figure 7 shows the variation in the average number of active fishers for each season. Statistical analysis using a Kruskal-Wallis test showed that the average number of active fishers per season was significantly different ($P<0.05$) but the only difference in post-hoc testing (Dunn's method) was between the 2019/20 season and the 2015/16 season with the latter having a significantly lower average number of active fishers. It is important to note that all permit holders actively fish throughout the season but do not necessarily fish for every month of the season. The reasons for this may be related to weather, vessel maintenance, alternative fishing practices, other work commitments or extraordinary circumstances.

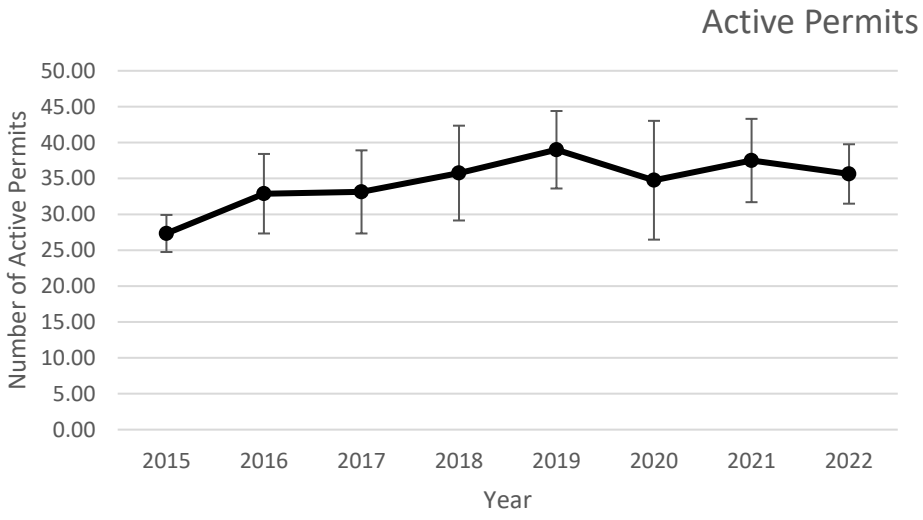


Figure 7: Average number of active permits per season for 2015/16 – 2022/23. Error bars represent the standard deviation.

The total number of hours fished in each month of the season is shown in Figure 8a for all seasons under the Poole Harbour Dredge Permit Byelaw to date. For the 2022/23 season, the total number of hours fished in a month (excluding May where there are only 5 days available for fishing), varied from 1498.0 in December to 2600.50 in August. Statistical analysis of the hours fished between fishing seasons (Figure 8b) showed that there was no statistical difference between seasons for hours fished (P=0.668).

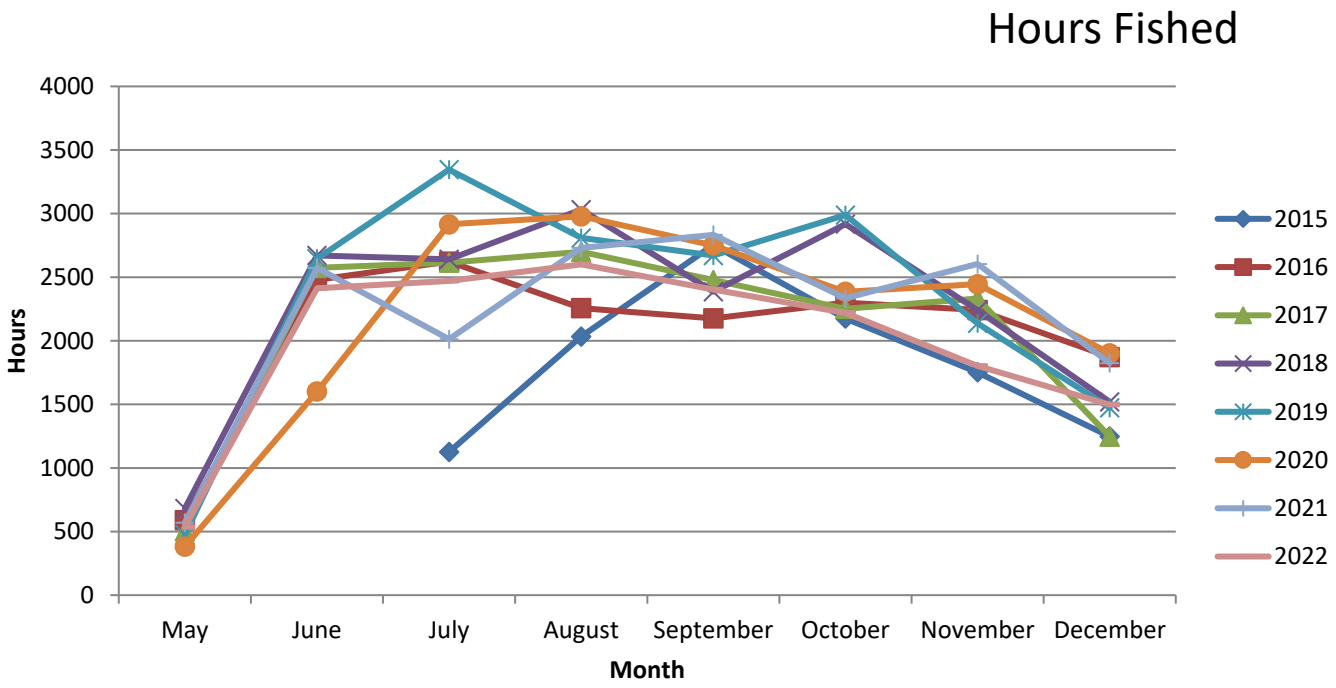


Figure 8a: The total number of hours fished by Poole Harbour Dredge Permit holders for each month of the fishing season from 2015/16 to 2022/23. In 2015, the season commenced on July 1st. For all other years the season commenced on May 25th.

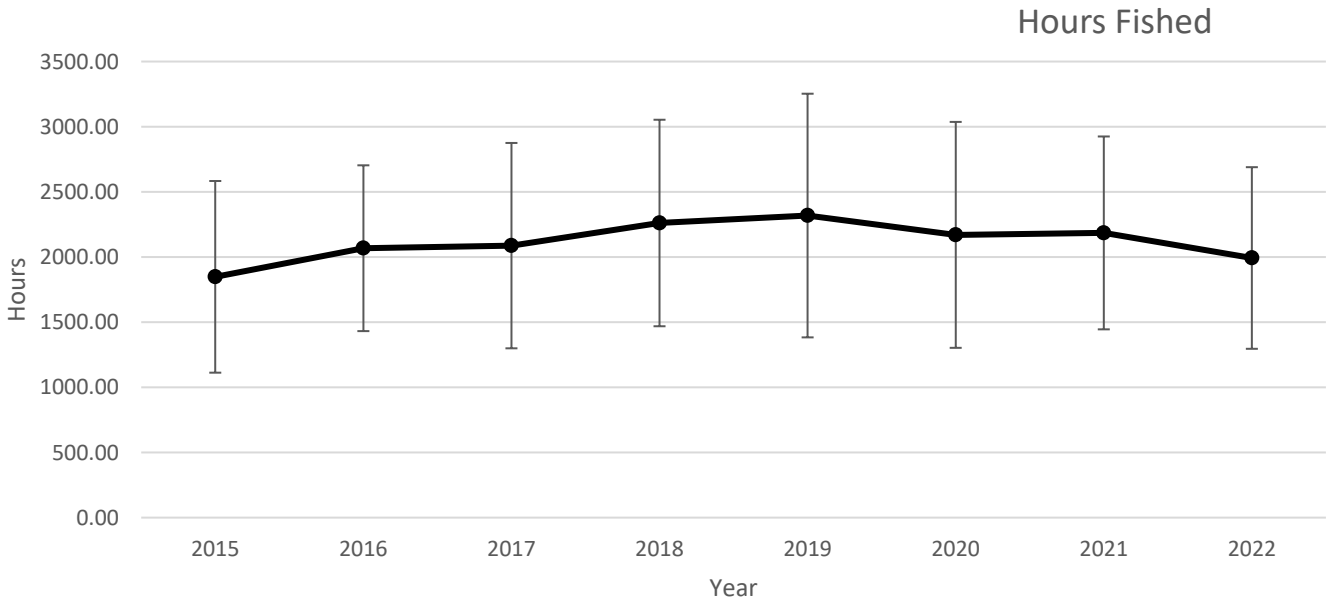


Figure 8b: Average hours fished across the whole fishing season for 2015/16 to 2022/23. The error bars represent the standard deviation.

The main targeted species is the Manila clam (*Ruditapes philippinarum*) which is reflected in the landings data, in comparison to landings for cockle and other bivalve species. The total quantity of Manila clam landed each month of the season is shown in Figure 9a for all seasons to date. For the 2022/23 season, the total quantity of Manila clam landed by all active fishers in a month (excluding May where there are only 5 days available for fishing), varied from 23,726.0kg in December to 60,055kg in July. Statistical analysis of the quantity of Manila clam landed between fishing seasons (Figure 9b) showed that there was a significant difference between seasons ($P<0.05$). Post-hoc testing showed that the quantities landed in 2020/21 and 2021/22 were significantly higher than the quantity landed in 2016/17. A large increase in the quantity of Manila clam landed was observed during the 2020/21 season, since then landings have been seen to steadily reduce each subsequent season back towards the quantities observed in the 2019/20 season. The reason for the large increase in landings in 2020/21 is not known, however the subsequent stock survey in spring 2021 did not indicate any negative impact on the stock from the increase landings.

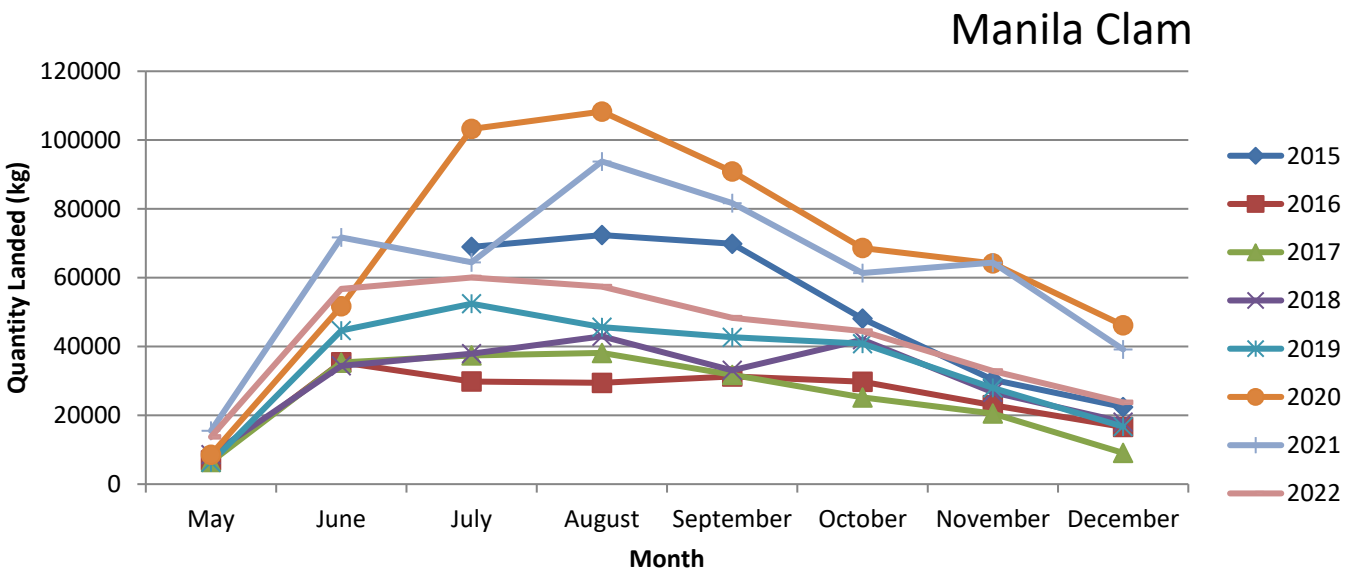


Figure 9a: The total quantity of Manila clam landed by Poole Harbour Dredge Permit holders for each month of the fishing season from 2015/16 to 2022/23. In 2015, the season commenced on July 1st. For all other years the season commenced on May 25th.

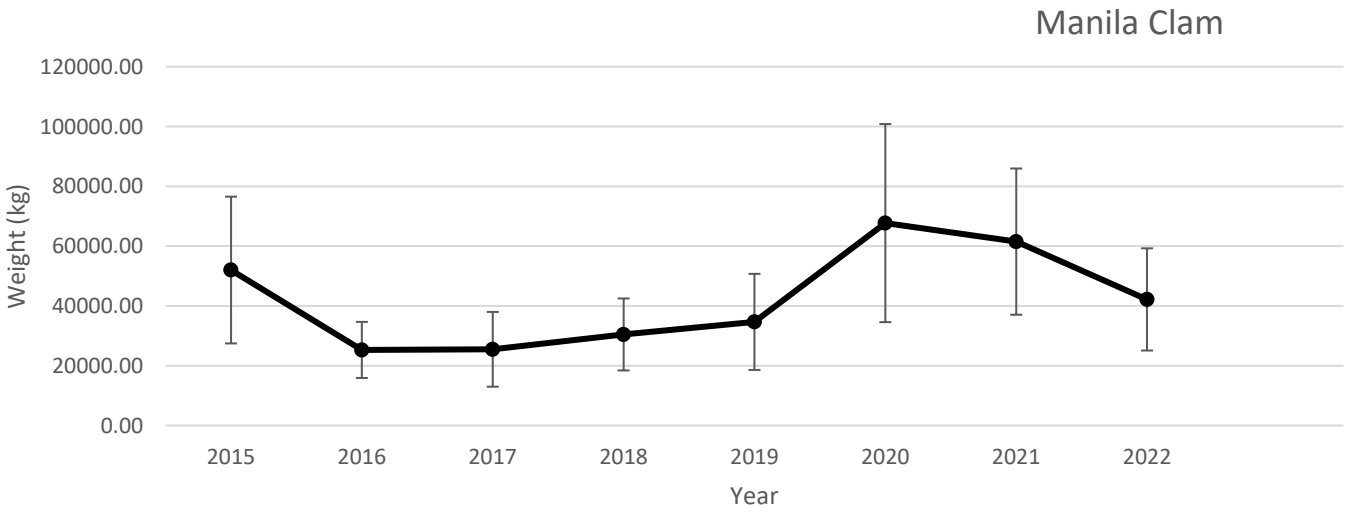


Figure 9b: Average quantity of Manila clam landed across the whole fishing season for 2015/16 to 2022/23. The error bars represent the standard deviation.

A number of fishermen target common cockle (*Cerastoderma edule*) throughout the season; however, it is usually less popular as a target species due to a lower market price, the fact they are less widespread within the Harbour and the difficulties with harvesting the species as they are associated with harder ground. The cockle fishery is also dependent on market demand which can cause large scale monthly fluctuations in catch quantity.

The total quantity of Cockle landed each month of the season is shown in Figure 10a for all seasons to date. For the 2022/23 season, the total quantity of Cockle landed by all active fishers in a month (excluding May where there are only 5 days available for fishing), varied from 2154.0kg in December to 8725.0kg in July. Statistical analysis of the quantity of Cockle landed between fishing seasons (Figure 10b) showed that there was a significant difference between seasons ($P<0.001$). Post-hoc testing showed that the quantities landed in 2018/19 and 2019/20 were significantly higher than the quantity landed in 2020/21. The lower catch levels for 2020/21 may be explained by the higher catches of Manila clam but relatively stable levels of hours fished suggesting that fishers spent similar times fishing but put more effort into targeting Manila clam than other species.

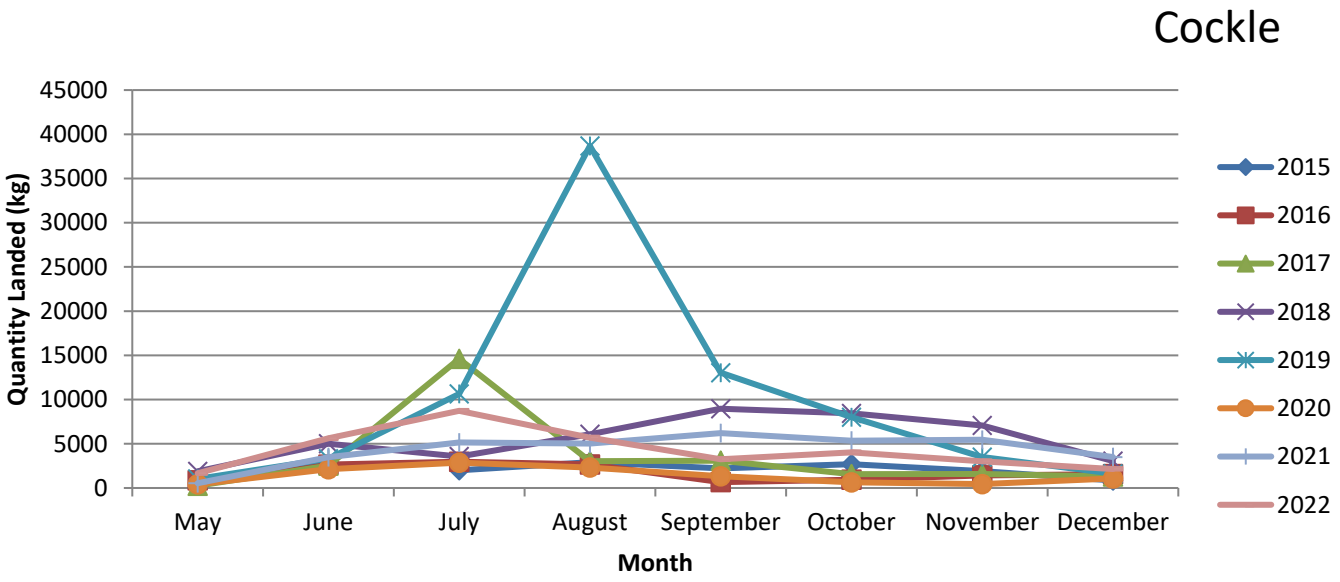


Figure 10a: The total quantity of Cockle landed by Poole Harbour Dredge Permit holders for each month of the fishing season from 2015/16 to 2022/23. In 2015, the season commenced on July 1st. For all other years the season commenced on May 25th.

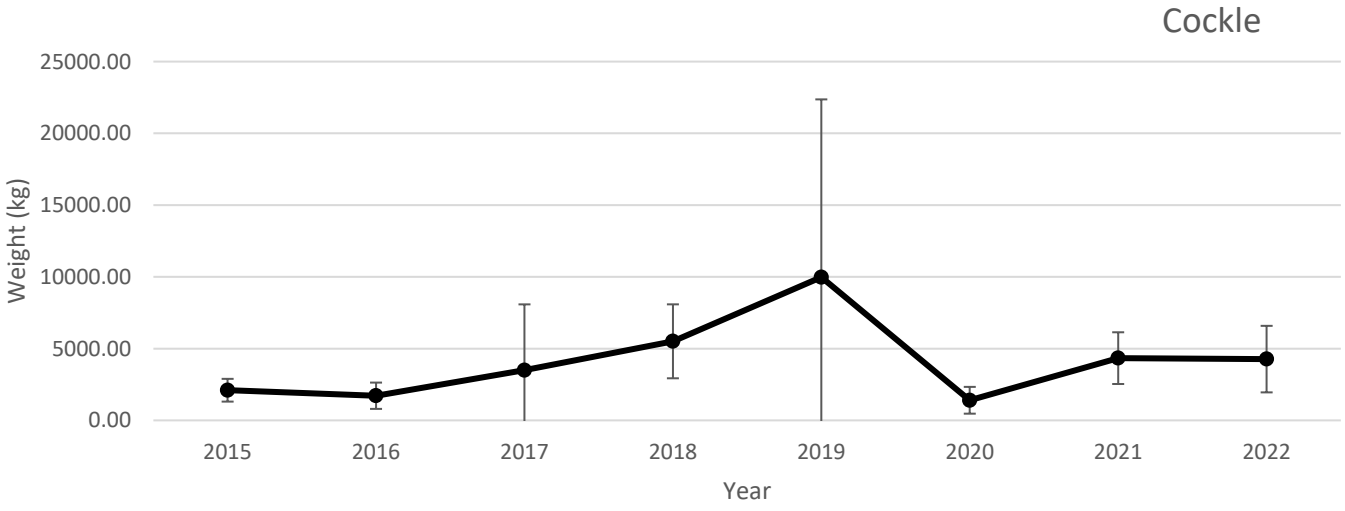


Figure 10b: Average quantity of Cockle landed across the whole fishing season for 2015/16 to 2022/23. The error bars represent the standard deviation.

Other bivalve species caught and landed within Poole Harbour consist predominantly of American hard-shelled clams (*Mercenaria mercenaria*), as well as the native Palourde clam (*Ruditapes decussatus*). The landings of these species are categorised together as 'other shellfish species' and vary largely between each year with no recognisable pattern.

The total quantity of 'other shellfish species' landed each month of the season is shown in Figure 11a for all seasons to date. For the 2022/23 season, the total quantity of 'other shellfish species' landed by all active fishers in a month (excluding May where there are only 5 days available for fishing), varied from 2586.0kg in June to 9642.0kg in September. Statistical analysis of the quantity of 'other shellfish species' landed between fishing seasons (Figure 11b) showed that there was a significant difference between seasons ($P<0.05$). Post-hoc testing showed that the quantities landed in 2022/23 were significantly higher than the quantity landed in 2025/16. In general the landings of 'other shellfish species' have been seen in increase over time, primarily caused by a increase over time in the landing of the American Hard-Shelled clam (*Mercenaria mercenaria*). In previous seasons (2021/22), fishers have indicated that they were getting a higher price per kg for this species than the Manila clam which may explain increased targeting of this species. If this price per kg remains at a good level and there is a market demand for this species, this may explain the upward trend in landings. As in previous years, the quantity of Native Palourde clam landed represents less than 1% of the total shellfish landed during the 2022/23 season. The Palourde clam and the Manila clam are very similar making it difficult to identify the species, particularly out of the water when the siphons are not visible. Whilst the Manila clam is the dominant of the two species, the Palourde clam will often fetch a higher price, and, if in particular demand by markets, fishers may make more of an effort to retain Palourde clams.

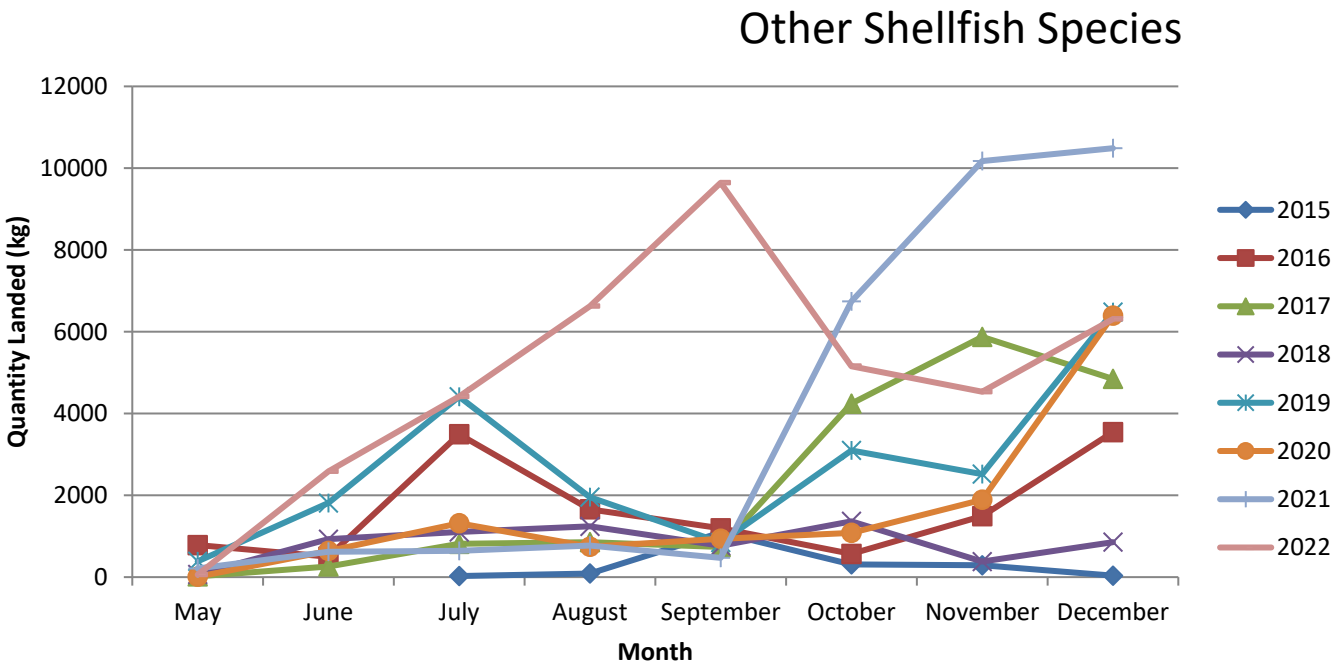


Figure 11a: The total quantity of 'other shellfish species' landed by Poole Harbour Dredge Permit holders for each month of the fishing season from 2015/16 to 2022/23. In 2015, the season commenced on July 1st. For all other years the season commenced on May 25th.

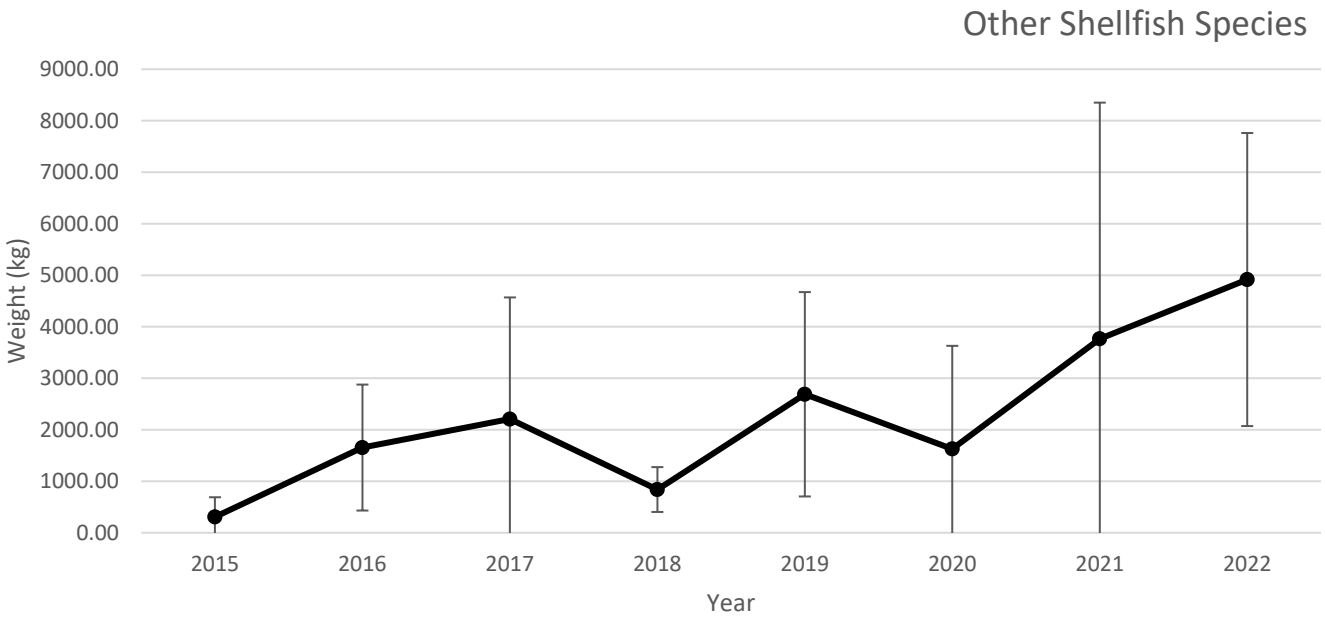


Figure 11b: Average quantity of 'other shellfish species' landed across the whole fishing season for 2015/16 to 2022/23. The error bars represent the standard deviation.

CPUE is measured as kg of shellfish per hour based on the data provided by the fishers in their monthly catch returns. The CPUE for each month of the season is shown in Figure 12a for all seasons to date. For the 2022/23 season, the CPUE varied from 21.49 $kghr^{-1}$ in December to 29.62 $kghr^{-1}$ in July (excluding May where there are only 5 days available for fishing). Statistical analysis of the CPUE between fishing seasons (Figure 12b) showed that there was a significant difference between seasons ($P<0.001$). Post-hoc testing showed that the CPUE for the 2022/23 season was significantly higher than that of the 2016/17 and 2017/18 seasons, the CPUE for the 2021/22 season was significantly higher than that of the 2016/17, 2017/18 and 2018/19 seasons, the CPUE for the 2020/21 season was significantly higher than that of the 2016/17, 2017/18 and 2018/19 seasons and the CPUE for the 2015/16 season was significantly higher than that of the 2016/17 and 2017/18 seasons. There is no significant difference in the CPUE between the last four seasons (2019/20 to 2022/23).

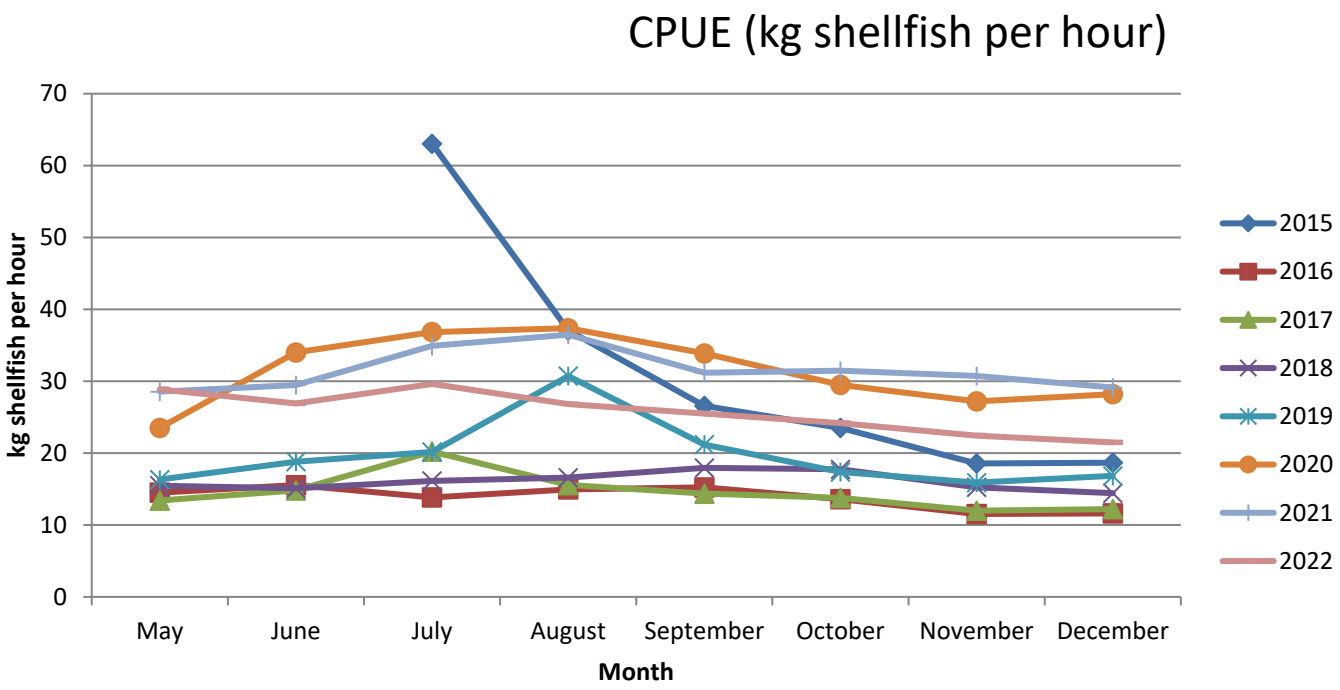


Figure 12a: Catch per Unit Effort (CPUE) measured as kg of shellfish per hour based on the data provided by the Poole Harbour Dredge Permit holders for each month of the fishing season from 2015/16 to 2022/23. In 2015, the season commenced on July 1st. For all other years the season commenced on May 25th.

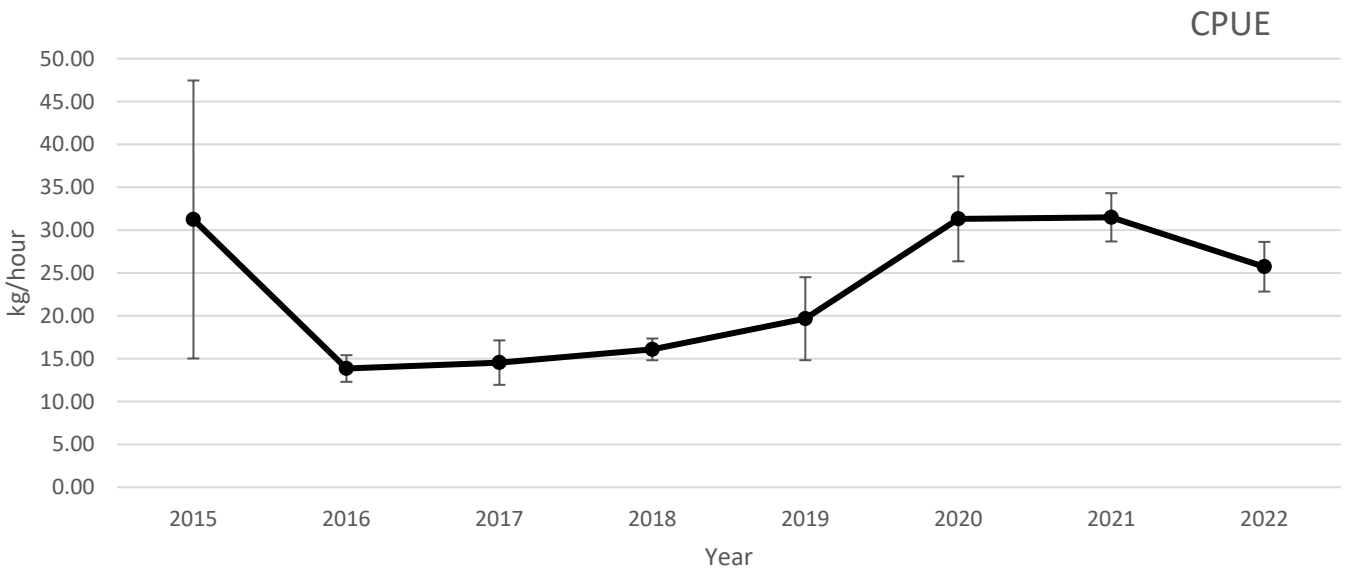


Figure 12b: Average Catch per Unit Effort (CPUE) measured as kg of shellfish per hour across the whole fishing season for 2015/16 to 2022/23. The error bars represent the standard deviation.

4.3.2 Sightings

Shellfish dredging takes in distinct and relatively small spatial areas, where shellfish beds exist. There are a number of beds within Poole Harbour and the level of fishing effort varies between them. This can depend on a number of factors including the target species, substrate type and level of weed. These sites occur intertidally (at high tide) with vessels operating in very shallow waters. Key sites are well illustrated using sightings data (Annex 3). Sightings from the dredge season (25th May to 23rd December) for all seasons up to 2022/23 illustrate distinct areas where shellfish dredging takes place, with activity largely concentrated in the area of Holton Mere and the Wards (between Round Island and Green Island). Sightings data shows shellfish dredging to also take place east of Giggers Island, Arne Bay, Middlebere Lake and Wych Lake, Ower Lake and Brands Bay. Almost all sightings occur within the intertidal. Sightings that occur within seasonal closed areas all occurred during periods when these areas were open to fishing activity (1st July to 31st October). Please note that Southern IFCA's sightings data may reflect the home port of the patrol vessel, high risk areas and typical patrol routes and therefore are only indicative of fishing activity. The frequent nature of patrols conducted in Poole Harbour mean it is likely that the geographical extent of the fishery is well reflected, however intensity may be skewed by aforementioned factors.

4.3.3 Stock Survey Data

The Poole Harbour Bivalve Stock Survey was carried out in April 2022. A survey report has been generated and is available on the Southern IFCA website at https://www.southern-ifca.gov.uk/poole-harbour-fisheries. A summary of the results from the survey is provided:

- The results of the survey focus on the two main commercial species, the Manila clam and the common cockle. Other species found during the survey in smaller quantities included the American Hard-Shelled clam (*Mercenaria mercenaria*), the Native clam (*Ruditapes decussatus*), the native oyster (*Ostrea edulis*), the Pacific oyster (*Magallana gigas*), the spiny cockle (*Acanthocardia aculeata*) and the blue mussel (*Mytilus edulis*).
- The average length for Manila calm was above the MCRS of 35mm at all but four sites, for those four sites the average length was 34mm. The average length for Cockle was above the MCRS of 23.8mm at all sites.
- A measure of Catch Per Unit Effort (CPUE) was calculated as weight of shellfish (kg) per metre of dredge per hour both above and below MCRS for the two species. The Harbour is divided into 11 catch reporting zones under the Poole Harbour Dredge Permit Byelaw therefore CPUE data from the survey was grouped according to the zone in which the survey site is located.
- For Manila clam, statistical analysis showed a significantly higher average CPUE under MCRS in Holes Bay (101.4 kg m of dredge^{-1} hr^{-1}) and Zone 11 (54.6 kg m of dredge^{-1} hr^{-1}) than Zones 1 (23.3 kg m of dredge^{-1} hr^{-1}) and 4 (21.6 kg m of dredge^{-1} hr^{-1}) ($P<0.001$). For CPUE over MCRS there was a significant difference between zones ($P<0.05$), but there was not enough variance between groups to show significant differences in post-hoc testing.
- For Cockle, statistical comparison of CPUE between catch zones for 2022 indicated a significant difference between sites for both above and under MCRS ($P<0.05$), however there was not enough variance between groups to show significant differences in post-hoc testing.
- For Manila clam, statistical comparisons between the last three survey years for each zone (2019-2022) showed that the average CPUE for the 2022 survey for over MCRS was significantly higher than the 2019 survey for Zones 11 ($P<0.001$), 10 ($P<0.05$) and 8 ($P<0.05$) and for under MCRS for Holes Bay ($P<0.05$). For Zone 10 the average CPUE over MCRS was also significantly higher in 2022 than in 2021 ($P<0.05$). The only other significant difference for the 2022 survey data was in Zone 1 where the average CPUE under MCRS was significantly

higher in 2021 than either 2019 or 2022 (P<0.001). Other significant differences were noted for average CPUE over MCRS in Zones 3 and 7 (both P<0.05), however there was not enough variance between groups to show significant differences in post-hoc testing. The visualisation of the data indicates that the average CPUE over MCRS for Zones 3 and 7 was higher in 2022 than in the previous two years. Zone 4 showed a significant difference for average CPUE under MCRS (P<0.05), however again there was not enough variance between groups to show significant differences in post-hoc testing.

- For Cockle, statistical comparisons between the last three survey years for each zone (2019-2022) showed significant results only for Zones 7, 10 and 11. For Zone 7, average CPUE under MCRS was significantly different between years (P<0.05), however there was not enough variance between groups to show significant differences in post-hoc testing. For Zone 10, the average CPUE over MCRS was significantly higher in 2022 than 2019 (P<0.05) and for under MCRS was significantly higher in 2022 than 2019 or 2021 (P<0.001). For Zone 11, average CPUE under MCRS was significantly higher in 2022 than in 2021 (P<0.05).
- Higher CPUE values for both Manila clam and cockle are consistent with popular fishing areas for each species and reflects a habitat driven distribution with Manila clam showing a higher CPUE in muddy, fine-grained sediments and cockle showing a higher CPUE in sandy, coarse-grained sediments. The higher levels of Manila clam under MCRS in Zones 10 and 11 is also consistent with preferred habitat type and areas within those zones which are sheltered and potentially provide a suitable area for settlement of larvae.
- Where significant differences in CPUE for both species were noted between survey years, the 2022 survey data showed a higher CPUE than at least one of the previous two years (except in Zone 1 for Manila clam under MCRS). This indicates that the stock appears to be robust to the fishing pressure exhibited in the previous season. For Manila clam in particular, the stock appears to be able to withstand the observed increase in fishing pressure in 2020 and, although slightly lower, in 2021 compared to landings in 2019 and previous years.

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[10]. Each feature/sub-feature was subject to a TLSE, a summary table is provided in Annex 7. Only those features or supporting habitats where there was potential for likely significant effect have been included.

[10] Managing Natura 2000 sites: http://ec.europa.eu/environment/nature/natura2000/management/guidance_en.htm

6 Appropriate Assessment

Note: this is only to be undertaken if the Test for LSE (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 2.

Table 2. 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	*Limosa 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 shellfish dredging and supporting habitats can be found in Annex 8. This reveals where shellfish dredging activity occurs in relation to designated supporting habitats of the site and shows activity occurring over intertidal mud and in the vicinity of saltmarsh. Using knowledge presented in table 2, shellfish dredging may have some effect on sites used by avocet, black-tailed godwit, Mediterranean gull, shelduck, Eurasan spoonbill, curlew, redshank and green shank. The sites used by these species, which occur in relatively close proximity to shellfish dredging, include outer Wych and Middlebere, Arne Bay, Ower Bay, Newton Bay, Brands Bay, Holton Mere and Keysworth. A number of key feeding and roosting sites identified in table 2 are however not affected by shellfish dredging either by the fact they are inaccessible to fishing vessels (Brownsea Lagoon) or through the year-round closure of certain areas (i.e., Lytchett Bay and Holes Bay).

The potential effect on the sites utilised by designated bird species however is mitigated through a number of permit conditions associated with the Poole Harbour Dredge Permit byelaw, principally, spatial and temporal restrictions and timing of the season (see section 6.6, table 9 for further details). It is also worth noting some effects, particularly disturbance, will be negated by the virtue that birds feed at low tide and shellfish dredging occurs at high tide.

6.2 Potential Impacts

Prior to the introduction of the PHDP byelaw in July 2015, Natural England provided initial advice on the potential impacts of shellfish dredging on the nature conservation features of Poole Harbour. Using the potential impacts identified in this advice, combined with the pressures outlined the

Advice on Operations (and identified in the TLSE process), a list of pressures and relevant attributes has been put together and is outlined below. In this section, these pressures are elaborated on using available scientific literature and results from relevant research.

Pressure	Relevant Attribute
Visual disturbance, Above water noise	Supporting habitat: disturbance caused by human activity
Physical change (to another sediment type)	Supporting habitat: extent and distribution of supporting non-breeding habitat; Supporting habitat: extent and distribution of supporting habitat for the breeding season
Removal of non-target species	Supporting habitat: food availability within supporting habitat; Supporting habitat: food availability within the intertidal
Removal of target species	Supporting habitat: food availability within supporting habitat; Supporting habitat: food availability within the intertidal

6.2.1 Disturbance (visual and noise)

Generic impacts

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

Disturbance can result in displacement when 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 effects of habitat loss through disturbance can include a reduction in the survival of displaced individuals and effects on the population size (Goss-Custard *et al*., 1995; Burton *et al*., 2006). Sites with high levels of human 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 feeding areas as a result of disturbance, which may be less suitable, 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 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 increase energy demands and reduce food intake with potential consequences for survival and reproduction.

Birds can 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 help to determine 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). Birds will 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, limited has taken place to investigate its potential effects on 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, p. 51) 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 increased energy expenditure of birds

Examples of disturbance impacts

In the mid-1980s, localised and sustained disturbance from bait diggers at Lindisfarne National Nature Reserve were considered responsible for significant declines in the numbers of Wigeon, Bar-tailed Godwit and Redshank at the site (Townshend & O'Connor, 1993).

In 1996/97, Gill *et al*. (2001a) investigated the effect of human-induced disturbance on black-tailed godwits across 20 sites on the east coast of England. The study revealed no significant relationship between numbers of godwits and human activity at a range of spatial scales (Gill *et al*., 2001a). There was also no effect of the presence of marinas or footpaths on the number of godwits supported on the adjacent mudflats (Gill *et al*., 2001a).

Using a behaviour-based model, Durell *et al*. (2005) explored the effect if 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. Body condition was expressed as the percentage of birds failing to achieve at least 75% of their target weight for the time of year. Disturbance to feeding birds, day and night, had a significant effect on the mortality and body condition of all three species. The same was found for roosting birds. Roost disturbance was simulated by increased energy costs due to extra flying time of 10 minutes or more each day. Disturbance limited to the daytime only removed the effect of disturbance in curlew and oyster catcher, and although reduced the disturbance effect it still had a significant effect on the body condition and mortality of feeding dunlin. The introduction of a buffer zone, which would prevent disturbance within 150 m of the seawall, reduced the effects of disturbance on mortality and body condition to pre-disturbance levels.

Studies in the Solent which have focused on disturbance to birds, have reported disturbance levels of 30% during the winter of 1993/94 using disturbance events observed during low tide counts. Sources of disturbance from human activity on the shore included dog walkers, walkers, bait diggers and kite flyers (Thompson, 1994). A more recent study conducted from December 2009 to February 2010, which formed phase II of the Solent Disturbance & Mitigation Project, found for water-based recreational activities that 25% of observations resulted in disturbance and on the intertidal 41% of observation result in disturbance (Liley *et al*., 2010). Surfing, rowing and horse riding were activities found to most likely result in disturbance to birds. Over half of 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). The most responsive bird species to different activities were oyster catcher and wigeon (Liley *et al*., 2010). These two species had the highest proportion of observations involving a disturbance response. Primary data collected by Liley *et al*. (2010) 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 (see species-specific response), 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 increases in the level of time spent feeding intertidally by dunlin, ringed plover, redshank and grey plover, with no effect on black-trailed godwit and reductions in oystercatcher and curlew (Stillman *et al*., 2012). This was related to the ability of modelled birds to feed in terrestrial habitats, as those unable to do so spent longer feeding in intertidal habitats (Stillman *et al*., 2012).

Site-specific impacts

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

A number of variables were found to influence the probability of major flight, including distance, with a shorter disturbance more likely to result in major flight, flock size, with a larger flock less likely to result in major flight, as well as 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 events were seen in the species red-breasted merganser and sanderling. Water-based activities, including canoeing, pump-scoop dredging, small sailing boats and kite surfing, relative to other activities, were more likely to cause

disturbance. This activity type made up a relatively small proportion of all recorded activities and it is worth noting the low sample sizes for water-based activities, with only 2 observations of pump-scoop dredging throughout the survey period. Thus, distorting the likelihood of disturbance, if for example major flight occurred 1 out of 2 observations, disturbance would be considered to occur 50% of the time.

Species-specific response

Responsiveness to disturbance is thought to be a species-specific trait (Yasué, 2005). Gathe and Hüppop (2004) developed a wind farm sensitivity index (WSI) for seabirds. The index was based on nine factors, derived from specie' attributes, and include; 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 (Gathe & Hüppop, 2004). 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 farms 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 3. Sensitivity scores for designated bird species in the Poole Harbour SPA 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, 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

There is great variation in the escape flight distances between species (Kirby *et al*., 2004) and the distance at which birds fly away from a disturbance can be viewed as a specie-specific trait (Blumstein *et al*., 2003). Response distances can depend on a number of different 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 9 and 10 provides details of response distances of species within Poole Harbour SPA, with Table 4 providing details of response distances in relation to different types of activities.

Table 4. Distances from disturbance stimuli (in metres) at which study waterbird species took flight. Taken from Kirby *et al*., 2004 in WWT Consulting 2012.

	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 effects of disturbance on the quality of an area 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 mitigated (Natural England *et al*., 2012). Modelling of wintering oystercatchers on the Exe estuary revealed that preventing disturbance during late winter, when feeding conditions are harder and a migratory bird's energetic demands are higher, has been shown to largely eliminate any predicted population consequences (West *et al*., 2002). Following this modelling, it was recommended that to eliminate predicted population consequences of disturbances, competent authorities responsible for management should prevent disturbance to birds during late winter (West *et al*., 2002).

Establishing flight-initiation distances may be considered a starting point for competent authorities responsible for management in order to minimise adverse effects of disturbance (Wheeler *et al*., 2014). The establishment of such buffer areas are dependent on a number of factors including population densities, food availability, time of year and behaviour of individuals (Wheeler *et al*., 2014). As aforementioned, a buffer zone of 150 m from the seawall was found to reduce the effects of disturbance from an extension to the port at Le Havre on the mortality and body condition to

pre-disturbance levels for three bird species (dunlin, curlew and oystercatcher) (Durell *et al*. 2005). Investigation into disturbance caused by recreational activities in the Solent however suggested that there was no clear set-back distance, for all species on all sites due to the large variability observed in response distances, which would result in no disturbance (Liley *et al*., 2010). The largely variability in flight-initiation distances suggests that competent authorities should be conservative when developing buffer zones, although previously published flight-initiation distances for a given species may be used as a guideline for setting buffer zones (Blumstein *et al*., 2003).

Whilst many authors may try and define a distance beyond which disturbance is assumed to have no effect, which is then used in turn to determine set-back distances, it may be inappropriate to set such distances (Stillman *et al*., 2009). The reason for this is because of the variation between species (Blumstein *et al*., 2005), as well as variation between individuals of the same species (Beale & Monaghan, 2004). This is further compounded by particular circumstances such as habitat, flock size, cold weather, variations in food availability, all of which will influence a birds' ability to response to disturbance and hence the scale of the impact (Rees *et al*., 2005; Stillman *et al*., 2001). In addition, there is no guarantee that the behavioural response i.e. response distance, will be related to population consequence (Gill *et al*., 1996; 2001b).

6.2.2 Physical change (to another sediment type)

Advice from Natural England, received prior to the introduction of the PHDP byelaw, outlining the potential impacts of shellfish dredging on the nature conservation features of the Poole Harbour SPA, highlighted a concern related to the potential erosion of saltmarsh taking place where shellfish dredging occurs in close proximity to this habitat type. Natural England advice refers to a study undertaken by Dyrynda (1995) in Liley *et al.* (2012) looking at the impacts of bait dragging on the seabed within Poole Harbour, who states

'Bait dragging would undoubtedly cause substantial damage to communities involved rooted species such as saltmarsh, seagrass and peacock-worm beds. However, these areas are not usually suitable for dragging and are avoided (R. Castle, pers. comm).'

As stated by Natural England and recognised in the above statement with regards to bait dragging, pump-scoop dredging is unlikely to occur over saltmarsh. This is further supported by a lack of literature on the impacts of towed gear with regards saltmarsh habitats, as any interaction between the two is not thought to occur (i.e., Hall *et al*., 2008; Roberts *et al*., 2010). Whilst fishing on saltmarsh is not a common occurrence, dredging has the potential to result in accidental interactions which could impact the root system of the saltmarsh. In addition, fishing in close proximity to saltmarsh habitat may cause an impact through changes in sedimentary conditions and increased wave exposure.

Saltmarsh habitat provides important ecosystem services including as a supporting roosting and breeding habitat for bird species, nursery areas for juvenile fish and in coastal protection via dissipation of wave energy (Moller *et al.,* 2001). Additionally, saltmarsh has been found to be a modest but sustained sink for atmospheric carbon dioxide (Burden *et al.,* 2013). Physical mechanisms resulting in changes to saltmarsh include a lack of sediment in the system (Ravens *et al.,* 2009) which has been attributed to sea level rise (Townend *et al.,* 2007) and dredging and disturbance

mechanisms which create changes to the tidal prism that then result in saltmarsh retreat (Cox *et al.,* 2003). Increased wave action as the seaward edge of saltmarsh has also been postulated to contribute to saltmarsh decline (Burd, 1992). Waves from boat wakes have been noted to contribute to this and result in front erosion of marshes (Ravens *et al.,* 2009). Additional impacting physical factors include storms and extreme weather events which can increase wind and wave exposure, altered sediment distribution from tidal asymmetry and slack water periods, and general variation in tidal range (Gardiner, 2015). Similar contributing factors have been identified to contribute to saltmarsh decline in the Greater Thames area (van de Wal and Pye, 2004). It is agreed that multiple drivers are likely to be responsible for saltmarsh decline (Gardiner, 2015) and for studies in other sites such as the Netherlands, it has been found that the feedback mechanisms between plant growth, morphology and hydrodynamics of both saltmarsh and the surrounding mudflats required consideration in determining the status of saltmarsh and potential impacts (van de Wal *et al.,* 2008). Recovery of saltmarsh appears to be dependent on the species but some species in Poole Harbour are known to be slow to recover. Recovery is dependent on recruitment from other populations and the ability to replace eroded sediment. In some cases, recovery may take up to five years.

While there are no studies directly on impacts from dredge fishing activity, a PhD thesis examining saltmarsh change in Poole Harbour identified fishing activity as being a potential additional human driver for saltmarsh change (Gardiner, 2015). The thesis states that during field work, deep grooves were observed in some of the mudflats fronting saltmarsh areas that were felt to be linked to the shellfish dredge fishery (Gardiner, 2015). It was identified that the mudflats in question were relatively high in the tidal frame and would therefore only be accessible to vessels at high tide with any sediment suspended into the water column during dredging likely to be redistributed during the following ebb tide (Gardiner, 2015). It was suggested that further work would be required to determine the impacts of shellfish dredging on the sediments and how this links to a potential driver for saltmarsh change (Gardiner, 2015).

6.2.3 Removal of target species

Commercial shellfisheries can provide a potential source of conflict by competing with the same food resources as certain bird species (Schmechel, 2001; Atkinson *et al*., 2003). The removal of food resources by shellfishing therefore has the potential to have detrimental effects on the amount of food available per bird and subsequently increases the chance of a threshold being reached where mortality from starvation begins to increase (West *et al*., 2005; Navedo *et al*., 2008). The removal of shellfish from productive beds, along with associated disturbance, can drive birds from preferred feeding grounds to areas of poorer quality. This can lead to an increase in bird densities and a subsequent intensification of interference and exploitation competition for food which can reduce intake rate and probability of starvation, particularly in winter (Goss-Custard & Verboven, 1993; Clark, 1993; Goss-Custard *et al*., 1996). It is important to understand to what degree bird species are able to switch to other food resources, if their target species (that may also be the target species of the fishery) is reduced (Schmechel, 2001). It was reported by Zwarts *et al*. (1996a) that along the north west European coast there are limited possibilities of alternative prey items for certain bird species, especially in winter due to changes in availability (Schmechel, 2001). Using individual behaviour-based models it has been shown that shellfish stocks should not fall below 2.5 to 8 times the biomass that shorebird populations require to survive (Stillman *et al*. 2003; Goss-Custard *et al*. 2004; Stillman *et al*. 2010).

A link has been shown between the state of shellfish stocks and oystercatcher survival in the Wash (Schmechel, 2001). The Wash, constitutes an important estuary for supporting large numbers of wintering waterfowl (310 000), including internationally important numbers of knot and oystercatcher (Schmechel, 2001; Atkinson *et al*., 2003). The area also supports one of the three major cockle fisheries in Britain (Atkinson *et al*., 2003). The majority of cockle harvesting involves the use of continuous delivery hydraulic suction dredges (Bannister, 1998; 1999). Between 1990 and 1999, stocks of cockles and mussels collapsed following a period of poor recruitment and high levels of fishing effort in the 1980s (Bannister, 1998; 1999). During this period, oystercatcher populations fell from 110,000 to 40,000 (Atkinson *et al*., 2000). Population modelling has confirmed that declines in the availability of these prey items were associated with changes in oystercatcher survival between 1970 and 1998, which included three periods of mass mortality (Atkinson *et al*., 2003). Oystercatchers are particularly sensitive to low cockle stocks in years where stocks of mussels are also low and in the Wash, it is thought that mussels act as a buffer during periods when cockle numbers are low (Atkinson *et al*., 2003; Velhurst *et al*., 2004). In the Wash, oystercatcher mortality occurred during winters when stocks of both species were low (Atkinson *et al*., 2003).

Atkinson *et al*. (2010) investigated overall changes in the waterbird assemblage in the Wash between 1980-1982 and 2002-2003. During this study period, the waterbird assemblage underwent a gradual change from one being dominated by species with a high proportion of bivalves or 'other' prey i.e. crustaceans and fish in their diet to those with a higher proportion of worms (Atkinson *et al*., 2010). Three winters in this period were characterised by elevated levels of oystercatcher mortality, 5 to 13 times greater than normal winter levels (Atkinson *et al*., 2010). The great declines were observed in oystercatcher, knot and shelduck (Atkinson *et al*., 2010). Bar-tailed godwit and grey plover showed large increases over the study period. As expected, these changes were found to be significantly related to mussel and cockle stock levels and nutrient levels to a lesser extent (Atkinson *et al*., 2010). Six out of 11 bird species investigated, showed significantly lower rates of annual change in the 10 years before and after the crash of mussel stocks (which occurred during 1992) (Atkinson *et al*., 2010).

There have also been changes in the bird populations in other areas were cockle fisheries are known exist. Like the Wash, the Burrey Inlet cockle fishery saw a decrease in the number of oystercatchers feeding in the inlet for a number of years, in response to removal of less than 25% of available cockle stocks (Norris *et al*., 1998). Oystercatcher numbers remained stable or slightly increased from 1970 to 1986, before declining through to 1993 and then recovering slightly (Schmechel, 2001). In the Thames, there has been a consistent increase in the number of birds from 5000 in the 1970s to 16000 in 1997/98, despite a simultaneous increase in cockle dredging (Schmechel, 2001). Contrasting to Schmechel (2001) in the Dutch, Wadden Sea international MPA a gradual loss of intertidal resources explained the loss of red knots (*Caldris cantrus islandica*) from the local populations and a decline in the EU wintering population (van Gils *et al.* 2006). Cockle (*Cerastoderma edule*) mechanical dredging led to lower settlement rates of cockles and reduced their quality (ratio of flesh to shell) (van *Gils et al.* 2006).

Stillman *et al*. (2001) used a behaviour-based model to investigate the effects of present-day management regimes of the Exe estuary mussel fishery and Burry Inlet cockle fishery on the survival and numbers of overwintering oystercatchers. Results of the study concluded that at present intensities (2 fishing units in the Exe estuary and 50 fishing units in Burry Inlet) in both fisheries does not cause oystercatcher mortality to be higher than it would be in absence of the activity (Stillman *et al*., 2001). Theoretical changes in management, such as fishing effort, a reduction in the

minimum size of target species and increase in the daily catch quota were shown to have an impact on oystercatcher mortality and population size (Stillman *et al*., 2001). Different fishing methods were investigated as part of the study. The model predicted the use of dredges on either estuary increased the time birds would spent feeding and the use of supplementary feeding areas (Stillman *et al*., 2001). As would be expected, the removal rates of mussels and cockles using mussel dredges and suction dredges were much greater that hand-raking or hand-picking (Stillman *et al*., 2001). Sixty suction dredges could kill all the Burry Inlet oystercatchers (Stillman *et al*., 2001). Hand-raking for mussels however was found to reduce the area of beds, permanently increase interference and disturb birds, temporarily increasing interference, whilst dredging for mussels only decreased bed area (Stillman *et al*., 2001). The varying impacts of different fishing methods reflect differences in the way they deplete shellfish stocks (Stillman *et al*., 2001).

Size of prey species

The exact role of the fishery and its effect on bird population, as a result of direct competition, will largely depend on the different size fractions of the stock that may be exploited by fishers and birds (Schmechel, 2001). Whilst there may be an overlap in the size of cockles taken by both fishers and birds, most bird predation is of a smaller size class than fishers take (Norris *et al*., 1998). If sizes overlap there can be a genuine conflict of interest between the birds and the fishery, therefore larger minimum sizes are therefore more favourable to birds (Lambeck *et al*., 1996). Oystercatchers have shown a preference for older cockles, 20 to 40 mm, and will not take cockles less than 10 mm when these larger size classes are available (Hulscher, 1982; Zwarts *et al*., 1996a). On the other hand, oystercatchers do not necessarily choose the largest cockles as they are difficult to handle, with studies reporting that larger cockles were refused more often than small ones (Zwarts *et al*. 1996a). Oystercatchers are known to refuse small prey due to low profitability and the size of cockles left after fishing may therefore have an impact on feeding rate of the oystercatcher (Zwarts *et al*. 1996b; Wheeler *et al*., 2014).

Caldow *et al*. (in Jensen *et al.* 2005) demonstrated, the main target species of pump-scooping dredging, the non-native Manila clam, forms a prey item of the oystercatcher population in Poole Harbour. In the study, it is speculated the fishery, which reduces abundance, maximum age and size of Manila clam, may suppress potential benefits to the oystercatcher population. Between late summer and the following spring, a significant increase in the proportion of the population (up to 40 to 50%) consumes this target species. Using an individuals-based simulation model, the study predicts the presence of Manila clams in the Harbour, at low densities of 5 clams per m^2 (mean density when the study was undertaken), has reduced over-winter mortality rates of oystercatchers by 3.5%. The size of individuals targeted by oystercatchers range in length from 16 to 50 mm, which overlaps to some extent with the fishery, where individuals 35 mm and above are removed. As such, there will be some level of direct competition between the two.

6.2.4 Removal of non-target species

Fishing activity can have indirect impact upon birds by affecting the availability of prey through pathways that do not include targeted removal (Natural England, 2014). In general, bottom towed fishing gear has been shown to reduce biomass, production and species richness and diversity of benthic communities where fishing activities take place (Veale *et al*., 2000; Hiddink *et al*., 2003). Alterations in the size structure of populations and community are also known to occur (Roberts *et al*., 2010). When dredges are towed along the seafloor, surface dwelling organisms can be removed; crushed, buried or exposed and sessile organisms will be removed from the substrate surface (Mercaldo-Allen & Goldberg, 2011). Direct burial or smothering of infaunal and epifaunal organisms is possible due to enhanced sedimentation rates (Mercaldo-Allen & Goldberg, 2011). In a meta-analysis of 39 studies investigating the effects of bottom towed gear, there was an overall reduction of 46% in the abundance of individuals within disturbed (fished) plots (Collie *et al*., 2000). In a separate meta-analysis of 38 studies, investigating the impacts of intertidal harvesting on benthic invertebrate communities, which represent bird prey sources, harvesting was shown to cause a significant reduction of 42% in the average abundance across all taxa in the first 10 days following disturbance (Clarke *et al*., 2017). A simultaneous increase in species diversity of 39% was reported in the first 10 days following disturbance, however this was followed by a significant reduction in diversity 51-500 days post-fishing and no significant effect after >500 days (Clarke *et al*., 2017). The magnitude of the response of fauna to bottom towed fishing gear varied with gear type, habitat (including sediment type) and among taxa (Collie *et al*., 2000).

In a study by Ferns *et al*. (2000), bird feed activity increased shortly after the mechanical harvesting of cockles using a tractor, particularly in areas of muddy sand rather than in areas of clean sand. Gulls and waders took advantage of the invertebrates made available by harvesting. For example, 80 dunlins and seven curlews were observed feeding on harvested areas 6 days after harvesting. Following this increase, the level of bird activity declined in areas of muddy sand when compared with control areas and become particularly apparent 21 and 45 days after harvest (Figure 13). Levels of bird activity remained significantly lower in curlews and gulls for more than 80 days after harvesting and in oystercatchers for more than 50 days. Any initial net benefit of harvesting was matched by decreased feeding opportunities in the winter. Harvesting large areas however would not result in a neutral effect, firstly as the bird population would not be large enough to fully exploit the enhanced feeding opportunities and secondly the subsequent reduction in feeding opportunities would extend over a longer period of time (Ferns *et al*., 2000). Other effects would include the migration of birds into unharvested areas which would then lead to increased bird densities in these areas (Sutherland & Goss-Custard 1991; Goss-Custard 1993).

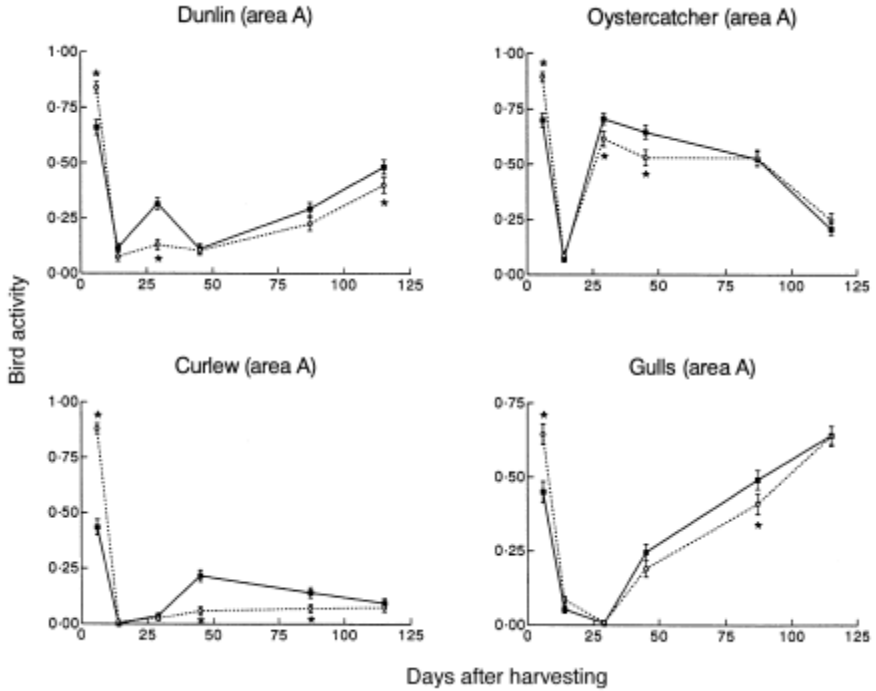


Figure 13. Mean proportion (±SD) of samples in control (black squares) and harvested (white circles) sectors containing footprints of different bird species. Significant differences between sectors are indicated by an asterisk and estimated by bootstrapping. Source: Ferns *et al*., 2000

The relative impact of shellfish dredging on benthic organisms, which form potential prey items, is species-specific and largely related to their biological characteristics and physical habitat (Mercaldo-Allen & Goldberg, 2011). The vulnerability of an organism is ultimately related to whether or not it is infaunal or epifaunal, modile or sessile and soft-bodied or hard-shelled (Mercaldo-Allen & Goldberg, 2011). Epifauna, organisms inhabiting the seabed surface, are subject to crushing or at risk of being buried, in addition to effects of smothering, whilst infauna, organisms living within sediment, may be excavated and exposed (Mercaldo-Allen & Goldberg, 2011). A number of studies have found soft-bodied, deposit feeding crustaceans, polychaetes and ophiuroids to be most affected by dredging activities (Constantino *et al*., 2009). This is supported by a meta-analysis conducted by Collie *et al*. (2000) who predicted a reduction of 93% for anthozoa, malacostraca, ophiuroidea and polychaete after chronic exposure to dredging. This is further supported by another meta-analysis conducted by Clarke *et al*. (2017) which reported the most severe decline in the taxonomic group annelida (39.17%), followed by mollusca (33.76%) and crustacea (29.61%) in the first 10 days following disturbance from intertidal harvesting. Furthermore, a study looking at the effects of mechanical cockle harvesting in intertidal plots of muddy sand and clean sand, found that annelids declined 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). Similar results were reported by EMU (1992), who found a distinct reduction in polychaetes, but less distinct difference in bivalves, after dredging had taken place and between dredged and control samples. This corresponds with analysis completed by Collie *et al*.

(2000) who reported that bivalves appeared to less sensitive to fishing disturbance than anthozoa, malacostraca, ophiuroidea, holothuroidea, maxillopoda, polychaeta, gastropoda and echinoidea,

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* are highly incapable of movement in response to disturbance and therefore take a significant period of time to recolonise 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 polychaete *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). Other polychaete species also thought to be particularly affected are *Arenicola*, *Scoloplos*, *Heteromastus* and *Glycera* (Collie *et al*., 2000). A meta-analysis of 38 studies investigated the initial impacts (0-10 days post-fishing) of intertidal harvesting on bird prey resources down to a specie-level response. The study reported reductions in all species (23.58% in *Cerastoderma edule*, 16.18% in *Nephtys* spp., 47.25% in *Hydrobia* (*Peringia*) *ulvae*, 48.78% in *Scoloplos* spp), although only significant for *Scoloplos* spp. and except for *Macoma baltica* which increased by 14.09%.

Furthermore, a study by Beukema and Dekker (2018) investigated the effects of cockle (*Cerastoderma edule*) abundance and fishery on bivalve abundance, finding that low adult cockle density led to high cockle recruit density. Low recruit densities were apparent before fishing started indicating that these low densities were a result of the high cockle abundance itself. Recruit numbers, which had not changed post fishing activity were not different between fishing and non-fishing years, nor between fished and unfished areas (Beukema & Dekker, 2018). This study was conducted in relatively muddy sediments a reason suggested for the lack of significant influences of fishery in the studied area.

Site-Specific Studies

A number of studies have specifically investigated the impacts of pump-scoop dredging in Poole Harbour (Parker & Pinn, 2005; Cesar, 2003 in Jensen *et al*., 2005), with the most recent being the most extensive

Jensen *et al*. (2005) reported on the preliminary results of a MSc project looking at potential impact of pump-scoop 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) were analysed and presented. The results show the infaunal community at Seagull Island to have a qualitatively similar level of disturbance before and after the fishing season, with no significant differences at all four sites before and after the season. 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 season occurred and whilst no 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 dredging (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 shingly ground occurring close inshore. Samples from each site were collected in April prior to the cockle fishery season (1st May to 31st January) opening, and then again in May, June and July during the season. The results show 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. Post-hoc tests reveal significant differences between July and all other months. 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 difference 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 also potentially indicative of a chronic effect of 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, whilst *Corophium* abundance and *Urothoe* spp. increased and *A. marina* abundance increased at the first site and remained constant at the second site. It was noted by 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 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 physical characteristics and community structure. Core samples were taken from separate areas representing different levels of dredging intensity: an area that has historically been intensively dredged and remains open for a seven-month season; an area that has historically been closed to dredging but will be opened for a four-month season and an area that remains 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.

Organic content and the proportion of fine sediments decreased in all sites throughout the study period, with the greatest declines in the intensively dredged site. Statistical analyses showed a significant effect with respect to site, with post-hoc tests revealing significantly less organic content at the intensively dredged site than the newly dredged and control sites, which showed no difference. However, the interaction term between time and site, which would indicate an overall impact of dredging activity in terms of relative change, appeared non-significant, thus indicating a small effect of dredging on the fine sediment content and very slight effect on organic content throughout the study period. The lower level of organic

content and volume of fine sediments may be reflective of the higher fishing intensity or a more dynamic environment dominated by coarser sediments.

Throughout the study period significant changes in community structure occurred in both dredged sites, with statistical analyses showing a significant effect of both site and time before and after fishing, indicating a variation in the magnitude of change in overall assemblage between sites. The overall community structure of the newly dredged site shifted during the study period from those resembling the control site to those 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 high abundances 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 14). 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 and also had a general absence of *A. marioni*. *A. tenuis* represents a key prey item for molluscivorous shorebirds. Throughout the study period, densities of all species at the control site were generally much lower but more stable than at both dredged sites, at which the magnitude of change was much larger. Across both months, species richness was also found to be significantly higher in both dredged site 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.

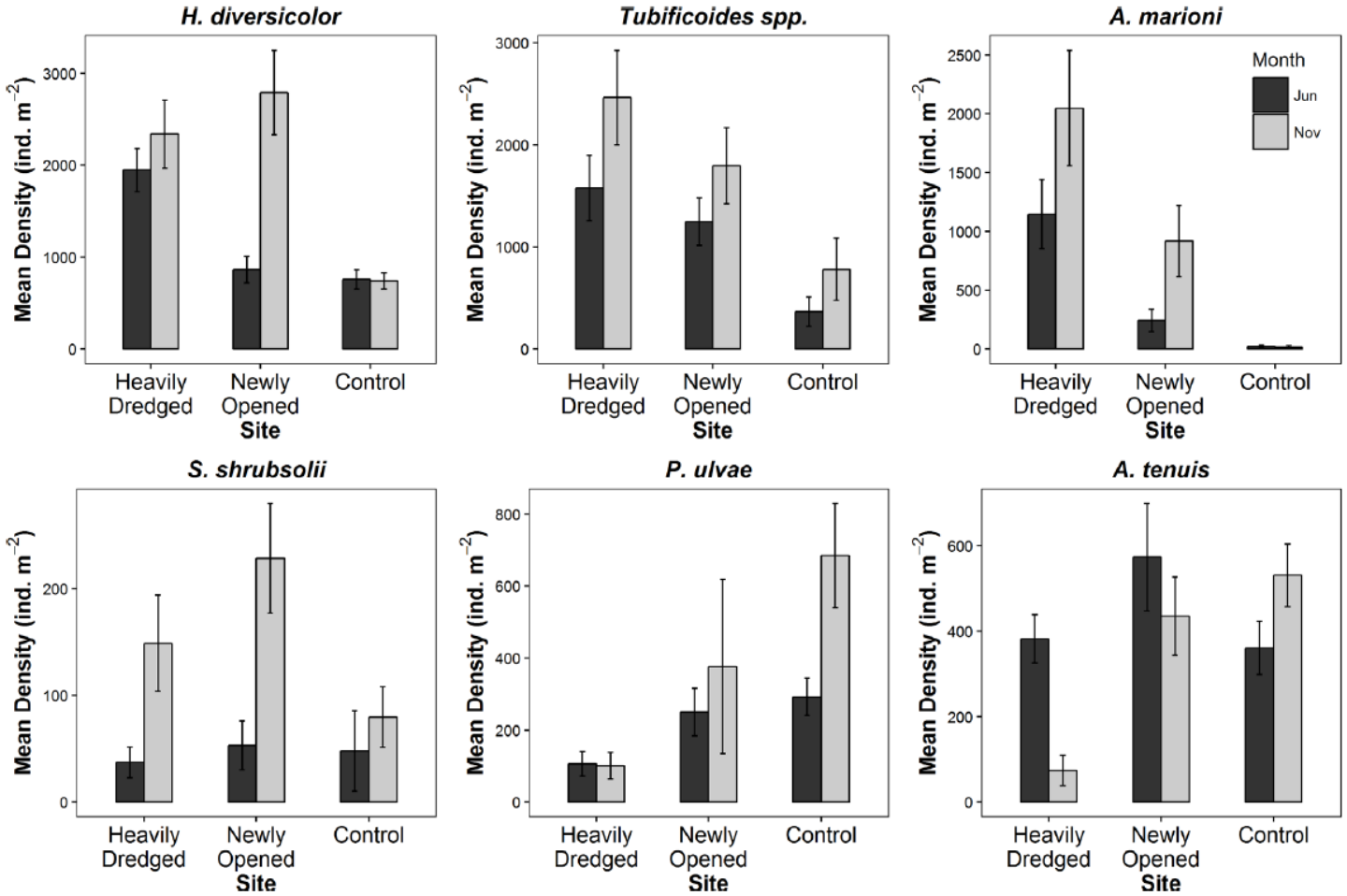


Figure 14. Mean densities of common species in June (dark grey) and November (light grey) 2015 at three sites representing different levels of pump-scoop dredging intensity (heavily dredged, newly opened, control) in Poole Harbour. Heavily dredged; an area that has historically been intensively dredged and remains open for a seven-month season (May 25th-December 23rd). Newly dredged; an area that has historically been closed to dredging but will be opened for a four-month season (1st July-31st October). Control site; an area that remains permanently closed to dredging (control site). Source: Clarke *et al*., 2018.

Recovery

The timescale of recovery for benthic communities and potential prey species largely depends on sediment type, associated fauna and the rate of natural disturbance (Roberts *et al*., 2010). In locations where natural disturbance levels are high, the associated fauna are characterised by species adapted to withstand and recover from disturbance (Collie *et al*., 2000; Roberts *et al*., 2010). More stable habitats, which are often distinguished by high diversity and epifauna, are likely to take a greater time to recover (Roberts *et al*., 2010). The recovery for gravel habitats has been predicted to be in the order of ten years (Collie *et al*., 2005). This was reported by recovery rates observed during a 10-year monitoring program of a gravel habitat located close to the Isle of Man following closure of the area to scallop dredging (Bradshaw *et al*., 2000). Similar recovery periods were estimated for muddy sands, which Kaiser *et al*. (2006) estimated to take years after finding the sediment type was particularly vulnerable to impacts of fishing activities. The recovery periods for sandy habitats is estimated to take days to months (Kaiser *et al*., 2006). In the meta-analysis conducted by Kaiser *et al*. (2006), a significant linear regression with time for the response of annelids to the impacts of intertidal dredging in sand and muddy sand habitats was reported. Annelids were predicted to have recovered after 98 days post fishing in sand habitats and 1210 days in muddy sand habitats (Kaiser *et al*., 2006). Authors stated recovery for the latter however should be treated with caution (Kaiser *et al*., 2006).

Population recovery rates are known to be species specific (Roberts *et al*., 2010). Long-lived bivalves will undoubtedly take longer to recovery from disturbance than other species (Roberts *et al*., 2010). Megafaunal species such as molluscs and shrimp over 10 mm in size, especially sessile species, are more vulnerable to impacts of fishing gear than macrofaunal species as a result of their slower growth and therefore are likely to have long recovery periods (Roberts *et al*., 2010). Short-lived and small benthic organisms on the other hand have rapid generation times, high fecundities and therefore excellent recolonization capacities (Coen, 1995). For example, slow-growing large biomass biota such as sponges and soft corals are estimated to take up to 8 years, whilst biota with short life-spans such as polychaetes are estimated to take less than a year (Kaiser *et al*., 2006).

In a meta-analysis of 38 studies, investigating the recovery of invertebrate communities from intertidal harvesting, the recovery of non-target species (of the fishery) did not appear more than 500 days following disturbance across all habitat types, with a further reduction in abundance occurring at this time (Clarke *et al*., 2017). When broken down by habitat type, some habitats may demonstrate a trend towards recovery at 51-500 days (Clarke *et al*., 2017). Recovery trends for the majority of gear-habitat combinations were shown to be are unstable and highly variable. The recovery for hydraulic dredging in mud habitats show relatively short-term impacts with respect to abundance, with reductions in the first 10 days following disturbance, and close to no effect thereafter. The recovery of from mechanical dredging in mud differs between phyla with a decline in mollusc abundance suppressed for >60 days post-fishing, but positive trend in other phyla (annelids, crustaceans), demonstrating near recovery over the same period. Recovery in may is variable with clear trends towards recovery only evidence for hydraulic and mechanical dredging. The recovery for mechanical dredging in sand indicates a positive trend, with partial recovery after 400 days.

Studies on recovery rate

There are a limited number of studies which examine the recovery rate from biological and physical disturbance caused by shellfish dredging. Five studies were found on the impacts of shellfish harvesting on intertidal habitats, four of which are based in the UK (details are provided in Annex 9). The recovery rates reported range from no effect (thus no recovery is required) up to 12 months, with intermediate recovery rates reported at 56 days and 7 months (Kaiser *et al*., 1996; Hall & Harding, 1997). Spencer *et al*. (1998) reported a recovery rate of up to 12 months, although inferred it was not possible to be certain recovery had not occurred before this as not all treatment replicates were taken 4 and 8 months after sampling. The authors compared their findings with similar studies and speculated the greater length of recovery in comparison was related to the protected nature of the site (Spencer *et al*. 1998). This study highlights the importance of exposure in determining recovery rates of different habitats and also how recovery rates are site-specific.

Species-specific diets

While shorebirds will typically eat a range of different prey species such as molluscs and annelids, the type of preferred prey species will vary between bird species (Natural England, 2014). It is important to knowledge these variations in prey preference as the impacts of dredging on bird species are likely to be reflective vary depending on the vulnerability of prey species to impacts of dredging. The plasticity of a bird's diet will also vary depending on the species and it is important to consider alternate prey species as bird will not be restricted to one source of food. Table 5 provides details of prey items taken by designated bird species within the Poole Harbour SPA. For example, oystercatchers will prey upon small cockles, Baltic tellins, soft-shell clams, lug-worms and ragworms (Wheeler *et al*., 2014). Some prey items may be of low value to the birds and not a major component of their diet (Zwarts *et al*. 1996ab; Atkinson *et al*. 2003). Alternative prey sources may also be less available as organisms may bury deeper into the sediment and thus require the birds to expend a greater amount of energy (Zwarts *et al*. 1996ab). Birds may directly compete with the fishery if both target the same species. The key bird species at risk from changes in prey availability are non-breeding overwintering species as food requirements are considerably greater during winter due to thermoregulatory needs and metabolic costs (Wheeler *et al*., 2014).

Table 5. 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 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)

6.3 Site-Specific Seasonality Table

Table 6 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. Where count data was available, highlighted months with significant numbers were defined on the basis of one or both of the following criteria being met in more than three-fifths (60%) of the years within the six years period 2007-2012. The two criteria used were: i) monthly maxima exceed 10% of the highest mean of monthly maxima over the six-year period; ii) monthly maxima exceed the 2012/2013 national significance threshold. These criteria were predominantly used for non-breeding bird features (based on WeBS data). Where insufficient count data were available to use these criteria, months with significant numbers were highlighted on the basis of generic information on seasonal patterns of occurrence in published sources. The data has been taken from NE Advice on Seasonality for Poole Harbour SPA, last updated 13th March 2020.

Table 6. Presence by month of mobile designated features at the Poole Harbour SPA. Grey indicates periods of presence in significant numbers whereas blank (white) indicates either periods of absence or presence in less significant numbers but where there may still be a significant effect.

Common Name	Latin Name	Designated Season	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Avocet	*Recurvirostra avosetta*	Nonbreeding; Wintering												
Black-tailed godwit	*Limosa limosa*	Nonbreeding; Wintering												
Common tern	*Sterna hirundo*	Breeding												
Mediterranean gull	*Larus melanocephalus*	Breeding												
Shelduck	*Tadorna tadorna*	Nonbreeding; Wintering												
Little egret	*Egretta garzetta*	Nonbreeding; Wintering												
Sandwich tern	Sterna sandvicensis	Breeding												
Spoonbill	Platalea leucorodia	Non-breeding												

6.4 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 will employ this methodology to start a rolling programme of marine feature condition assessments in 2017-18, which will be 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.

6.4.1 Poole Harbour SSSI Condition Assessment

An indication of the condition of site interest features can be inferred, if available, from assessments of SSSIs[11] that underpin the SPA. There are a number of SSSIs which exist within the area covered by Poole Harbour SPA and these, along with relevant feature condition assessments are summarised in Table 7. Note that only SSSI sites where shellfish dredging is known to occur have been chosen. The only update to this table from the previous HRA for this fishery is for Unit 037 where the condition assessment was updated in 2021.

Table 7. Condition assessments of SSSI units within the Poole Harbour SPA.

SSSI Site Name	Habitat	Unit number	Unit Name	Condition	Condition Threat Risk	Comments
Poole Harbour	Littoral Sediment	02	Whitley Lake	Favourable	High	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.

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

						Estuarine feature – no significant algal mat coverage in 2005, so no further samples. Saltmarsh feature – substantial loss, approx. 80%, of marsh since 2004. Some trampling as heavily used site during summer months but no adverse effects apparent, no signs of pollution, appears to be natural change. Aggregation of non-breeding birds, large numbers of feeding and roosting wildfowl although there is some disturbance from activities such as windsurfing and dog walking.
Poole Harbour	Littoral Sediment	15	Ham Common	Favourable	High	Estuarine feature – no significant algal mat coverage in 2005, so no further samples.
Poole Harbour	Fen, Marsh and Swamp – Lowland	31	Holton Mere and Wood Bar Looe	Unfavourable - declining	High	The condition of this unit is based on an assessment of the water environment, saltmarsh, mudflat and reedbed habitats and wintering and breeding birds. Unfavourable status in 2021 resulting from unfavourable assessments for littoral sediment, saltmarsh and some wintering bird features. Whilst several different factors may contribute to the negative trends, one overarching and dominant factor is eutrophication (nutrient enrichment).There are both water quality and biological indicators of a eutrophication problem that is affecting the ecology of littoral sediment, saltmarsh some wintering birds and there is no sign that the problem is reducing. This wintering bird assessment has been made in relation to the interest features of waterfowl and the peak wintering populations of some species. Although the total number of wintering waterfowl has been relatively stable and above 20,000 the composition of this bird assemblage has changed markedly with

						some species showing substantial increases and others significant declines. It is the nature of these changes that leads to the unfavourable assessment as detailed below with the assessment focussing particularly on the nine individual species that are features of this unit (because they mainly depend on intertidal habitat rather than open water and the subtidal - redshank, grey plover, curlew, dunlin, black-tailed godwit, avocet, shelduck, teal, brent goose). Wintering populations of avocet and black-tailed godwit have generally increased in line with national trends but declines have occurred in a suite of the commoner wader species – redshank, grey plover, curlew, dunlin, and lapwing. The littoral sediment feature in this unit is assessed as unfavourable because of the extent of the occurrence of macroalgae on mudflat. A number of environmental factors apart from nitrogen (e.g. temperature, exposure, salinity, phosphorus concentration, light penetration, sediment nutrient re-cycling) can affect the occurrence, abundance and type of macroalgae both during the year and from year to year. Evidence from different aerial photos shows algal mats were widespread on mudflats on this unit in 1997, 2002, 2005, 2008, 2009, 2015, 2016, 2017 and 2018 (not every year has aerial photo coverage; in some years aerial photos show little or no algae in the unit but these were all from spring photos, before significant algal growth commences). Algae in the unit is not ubiquitous on the mudflat but generally in three discreet areas. The saltmarsh feature is assessed as unfavourable because of the rapid erosion rate of the ‘gull islands’ and the more minor reed invasion at Wood Bar.

Poole Harbour	Fen, Marsh and Swamp – Lowland	32	Keysworth Saltings and Shag Looe Head	Favourable	High	Very few changes since 2001.
Poole Harbour	Fen, Marsh and Swamp – Lowland	34	Swineham point	Favourable	No identified Condition Threat	Communities and zonation noted in 2001, still present.
Poole Harbour	Fen, Marsh and Swamp – Lowland	36	Gigger's Island mudflat and Arne Reedbeds	Favourable	High	Intertidal sediment feature – favourable, reduction in the overall biomass of small invertebrates from 2002-2009. Change may be a result of slightly seasonal differences in sampling or natural variation. Estuarine feature – no significant algal mat coverage in 2005, so no further samples.
Poole Harbour	Fen, Marsh and Swamp – Lowland	37	Patchin Point and Arne Bay	Unfavourable – Declining	High	The assessment of the water environment, saltmarsh, mudflat habitats and wintering birds led to area being in unfavourable condition in 2010, deemed to still be the case. A eutrophication problem affecting ecology. Decline in numbers of overwintering shelduck. Concentrations of dissolved inorganic nitrogen, measured in winter, are less than WFD good status across the Harbour as a whole. Nitrogen enrichment encourages growth of opportunistic macroalgae on mudflat and within saltmarsh. Extent, density and biomass of macroalgae puts unit on borderline between WFD Moderate and WFD Good classes based on three years data. Widespread loss of saltmarsh in Poole Harbour has been happening for many year following a previous

						rapid saltmarsh expansion at the beginning of the 20th Century with the introduction of Spartina. Saltmarsh at Arne Bay seems relatively stable compared with the substantial changes seen elsewhere in the Harbour. EA geomatic data (2011-2014) does not reveal any significant saltmarsh changes at this site. Some algae accumulations on the edges. Numbers of shelduck have declined below the indicative level for favourable condition. A steeper decline has been observed at this site than expected from regional and national trends, therefore it is likely that site-specific pressures are contributing at least in part to this decline. Numbers have increased a little since the last WeBs alert but still remain lower than at almost any time since the 1960s. May be linked to reduced food availability due to algal mat occurrence and being more vulnerable to disturbance than other species. Breeding redshank on Arne saltmarshes appear to have remained stable since 1997.
Poole Harbour	Fen, Marsh and Swamp – Lowland	42	Wych Lake	Favourable	High	Saltmarsh feature – favourable. Little change with limited erosion. Some die back of Spartina anglica within the lower marsh, no changes in upper saltmarsh which is in good condition. Surrounding mudflats are largely free of green seaweed. Estuarine feature – favourable. Algal mats recorded in 2009 however no samples over 2kg/m^2, which is the threshold considered to be unfavourable in terms of algal cover.
Poole Harbour	Fen, Marsh	46	Long and Round Island	Favourable	High	Saltmarsh feature – little change between 2002 and 2009 save for a very small retreat on the NE

	and Swamp - Lowland		saltmarsh and mudflat			shorelines of both islands. Aerials from 2009 show significant bare mud areas, mainly in lower marsh, presumably caused by Spartina dieback. Intertidal sediment feature – reduction in the biomass of small worms and overall biomass of invertebrate, 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.
Poole Harbour	Fen, Marsh and Swamp – Lowland	47	Ower Bay and Fitzworth	Unfavourable - declining	High	There are both water quality and biological indicators of a eutrophication (nutrient enrichment) problem that is affecting the ecology. Monitoring shows no evidence that the problem is reducing. The nitrate-nitrogen load reaching the Harbour from its catchment is continuing to increase but more slowly in recent years. Erosion of saltmarsh is also evident, and numbers of wintering shelduck in the Harbour have declined significantly in recent years. Current measures to address these matters are not adequate to achieve favourable condition. Elevated levels of nitrogen enrichment encourage macroalgae growth on mudflat and saltmarsh. Green algal mats were widespread in 2016 and 2017. Algal species present dense impenetrable mats. Research indicates macroalgae can cause adverse effects on mudflat invertebrates and wintering birds, as well as saltmarsh by increasing its susceptibility to erosion. The nitrate-nitrogen load continues to increase but more slowly in recent years.
Poole Harbour	Fen, Marsh and Swamp – Lowland	52	Newton Bay	Unfavourable – declining	High	There are both water quality and biological indicators of a eutrophication (nutrient enrichment) problem that is affecting the ecology. Monitoring shows no evidence that the problem is reducing. Erosion of saltmarsh is also evident, and numbers of wintering

						shelduck in the Harbour have declined significantly in recent years. Current measures to address these matters are not adequate to achieve favourable condition. Intertidal sediment feature – comparison of 2002 and 2009 data from the biomass of small worms to have reduced and the overall biomass of invertebrates has decreased, including a reduction in the number of Corophium (an important prey item for Avocet). This could be due to slightly different seasonal difference in sampling or a result of natural variation. The AZTI Marine Biotic Index for the invertebrate community also indicated the site to be a 'heavily disturbed site'. Further investigation is required.
Poole Harbour	Littoral rock	63, 53	Brands Bay north; Inner Brand's Bay and Drove Island	Unfavourable - declining	High	See Unit 64
Poole Harbour	Littoral sediment	64	Brands Bay east	Unfavourable - declining	High	Condition of the Brands Bay Unit (also the same for units 53 and 63) is based on an assessment of the water environment, the saltmarsh, the mudflat habitats and wintering birds. A number of factors indicate an unfavourable condition. There are both water quality and biological indicators of a eutrophication problem that is affecting ecology. Monitoring shows no evidence that the problem is reducing. Erosion of saltmarsh is also evident. Numbers of wintering shelduck in the Harbour have declined significantly in recent years. Current measures to address these matters are not adequate to achieve favourable condition.

						Nitrogen enrichment encourages growth of opportunistic macroalgae on mudflat and within saltmarsh. Extent, density and biomass of macroalgae puts unit in WFD Moderate status based on 4 years of data. 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 (Ulva compressa and intestinalis) dominant in Brands Bay form dense impenetrable mats. Research in Poole Harbour (including Brands Bay) on mudflat invertebrates and wintering birds indicates that macroalgae cause adverse biological effects. The nitrate-nitrogen load reaching the Harbour from its catchment is continuing to increase but more slowly in recent years. Further measures are required to tackle these issues and achieve a substantial decline in the nitrogen load and possibly also phosphorus. Extent of saltmarsh has been assessed using both a direct comparison of aerial photos and an EA saltmarsh geomatic data comparison (2011 and 2014) itself derived from aerial photos. Interpretation of aerial photos has been ground truthed on selected units. Substantial loss of saltmarsh vegetation has occurred within most of the Brands Bay saltmarshes. However, the timing and pattern of loss is very different from that within the Holes Bay units assessed earlier this year. In Brands Bay, most of the changes seem to have occurred between 1972 and 1997 with the situation relatively stable subsequently. These changes contribute to unfavourable condition and a number of factors are undoubtedly involved. Algal

						mats dislodged from mudflat are deposited on saltmarsh by high tides, smothering saltmarsh vegetation. Smothering of saltmarsh vegetation by dead algal mats at the edges of the marsh also appears locally to be a factor in their retreat. High levels of nitrogen have been shown elsewhere to increase the susceptibility of saltmarsh to erosion, both because of effects on root growth (root biomass being smaller) and the stability of the mud itself. Sea level rise may also be a factor. Spartina dieback has been noted before at the back of marshes where anaerobic conditions cause the death of rhizomes due to lack of oxygen, but in Brands Bay the main effect has been on the lower saltmarsh. Numbers of shelduck have declined below the indicative level for favourable condition. A steeper decline has been observed at this site than expected from regional and national trends, therefore it is likely that site-specific pressures are contributing at least in part to this decline. Numbers have increased a little since the last WeBs alert but still remain lower than at almost any time since the 1960s. May be linked to reduced food availability due to algal mat occurrence and being more vulnerable to disturbance than other species. Data in Brands Bay itself is incomplete so does not allow a robust assessment of local changes but indicates that that numbers may have held up better in Brands Bay than in the Harbour as a whole.
Poole Harbour	Littoral sediment	65	Poole Harbour channels and open water	Unfavourable – declining	No identified Condition Threat	The overall condition of this unit, the unit covering the entire sub-tidal area of Poole Harbour, is based on an evaluation of the condition of different ecological attributes of the estuary as well as the overall health of the bird population and the condition of the

						nationally important bird species primarily dependent on this sub-tidal environment. The Harbour shows a number of water quality and biological indicators of a eutrophication problem that is affect the ecology of a number of features that are critical components of the estuary. These include the littoral sediment, saltmarsh and the benthic flora and fauna. The assessment of the estuary feature for this unit concentrates on the sub-tidal sub features of the estuary. In summary the weight of evidence indicated the estuary is in unfavourable declining condition because the trends causing the deterioration in condition are continuing. Dense mats of opportunistic macroalgae now occur on mudflat and within saltmarsh but macroalgae are also found sub-tidally. In 2003 a survey found that large quantities of the green macroalgae Ulva rigida had colonised across much of the sub-tidal channel system within the harbour, having previously, in the early to mid-1980s, only been found in quantity in the channel in the south of the outer harbour. Despite the high DAIN concentrations phytoplankton abundance has been assessed at WFD Good status harbour-wide. Nevertheless, the composition of the phytoplankton had fundamentally changed since the 1990s with diatom species characteristic of high nutrient conditions replacing those typical of lower nutrient conditions. This was one indication of a sharp decline in water quality; another was a decrease in water clarity since c2000 a finding backed up by EA data showing an increase in turbidity since the early 2000s. A survey of eelgrass beds showed signs of moderate ephipyte loads and wasting disease coverage and the

						recent literature review indicated that this can be a result of high nutrient pressures. Modelling has shown that there are suitable habitats for subtidal eelgrass Zostera marina restoration across the whole of Poole Harbour. However, the nitrogen loading and concentrations in the wider harbour are well above the level where submerged aquatic vegetation such as Zostera species is typically lost from estuaries. The waterbird assemblage feature is unfavourable for not meeting SPA conservation objectives in a number of respects, primarily declines in a number of different species not explained by national trends, changes in the composition of the wintering population, species declines resulting in several species no longer meeting thresholds for international and national importance and declines in some of the more common species. A number of these changes have been linked to eutrophication effects. Red-breasted Merganser - have suffered a 46% decline since the late 1980s and the latest 5 year mean peak (207) is well below the indicative level for favourable condition (302). There are further indications from comparison of trends in Poole Harbour with national and regional ones that site specific factors are at least partly responsible for this decline. Numbers in Poole Harbour have been declining since the early 2000s after peaking in the late 1990s. Although the national trend has also been a decline the Poole Harbour one has been more severe; in the reference period in the late 1980s Poole harbour averaged 9.7% of the GB population. In the last 5 years this average was 7.2%. Since the two most populous merganser sites in the SW are close together (Poole Harbour and the Fleet and Wey)

						evaluation of trends against regional ones is more instructive than for other species (where the Severn estuary dominates regional numbers). Here Poole Harbour's contribution to regional numbers has fallen from an average of 78.7% in the late 1980s to 52.9% in the last 5 years. Poole is one of several sites along this stretch of the Channel coast between Pagham Harbour and Chesil and the Fleet (including the Isle of Wight; Chichester, Langstone and Portsmouth Harbours, Poole Harbour and the Fleet/Wey are the most important sites) which together hold over 900 birds, about a third of the GB wintering population. Taken together the population is over the threshold for international importance (860). However, the other sites in this cluster have not suffered declines to the same extent as Poole; numbers at Chichester and Langstone have been stable since the late 1980s although there has been a decline in the last 2 years. These observations indicate that mergansers in Poole Harbour are faring significantly worse than in nearby sites, both to the east and west. In turn this strongly suggests that adverse factors specific to Poole Harbour are involved. Goldeneye - have suffered a 43% decline since the late 1980s and the latest 5 year mean peak (79) is below the indicative level for favourable condition (109). Wintering goldeneye populations in the harbour have suffered a sharp decline since peaks in the late 1990s. The increases before then and this subsequent decline are broadly similar to national trends but the Poole Harbour decline is greater. Poole Harbour is the most important site for goldeneye in the area. It contributes up to 70 or 80% of the regional population. The Solent sites to the east support only

						low numbers so, unlike with mergansers, there are no nearby sites that give a good comparison. Nevertheless these observations indicate that there are site specific issues affecting wintering goldeneye in Poole Harbour. Aggregations of breeding birds – Sandwich tern, numbers have been stable or increasing. Common tern, numbers have been stable. Brent goose, numbers have increase by some 142% since the late 1980s an increase greater than the national trend. Teal, numbers have increased greatly; there are now over 3x as many wintering teal as there were in the late 1980s an increase greater than the national trend. Pintail, in the long term, numbers are broadly following national trends. Cormorant, numbers have increased by 74% since the late 1980s.

Overall, the SSSI condition assessment shows that there are units in favourable condition and there are units where the condition is noted to be declining. The unfavourable condition appears to be primarily caused by eutrophication and resulting significant algal mat cover, there are also some concerns noted with regard to certain bird species comprising the waterbird assemblage where populations are declining, and the decline cannot be explained by national trends. A number of the changes to the waterbird assemblage have been linked to the eutrophication effects. A number of units considered to be in favourable condition do however note reductions in the overall biomass of small invertebrates (particularly worms) with respect to intertidal sediment communities. Such reductions however do not constitute a reason to classify such units as unfavourable.

Advice from Natural England received prior to the introduction of the PHDP byelaw, outlining the potential impacts of shellfish dredging on the nature conservation features of the Poole Harbour SPA, reiterated the findings of the 2010 SSSI condition 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.'

6.4.2 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. The population trend data is available for 8 species that are qualifying features of the site and the waterbird assemblage, non-breeding. The information is presented in table 8 below.

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
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 13% of the latest (2013-2017) GB breeding population estimate of 1200 pairs.
Sandwich Tern	Maintain	The most recent five-year mean (2017-2021) of 154 pairs (classified population was 181), represents 1.1% of the GB breeding population. The number of pairs during the most recent five-year period were 2017 – 140 pairs, 2018 – 110 pairs, 2019 – 241 pairs, 2020 – 220 pairs, 2021 – 57 pairs.
Common Tern	Maintain	When classified in 2000 the site supported 155 pairs, representing over 1% of the British population. When the site was re-classified in 2017, a new baseline for this species was set at 178 pairs. The most recent five-year mean of 174 pairs (2017-2021) represents 1.6% of the GB breeding population (11,000 pairs). The number of nesting pairs of common tern during the recent five-year period were 2017 – 170 pairs, 2018 – 115 pairs, 2019 – 110 pairs, 2020 – 164 pairs, 2021 – 174 pairs.
Little Egret	Maintain	Little egret was added as an over-wintering feature of the Poole Harbour SPA in 2017, due to its presence in the harbour in numbers exceeding qualifying thresholds. At classification, there were 114 individuals (2010-2014), representing 2.5% of the British population. Currently, the Poole Harbour population peak mean is 155 individuals (2015/16-2019/20), representing 2.6% of the British population of 5916 individuals. The most recent WeBS report indicates that Poole Harbour currently ranks as the 12th most important overwintering site in the UK for this species.
Spoonbill	Maintain	Spoonbill was added as an overwintering feature of the Poole Harbour SPA in 2017, due to its presence in the harbour in numbers exceeding qualifying thresholds. At classification, there were 20 individuals (2010-2014), representing 100% of the British population estimate in 2015. Since then, the British population estimate has been revised to a maximum of 198 and so the current five-year peak mean of 54 individuals (2015/16 – 2019/20) represents 27% of the British population. The most recent WeBS report indicates that Poole Harbour currently ranks as the second most important overwintering site in the UK. Counts of over 60 individuals are regularly made around Brownsea lagoon and, as this is a newly colonising species, numbers are expected to increase and then stabilise at a figure in excess of the baseline of 20 individuals.

Shelduck	Restore	When classified in 1999, the site supported 3,569 individuals, then representing 1.2% of the north-west European population. The over-wintering population of Shelduck in Poole Harbour has declined in the years following designation (by 65%) and the site now supports a five-year peak mean of 1,223 individuals, recorded between 2015/16 and 2019/20. As such, the SPA is currently only the 17th most important site for the species in the UK, holding less than 0.40% of the north-west European population. A WeBS Alert has been triggered for this species and suggests that the declines observed may be due to site-specific pressures, as the site trend does not appear to be tracking either the regional or the British trend. There is no available 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). Studies elsewhere suggest shelduck declines may be linked to reduced food availability as a result of increase in opportunistic algal mat cover possibly leading to a physical inhibition of feeding activity (scything action) in the presence of dense mats of algae. For example, shelduck avoid foraging in areas with dense algal mats. A study of bird disturbance in Poole Harbour in 2012 also found shelduck to be particularly vulnerable to disturbance with the probability of a major flight being higher in this species (together with curlew and oystercatcher) compared to other species.
Avocet	Maintain	When classified in 1999, the SPA supported nationally important numbers of pied avocet (459 individuals) then representing 36% of the GB population. The over-wintering population of pied avocet in Poole Harbour has significantly increased in the years following classification and the site now supports a five-year peak mean of 1,526 individuals (2015/16 and 2019/20). This represents approximately 19% of the latest GB wintering population estimate of 7,969 individuals, ranking as the fourth most important wintering site in the UK.
Black-tailed godwit (Icelandic Race)	Maintain	When classified in 1999, the site supported 1,576 individuals, then representing 2.4% of the Icelandic population. The over-wintering population of black-tailed godwit in Poole Harbour has increased in the years following classification, and the site now supports a five-year peak mean of 3,110 individuals (2015/16 – 2019/20), making it the 7th most important over-wintering sites for species in the UK. This five-year peak mean represents 7.6% of the latest GB over-wintering population estimate of the Icelandic race of this species of just over 40,000 individuals.
Water bird assemblage	Maintain	With little egret and Eurasian spoonbill added as features of the SPA in 2017, they are included within the assemblage, thus deriving the new assemblage baseline total of 25,176. The highest count was 27,798 individuals in 2019/20. Whilst no species have currently been lost from the assemblage, Pochard was present in the assemblage at numbers over 700 at the time of the original classification. The peak count from 2019/20 was two individuals, suggesting that this species has almost disappeared from Poole Harbour and the assemblage. Currently, on the following species occur in the assemblage in nationally important numbers in addition to species which are features of the site; cormorant, teal, red-breasted merganser and greenshank. Shelduck (65%), curlew (43%), redshank (29%), dunlin (62%), red-breasted merganser (51%), goldeneye (63%), pochard (99%) and lapwing (77%) are all recorded as declining in Poole Harbour. Apart from dunlin and red-breasted merganser, the decline is likely due in part to site-specific reasons as the site trend is at variance with regional or national trends.

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. The data presented in the table above is based on the 2022 update to the Poole Harbour SPA Conservation Advice Package which incorporates data from the most recent WeBS report.

6.5 Existing Management

This list details the management measures which also apply in Poole Harbour, in addition to the Poole Harbour Dredge Permit Byelaw:

- **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 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 applies restrictions to the fishing for cockles by hand in Poole Harbour through a seasonal closed season (1st February to 30th April inclusive) and specifications on the methods of collection, specifying hand picking or a rake or other similar instrument with specified size requirements. The dredge specifications under this byelaw do not apply in Poole Harbour as this is regulated under the Poole Harbour Dredge Permit Byelaw. The minimum conservation reference size for cockles is set under this byelaw at 23.8mm, this applies to hand gathering and dredging fishing.
- **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. 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.
- **Minimum Conservation Reference Size Byelaw.** Minimum conservation reference sizes listed in the schedules of this byelaw apply to all fishery participants and through the supply chain. A person must not take, retain on board, tranship, land, transport, store, display or offer for sale from a fishery within the District, any fish of shellfish species specified in the schedules which measure less than the minimum conservation reference size specified in the schedule. Any such fish or shellfish must be returned to the sea immediately.

6.6 Table 9: Summary of Impacts

The potential pressures, associated impacts, level of exposure and mitigation measures are summarised in table 9.

Feature	Supporting habitat(s)	Attribute	Target	Potential Pressure(s) and Associated Impacts	Nature and Likelihood of Impacts	Mitigation measures
Avocet Little egret Eurasian spoonbill Black-tailed godwit Shelduck Waterbird assemblage (Non-breeding – winter and//or passage season)	Saltmarsh: Atlantic salt meadows *Spartina* swards	Supporting habitat: extent and distribution of supporting non-breeding habitat;	Restore the extent and distribution 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).	Natural England raised concerns with respect to potential erosion caused by pump-scoop dredging taking place in close proximity to saltmarsh supporting habitats.	Shellfish dredging occurs in the vicinity of saltmarsh, in particular to Seagull Island. The shallow nature of these areas and pattern of the dredging activity means vessels are likely to be operating at a slow speed in these areas. As stated by Natural England and recognised in the above statement with regards to bait dragging, pump-scoop dredging is unlikely to occur over saltmarsh. This is further supported by a lack of literature on the impacts of towed gear with regards saltmarsh habitats (i.e. Hall *et al*., 2008; Roberts *et al*., 2010).	Shellfish dredging is prohibited between 23rd December and 25th May. Shellfish dredging is excluded all year round from Holes Bay, Lytchett Bay, upper Wych Lake and upper Middlebere Lake. Shellfish dredging is excluded all year round from the closure areas at Green Island and Seagull Island. Temporal closures prohibit shellfish dredging during key sensitive times of the year (1st November-23rd December & 25th May to 30th June) during the fishing season in key feeding and roosting areas for overwintering birds (Wych Lake, Middlebere Lake, Newton Bay, Ower Bay, Keysworth and parts of Arne Bay and Brands Bay). The level of fishing effort is capped through the allocation of a set number permits at a level of maximum of 45 vessels.
Common tern Sandwich tern	Saltmarsh: Atlantic salt meadows	Supporting habitat: extent and distribution of supporting	Maintain the extent, distribution and availability			

Mediterranean gull (Breeding (summer) season)	*Spartina* swards	habitat for the breeding season	of suitable breeding habitat which supports the feature for all necessary stages of its breeding cycle (courtship, nesting, feeding)			The Southern IFCA 'Poole Harbour Saltmarsh Code of Practice' (Annex 10) sets out the following provision in order to prevent disturbance to breeding and roosting bird species and promote protection of supporting habitat and apply to any person carrying out dredge fishing activity within Poole Harbour between 25th May and 23rd December: • No person should fish using a dredge within 10 metres of saltmarsh
Avocet Little egret Eurasian spoonbill Black-tailed godwit Shelduck Waterbird assemblage (Non-breeding (winter and/or passage) season) Common tern	All habitats	Supporting habitat: disturbance caused by human activity	Reduce the frequency, duration and / or intensity of disturbance affecting roosting, foraging, feeding, moulting and/or loafing birds so that they are not significantly disturbed.	Visual disturbance and above-water noise were identified as potential pressures of pump-scoop dredging. A pump-scoop dredge uses a hydraulic pump to power water jets attached to the front edge of the basket dredge. As such, the noise associated with pump-scoop dredging has previously been raised as a concern (Parker & Pinn, 2005). Disturbance can result in displacement when birds are unable to use an area due to the magnitude of disturbance. The effects of disturbance can include a reduction in the survival of displaced individuals and effects on the population size. The movement of birds to less suitable feeding areas can lead to increased densities and interspecific competition. Disturbance can cause birds to	During the 2016/17 and 2017/18 seasons, 43 out of 45 permit entitlements were taken out. In the 2018/19 and 2019/20 seasons 45 permits were taken (one permit was not fished during the 2018/19 season). The number of permit holders fishing per month varies. The average number of active fishers per month was highest in 2018 and 2019 with 43, compared to 33 in 2017 and 2016, and 27 in 2015. Sightings data show shellfish dredging occurs intertidally (at high tide) in distinct and relatively small spatial areas. Activity is largely concentrated in the area of Holton Mete and the Wards, with activity also taking place east of Giggers Island, Arne Bay, Middlebere Lake, Wych Lake, Ower Lake and Brands Bay. Using the co-location analysis, shellfish dredging may have some effect on sites used by avocet, black-tailed godwit,	Shellfish dredging is excluded all year round from Holes Bay, Lytchett Bay, upper Wych Lake and upper Middlebere Lake which represent key feeding and roosting areas for designated bird species. Shellfish dredging is excluded all year round from the closure areas at Green Island and Seagull Island. Temporal closures prohibit shellfish dredging during key sensitive times of the year (1st November to 23rd December & 25th May to 30th June) during the fishing season in key feeding and roosting areas for overwintering birds (Wych Lake, Middlebere Lake, Newton Bay, Ower Bay, Keysworth and parts of Arne Bay and Brands Bay). Shellfish dredging is prohibited between 23rd December and 25th May. This corresponds to the

Mediterranean gull (Breeding (summer) season)				take flight which increase energy demands and reduce food intake with potential consequences for survival and reproduction. The significance of disturbance is likely to depend on the availability of alternative undisturbed areas for birds and the frequency, seasonality and intensity at which shellfish dredging takes place. Responsiveness to disturbance is largely thought to be a species-specific trait.	Mediterranean gull, shelduck, curlew, redshank and greenshank with potentially sensitive sites including outer Wych and Middlebere, Arne Bay, Ower Bay, Newton Bay, Brands Bay, Holtojn Mere and Keysworth. Avocet are present from September to February, black-tailed godwit are present from September to March and Mediterranean gull are present from April to August. Shelduck, curlew, redshank and greenshank are part of the overwintering bird assemblage and as such will be present during the winter months (September – March). The wind-sensitivity farm indicates black-tailed godwits have moderate to low sensitivity and curlew and shelduck have very low sensitivity to offshore wind farm developments. The escape flight distance exhibited by the shelduck has been reported to vary from 126 metres in response to disturbance by researchers to 400 m in response to surfers. The escape flight distance exhibited by redshank has been reported to vary from 92 in response to disturbance by researchers to 260 m in response to people. In a Poole Harbour disturbance study shelduck were highlighted to have a higher probability of major flight. The mitigation measures outlined reduces the likelihood of disturbance through a number of permanently and seasonally closed areas which not only provide areas where no disturbance through pump-scoop dredging can	period of highest disturbance sensitivity due to the cold weather conditions and availability of food resources. The start of the fishing season takes place after the start of the gull breeding season (1st April). Shellfish dredging is only permitted between 06:00 and 18:00 each day and from Monday to Saturday. Disturbance is minimised through the allocation of a set number permits, thus capping fishing effort at a level of maximum of 45 vessels. The Southern IFCA 'Poole Harbour Saltmarsh Code of Practice' (Annex 10) sets out the following provision in order to prevent disturbance to breeding and roosting bird species and promote protection of supporting habitat and apply to any person carrying out dredge fishing activity within Poole Harbour between 25th May and 23rd December: - No person should fish using a dredge within 10 metres of saltmarsh

					occur in the overwintering period, it also provides alternative undisturbed sites for birds. These sites were chosen based on a number of criteria including bird sensitive areas and in areas where declines in some species have been observed. The timing of the fishing season eliminates any disturbance over a large proportion of the overwintering period and beginning of the Mediterranean gull breeding season. Additional protection is afforded for Mediterranean gulls through guidelines set out in the code of practice.	
Avocet Little egret Eurasian spoonbill	Intertidal mud Intertidal mixed sediments Intertidal sand and muddy sand	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).	Removal of target and non-target species were identified as potential pressures of pump-scoop dredging. Shellfish dredging can lead to impacts on non-target species through physical disturbance or damage to supporting habitats which in turn can cause changes in community structure, the removal and mortality of non-target organisms through interaction with fishing gear and smothering of prey through increased sedimentation. Generally, bottom towed fishing gear has shown to reduce biomass, production, species richness and diversity communities. In a meta-analysis of 38 studies, intertidal harvesting was shown to cause a reduction in abundance of benthic invertebrates by 42%	During the 2016/17 and 2017/18 seasons, 43 out of 45 permit entitlements were taken out. In the 2018/19 and 2019/20 seasons 45 permits were taken (one permit was not fished during the 2018/19 season). The number of permit holders fishing per month varies. The average number of active fishers per month was highest in 2018 and 2019 with 43, compared to 33 in 2017 and 2016, and 27 in 2015. Sightings data show shellfish dredging occurs intertidally (at high tide) in distinct and relatively small spatial areas. Activity is largely concentrated in the area of Holton Mete and the Wards, with activity also taking place east of Giggers Island, Arne Bay, Middlebere Lake, Wych Lake, Ower Lake and Brands Bay. Using the co-location analysis, shellfish dredging may have some effect on sites used by avocet, black-tailed godwit, Mediterranean gull, shelduck, curlew, redshank and greenshank with	Shellfish dredging is excluded all year round from Holes Bay, Lytchett Bay, upper Wych Lake and upper Middlebere Lake and as such protect key feeding areas for designated bird species. These areas provide alternative undisturbed foraging sites. Shellfish dredging is excluded all year round from the closure areas at Green Island and Seagull Island. Temporal closures prohibit shellfish dredging during key sensitive times of the year (1st November-23rd December & 25th May to 30th June) during the fishing season in key feeding areas for overwintering birds (Wych Lake, Middlebere Lake, Newton Bay, Ower Bay, Keysworth and parts of Arne Bay and Brands Bay). Shellfish dredging is prohibited between 23rd December and 25th
Black-tailed godwit	Intertidal mud Intertidal mixed sediments	Supporting habitat: food availability	Maintain overall prey availability (e.g.			

	Intertidal sand and muddy sand	within the intertidal	Macoma, Cardium, Nereis) at preferred prey sizes.	and 39% reduction in species diversity in the first 10 days following disturbance (Clark *et al*., 2017).	potentially sensitive sites including outer Wych and Middlebere, Arne Bay, Ower Bay, Newton Bay, Brands Bay, Holtojn Mere and Keysworth.	May. This largely overlaps with the overwintering periods for a number of designated bird species. Disturbance to intertidal sediments is minimised through the allocation of a set number permits, thus capping fishing effort at a level of maximum of 45 vessels.
Shelduck	Intertidal mud Intertidal mixed sediments Intertidal sand and muddy sand	Supporting habitat: food availability within the intertidal	Restore availability of key prey species (e.g. especially Hydrobia, but also Nereis, Corophium, hatching midges) at preferred prey sizes.	The relative impact of shellfish dredging on benthic organisms is species-specific and often related to their biological characteristics and physical habitats. A number of studies have found soft-bodied, deposit feeding crustaceans, polychaetes and ophiuroids to be most affected by dredging activities (Collie *et al*., 2000; Constantino *et al*., 2009; Clark *et al*., 2017). Recovery of affected species is largely species-specific, with short-lived and small benthic organisms, such as polychaetes having excellent recolonization capacities (Coen, 1985; Kaiser *et al*., 2006).	Avocet are present from September to February, black-tailed godwit are present from September to March and Mediterranean gull are present from April to August. Shelduck, curlew, redshank and greenshank are part of the overwintering bird assemblage and as such will be present during the winter months (September – March). Using the co-location analysis and information on diet (table 5), 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 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). 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	A number of restrictions are imposed on the gear configuration of the dredge basket including specified bar spacing which allows small invertebrates to pass through the dredge. There is a requirement to sort catch immediately and return all shellfish under minimum size restrictions (as per Southern IFCA byelaws), as well as bycatch, to the water. The Southern IFCA 'Poole Harbour Saltmarsh Code of Practice' (Annex 10) sets out the following provision in order to prevent disturbance to breeding and roosting bird species and promote protection of supporting habitat and apply to any person carrying out dredge fishing activity within Poole Harbour between 25th May and 23rd December: - No person should fish using a dredge within 10 metres of saltmarsh

					their capacity for rapid recolonization (Coen, 1995). In such instances, the effect of shellfish dredging is likely to only be short term. The mitigation measures outlined reduces the likelihood of disturbance through the removal of target and non-target species through a number of permanently and seasonally closed areas which provide a series of foraging and feeding areas where no pump-scoop dredging can occur in the overwintering period (or all year round in a number of sites). These sites were chosen based on a number of criteria including bird sensitive areas, in areas where declines in some species have been observed and where sediment recovery is likely to be slow i.e. low energy sites. The timing of the fishing season eliminates any disturbance of intertidal mudflats over a large proportion of the overwintering period and allows for the recovery of impacted communities over a five-month period.	

7 Conclusion[12]

In order to conclude whether the issuing of permits under the Poole Harbour Dredge Permit byelaw, which will allow up to 45 vessels to undertake pump-scoop dredging (subject to a number of permit conditions), has an effect on the integrity of the Poole Harbour SPA, it is necessary to assess whether the impacts of the permitted activity (pump-scoop dredging) 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 shellfish dredging (detailed in section 6.2) identifies that this activity has the potential to disturb regularly occurring migratory birds and waterfowl species and lead to changes in prey availability. Disturbance can occur visually or through noise. Changes in prey availability mainly relate to the indirect effects of pump-dredging which include interactions with fishing gear through crushing, burial or exposure. It is also noted that there is a potential risk of physical changes to saltmarsh habitat although peer-reviewed research is lacking.
It is therefore recognised that this activity has the potential to lead an adverse effect upon the following SPA attributes:

- Supporting habitat: disturbance caused by human activity
- Supporting habitat: extent and distribution of supporting non-breeding habitat
- Supporting habitat: extent and distribution of supporting habitat for the breeding season
- Supporting habitat: food availability within supporting habitat
- Supporting habitat: food availability within the intertidal

These potential impacts and risks to the integrity of the site are mitigated through a number of conditions applied under the permit which;

- Provides a network of areas where there is little or no noise and visual disturbance and supporting habitat disturbance including; bird sensitive areas, areas where declines in some bird species have been observed that are likely to be in part attributable to site specific pressures, Mediterranean gull nesting sites at Seagull Island, areas where sediment recovery is likely to be slow (low energy sites), fringing saltmarsh, reedbed and lowland water habitats supporting breeding birds. Shellfish dredging is excluded in Lytchett Bay, Holes Bay, and inner regions Wych Lake and Middlebere Lake all year round. Shellfish dredging is also excluded from defined areas at Green Island and

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

Seagull Island all year round. Shellfish dredging is excluded from overwintering, feeding and roosting bird sensitive areas at Wych Lake, Middlebere Lake, Newton Bay, Ower Bay, Keysworth Bay and parts of Arne Bay and Brands Bay during key sensitive times of the year for bird species between 25th May and 1st July, 1st November and 23rd December. The 'Poole Harbour Saltmarsh Code of Practice' provides an extra voluntary provision to reduce disturbance and reduce the risk of impacts to supporting habitats year-round.

- Manage shellfish dredging throughout the Harbour in a way that minimises its impact on prey availability and disturbance, through restrictions in the number of permits (45), the design of the pump and dredge used and restrictions in the timing of when the fishery takes place (closed from 24th December to 24th May). The prohibition on dredge fishing between 23rd December to 25th May mitigates over-wintering bird disturbance during this lean period.
- Allow for an assessment of fishing effort of key commercial species including the Manila clam and common cockle, which are prey items for some of the designated bird species, through the requirement for catch data indicating, for each month, the hours fished, the quantities of species caught, the buyer(s) and the zone from which the catch was taken. This data can be used to indicate trends in fishing activity and can be related to data from the Poole Harbour Bivalve Stock Assessment to ensure that the level of fishing remains sustainable and will not have an adverse impact on prey availability of the commercially harvested species.

Taking into account all the evidence presented in this Appropriate Assessment, including scientific literature, habitat feature data and sightings data, it is concluded that issuing of permits for 2023/24 season under the Poole Harbour Dredge Permit byelaw will not hinder the site from achieving its conservation objectives and as such will not have an adverse effect upon on the integrity of the Poole Harbour SPA. As in previous years (2015/16, 2016/17, 2017/18, 2018/19, 2019/20, 2020/21, 2021/22, 2022/23) it is therefore proposed the number of permits issued should remain at 45. This reflects the current level of effort which is considered to be sustainable. As outlined above, the permit conditions and Code of Practice will continue to mitigate against any potential impacts of the fishery on the bird features and supporting habitats of this site. In addition, required catch reporting will allow catch rates and fishing effort to be monitored. Furthermore, the permit is flexible and Southern IFCA can therefore review the suitability of the permit conditions, attach conditions to the permit and vary or revoke conditions attached to the permit at any time after the permits have been issued, following a set process. As such, any changes will have regard to the Authority's duties and obligations under section 153 and 154 of the Marine and Coastal Access Act 2009, advice from Natural England, new evidence in the form of scientific data or literature and/or any Habitats Regulations Assessment. This flexibility allows proportionate management of the dredge fishery in Poole Harbour whilst achieving the conservation objectives of the site.

8 In-combination assessment

Based on the mitigation measures, in the form of permit conditions, it is concluded that issuing 45 permits under the Poole Harbour Dredge Permit byelaw for the 2023/24 season alone will not have an adverse effect on bird features and their supporting habitats within Poole Harbour SPA.

Under Article 6(3) of the Habitats Directive and outlined in the Conservation of Habitats and Species Regulations (Amendment) (EU Exit) 2019, the assessment of any plan or project likely to have a significant effect on a site within the National Site Network, must be assessed in combination with other plans or projects. Any commercial plan or project require a Habitat Regulations Assessment in their own right and must also account for any in-combination effects with the Poole Harbour Dredge Permit byelaw.

Commercial plans and projects that occur within or that may affect the Poole Harbour SPA are considered in below. The impacts of these plans or projects require a Habitat Regulations Assessment in their own right and must also account for any in-combination effects with the Poole Harbour Dredge Permit byelaw.

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 Dredge Permit of visual disturbance/above water noise is possible. However, through this assessment of the Poole Harbour Permit Dredge Byelaw 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 Dredge Permit Byelaw.

8.1 Fishing Activity In-combination Assessment

The Poole Harbour Fishery Order 2015	The Poole Harbour Fishery Order 2015 is a several order which sets an area within the Harbour within which the Southern IFCA can lease out areas of seabed for aquaculture. Leases are issued on a five yearly basis and the current leases are for the period 2020-25. The conclusion of the 2020-25 HRA for the issuing of leases under the Order was that the issuing of leases would not have an adverse effect on the integrity of the Poole Harbour SPA. Lease beds under the Order are severed from the public right to fish therefore there is no potential for spatial overlap of the two activities within Poole Harbour. Based on this and the conclusion of both this HRA and the HRA for the issuing of leases under the Order of no adverse effect on the integrity of the SPA 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 Dredge Permit Byelaw 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 Dredge Permit Byelaw 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 Dredge Permit Byelaw were screened in. Therefore, there is unlikely to be any in-combination effect between the two gear types.
Net Fishing	At a TSLE level no common pressures between net fishing and the Dredge Permit Byelaw were screened in. Therefore, there is unlikely to be any in-combination effect between the two gear types.

8. Summary of consultation with Natural England

Date	Contact	Sent	Comments Received

9 Integrity test

Based on the mitigation measures, in the form of permit conditions, it is concluded that the issuing of permits under the Poole Harbour Dredge Permit byelaw for the 2023/24 season will not have an adverse effect, alone or in-combination, on bird features and their supporting habitats within Poole Harbour SPA. As in previous years (2015/16, 2016/17, 2017/18, 2018/19, 2019/20, 2020/21, 2021/22, 2022/23) it is therefore proposed the number of permits issued should remain at 45.

Annex 1: Reference list

Atkinson, P.W., Austin, G.E., Burton, N.H.K., Musgrove, A.J., Pollitt, M., Rehfisch, M.M., 2000. WeBS Alerts 1998/99: Changes in Numbers of Wintering Waterbirds in the United Kingdom at National, Country and Special Protection Area (SPA) Scales (BTO Research Report No. 239). BTO, Norfolk. 127 pp.

Atkinson, P.W., Clark, N.A., Bell, M.C., Dare, P.J., Clark, J.A. & Ireland, P.L. 2003. Changes in commercially fished shellfish stocks and shorebird populations in the Wash, England. *Biol. Cons*., **114**, 127-141.

Atkinson, P.W., Maclean, I.M.D. & Clark, N.A. 2010. Impacts of shellfisheries and nutrient inputs on waterbird communities in the Wash, England. *J. Appl. Ecol*., **47**, 191-199.

Bannister, R.C.A., 1998. Analysing cockle and mussel stocks. Part 1—The Wash. *Shellfish News*, **6**, 25–29.

Bannister, R.C.A., 1999. The Dr Walne memorial lecture. A review of shellfish resources and their management. In: Proceedings of the Thirtieth Annual Shellfish Conference of the Shellfish Association of Great Britain. SAGB, London.

Baudains, T. P. & Lloyd, P. 2007. Habituation and habitat changes can moderate the impacts of human disturbance on shorebird breeding performance. *Anim. Conserv*., **10,** 400-407.

Beale, C. M. & Monaghan, P. 2004. Behavioural responses to human disturbance: a matter of choice? *Anim. Behav.*, **68,** 1065-1069.

Beukema J.J. & Dekker R. 2018. Effects of cockle abundance and fishery on bivalve recruitment. *Journal of Sea Research*. **140.** Pp81-86. https://doi.org/10.1016/j.seares.2018.07.013

Blumstein, D.T., Anthony, D.T., Harcourt, R.G. & Ross, G. 2003. Testing a key assumption of wildlife buffer zones: is flight initiation distance a species-specific trait? *Biol. Cons*., **110**, 97-100.

Blumstein, D. T., Fernandez-Juricic, E., Zollner, P. A. & Garity, S. C. 2005. Inter-specific variation in avian responses to human disturbance. *J. Appl. Ecol.*, **42**, 5, 943-953

Bradshaw, C., Veale, L.O., Hill, A.S., & Brand, A.R. 2000. The effects of scallop dredging on gravelly seabed communities. In Kaiser, M.J. & de Groots, S.J. (Eds). *The Effects of Fishing on Non-Target Species and Habitats: Biological Conservation and Socio-Economic Issues*. Oxford, Blackwell Science, pp. 83-104.

Brearey, D.M. 1982. The feeding ecology and foraging behaviour of Sanderling *Calidris alba* and Turnstone *Arenaria interpres* at Teesmouth N. E. England. Theses. Durham University. UK. 412 pp.

Burd, F. 1992. *Erosion and Vegetation Change on the Saltmarshes of Essex and North Kent between 1973 and 1988*. Peterborough, UK, pp. 116

Burden, A., Garbutt, R. A., Evans, C. D., Jones, D. L. and Cooper, D. M. 2013. Carbon sequestration and biogeochemical cycling in saltmarsh subject to coastal managed realignment. *Est. Coast. Shelf. Sci.*, **120**, 12-20

Burger, J. 1981. The effect of human activity on birds at a coastal bay. *Biol. Cons*., **21**, 231-241.

Burton, N.H.K., Rehfisch, M.M., Clark, N.A. & Dodd, S.G. 2006. Impacts of sudden winter habitat loss on the body condition and survival of redshank *Tringa totanus*. *J. Appl. Ecol*., **43**, 464-473.

Burton, N.H.K., Rehfisch, M.M., Clark, N.A. & Dodd, S.G. 2006. Impacts of sudden winter habitat loss on the body condition and survival of redshank *Tringa totanus*. *J. Appl. Ecol*., **43**, 464-473.

Clark, N.A. 1993. Wash oystercatchers starving. *BTO News*, **185**, 1, 24.
Clarke L.J., Hughes K.M., Esteves L.S., Herbert R.J.H. and Stilman R.A. 2017. Intertidal invertebrate harvesting: a meta-analysis of impacts and recovery in an important waterbird prey resource. *Marine Ecology Progress Series*. Vol **584**: 229-244.

Clarke, L., 2018. *Ecosystem impacts of intertidal invertebrate harvesting: from benthic habitats to bird predators.* Doctorate Thesis (Doctorate). Bournemouth University. Available at: http://eprints.bournemouth.ac.uk/31136/. Date Accessed: 24/09/2018

Clarke, L.J., Esteves, L.S., Stillman, R.A. & Herbert, R.J.H. 2018a. Impacts of a novel shellfishing gear on macrobenthos in a marine protected area: pump-scoop dredging in Poole Harbour, UK. *Aquat. Living Resour*., **31**, 5, https://doi.org/10.1051/alr/2017044.

Clarke, L.J., Stillman, R.A. & Herbert, R.J.H. 2018b. Monitoring of the Solent bottom-towed fishing gear management measures: a focused project on shellfish dredging in Langstone Harbour. BU Global Environmental Solutions (BUG) report (BUG2801) to Natural England. 100 pp.

Coen, L.D. 1995. A review of the potential impacts of mechanical harvesting on subtidal and intertidal shellfish resources. SCDNR-MRRI, 46 pp.

Collie, J.S., Hall, S.J., Kaiser, M.J. & Poiner, I.R. 2000 A quantitative analysis of fishing impacts on shelf-sea benthos. *J. Anim. Ecol*., **69**, 785-798.

Collie, J.S., Hermsen, J.M., Valentine, P.C. & Almeida, F.P. 2005. Effects of fishing on gravel habitats: assessment and recovery of benthic megafauna on Georges Bank. American Fisheries Society Symposium. American Fisheries Society. 325 pp.

Constantino, R., Gaspar, M.B., Tata-Regala, J., Carvalho, S., Curdia. J., Drago, T. Taborda, R. 2009. Clam dredging effects and subsequent recovery of benthic communities at different depth ranges. *Mar. Environ. Res*., **67**, 89-99.

Cox, R., Lancaster, J. & Rutherford, V. 2014. Review of Potential Impacts on the Diet of Sanderlings and Ringed Plovers and their Foraging Distribution. Tidal Lagoon Swansea Bay. 1063030. Natural Power. 15 pp.

Cox, R., Wadsworth, R. A. and Thomson, A. G. 2003. Long-term changes in salt marsh extent affected by channel deepening in a modified estuary. *Cont. Shelf. Res.,* 474-479

Durell, S.E.A. Le V. Dit. & Kelly, C.P. 1990. Diets of Dunlin *Calidris alpine* and Grey Plover *Pluvialis squatarola* on the Wash as determined by dropping analysis. *Bird Study*, **37**, 1, 44-47.

Durell, S.E.A. Le V. dit., Stillman, R.A., Triplet, P., Aulert, C., Biot, D.O. dit., Bouchet, A., Duhamel, S., Mayot & Goss-Custard, J.D. 2005. Modelling the efficacy of proposed mitigation areas for shorebirds: a case study on the Seine estuary, France. *Biol. Cons*., **123**, 67-77.

Dyrynda, P. 1995. Impacts of bait dragging on the seabed within Poole Harbour. Report to Southern Sea District Fisheries Committee from Marine Environmental Research Group, University of Wales, Swansea.

European Commission. 2009. European Union Management Plan 2009-2011. Redshank *Tringa totanus*. Technical Report – 2009 – 031. 44 pp.

Ferns, P.N., Rostron, D.M. & Sima, H.Y. 2000. Effects of mechanical cockle harvesting on intertidal communities. *J. Appl. Ecol*., 37. 464-474.

Gardiner, S. C. 2015. Physical drivers of saltmarsh change in enclosed microtidal estuaries. PhD Thesis, University of Southampton, Southampton, pp. 238

Garthe, S. & Hüppop, O. 2004. Scaling possible adverse effects of marine wind farms on seabirds: developing and applying a vulnerability index. *J. Appl. Ecol*., **41**, 724-734.

Gill, J.A., Sutherland, W.J. & Watkinson, A.R. 1996. A method to quantify the effects of human disturbance on animal populations. *J. Appl. Ecol.,* **33**, 786-792.

Gill, J.A., Norris, K. & Sutherland, W.J. 2001a. The effects of disturbance on habitat use by black-tailed godwits *Limosa limosa*. *J. Appl. Ecol*., **38**, 846-856.

Gill, J.A., Norris, K. & Sutherland, W.J. 2001b. Why behavioural responses may not reflect the population consequences of human disturbance. *Biol*. *Conserv*. **97,** 265–268.

Goss-Custard, J.D. & Verboven, N. 1993. Disturbance and feeding shorebirds on the Exe estuary. Wader Study Group Bull. 68.: 59-66.

Goss-Custard, J.D. 1977. The ecology of the Wash. III. Density-related behaviour and the possible effects of a loss of feeding grounds on wading birds (Charadrii). *J. Anim. Ecol*., **14**, 721-739.

Goss-Custard, J.D. 1993. The effect of migration and scale on the study of bird populations: 1991. Witherby Lecture. Bird Study, 40, 81-96.

Goss-Custard, J.D., Stillman, R., West, A.D., Caldow, R.W.G., Triplet, P., Durell, S.E.A. Le V.dit. & McGrorty, S. 2004. When enough is not enough: Shorebirds and shellfishing. *Proc. R. Soc. Lond. B*., **271**, 233-237.

Goss-Custard, J.D., Triplet, P., Sueur, F. & West, A.D. 2006. Critical Thresholds of Disturbance by People and Raptors in Foraging Wading Birds. *Biol. Cons.*, **127**, 88–97.

Goss-Custard, J.D., Clarke, R.T., Durell, S.E.A. le V. dit, Caldow, R.W.G. & Ens, B.J. 1995. Population consequences of winter habitat loss in a migratory shorebird. II. Model predictions. *J. Appl. Ecol*., **32**, 337-351.

Goss-Custard, J.D., Durell, S.E.A. le V. dit, Goater, C.P., Hulscher, J.B., Lambeck, R.H.D., Meininger, P.L. & Urfi, J. 1996. How oystercatchers survive the winter. In Goss-Custard, J.D. (Ed). *The Oystercatcher: From Individuals to Populations*. Oxford, UK, Oxford University Press. pp. 133–154.

Hall, S.J. & Harding, M.J.C. 1997. Physical disturbance and marine benthic communities: the effects of mechanical harvesting of cockles on non-target benthic infauna. *J. App. Ecol.*, 34, 497-517.

Hall, K., Paramor, O.A.L., Robinson L.A., Winrow-Giffin, A., Frid C.L.J., Eno, N.C., Dernie, K.M., Sharp, R.A.M., Wyn, G.C.& Ramsay, K. (2008). Mapping the sensitivity of benthic habitats to fishing in Welsh waters- development of a protocol. CCW [Policy Research] Report.

Hiddink, J.G. 2003. Effects of suction-dredging for cockles on non-target fauna in the Wadden Sea, *J. Sea. Res*., **50**, 315-323

Hill, D., Hockin, D., Price, D., Tucker, G., Morriss, R. & Treweek, J. 1997. Bird disturbance: improving the quality and utility of disturbance research. *J. Appl. Ecol*., **34**, 275-288.

Hulscher, J.B. 1982. The oystercatcher *Haematopus ostralegus* as a predator of the bivalve *Macoma balthica* in the Dutch Wadden Sea. *Ardea*, **70**, 89–152.

Jensen, A & Humphreys, John & Caldow, Richard & Cesar, Christopher. (2005). 13. The Manila Clam in Poole Harbour. Proceedings in Marine Science**. 7**. 10.1016/S1568-2692(05)80018-X.

Kaiser, M.J., Edwards, B. & Spencer, B.E. 1996. Infaunal community changes as a result of commercial clam cultivation and harvesting. *Aquat. Living Resour.,* 9, 57-63.

Kaiser, M.J., Clarke, K.R., Hinz, H., Austen, M.C.V., Somerfield, P.J. & Karakassis, I. 2006. Global analysis of response and recovery of benthic biota to fishing. *Mar. Ecol. Prog. Ser*., **311**, 1-14

King, S., Maclean, I.M.D., Norman, T. & Prior, A. 2009. Developing Guidance on Ornithological Cumulative Impact Assessment for Offshore Wind Farm Developers. COWRIE. 129 pp.

Kirby, J., Davidson, N., Giles, N., Owen, M. & Spray, C. 2004. Waterbirds & Wetland recreation handbook. A review of issues and management practice. WWT. 128 pp.

Klaassen, M., Bauer, S., Madsen, J. & Tombre, I. 2006. Modelling Behavioural and Fitness Consequences of Disturbance for Geese Along Their Spring Flyway. *J. Appl. Ecol.*, **43**, 92–100.

Klein, M.L., Humphrey, S.R. & Percival, H.F. 1995. Effects of ecotourism on the distribution of waterbirds in a wildlife refuge. *Conserv. Biol*., **9**, 1454-1465.

Lambeck, R., Goss-Custard, J.D. & Triplet, P. 1996. Oystercatchers and man in the coastal zone. In Goss-Custard, J.D. (Ed). The Oystercatcher: From Individuals to Populations. Oxford, Oxford University Press. pp. 289-326

Liley, D., Cruickshanks, K, Fearnley, H. & Lake, S. 2012 The effect of bait collection on waterfowl foraging behaviour in Holes Bay, Poole Harbour. Report for Natural England. Footprint Ecology Ltd., Wareham, Dorset.

Liley, D. & Fearnley, H. (2012). Poole Harbour Disturbance Study. Report for Natural England. Footprint Ecology Ltd., Wareham, Dorset.

Liley, D., Stillman, R. A. & Fearnley, H. 2010. The Solent Disturbance and Mitigation Project: results of disturbance fieldwork 2009/10. Report to the Solent Forum. 71 pp.

Madsen, J. 1995. Impacts of disturbance on migratory waterfowl. *Ibis*, **137** (Supplement), S67-S74.

Mercaldo-Allen, R. & Goldberg, R. 2011. Review of the Ecological Effects of Dredging in the Cultivation and Harvest of Molluscan Shellfish. NOAA Technical Memorandum NMFS-NE-220. 84 pp.

Moller, I., Spencer, T., French, J. R., Leggett, D. J. and Dixon, M. 2001. The sea defence value of saltmarshes – a review in the light of field evidence from North Norfolk. *Journal of the Chartered Institute of Water and the Environmental Management*, 15, 109-116

Natural England. 2011. Bait collection in Poole Harbour European Marine Site. 19 pp.

Natural England. 2014. Poole Harbour Fishing Dredge Permit Byelaw – NEs advice on the potential impacts of shellfish dredging on the nature conservation features of Poole Harbour SPA, RAMSAR and SSSI. 3 June 2014. Pp1-10

Natural England. 2018. Natural England Conservation Advice for Marine Protected Areas: Poole Harbour SPA. **A**vailable at: **https://designatedsites.naturalengland.org.uk/Marine/MarineSiteDetail.aspx?SiteCode=UK9010111&SiteName=poole%20Harbour&countyCode=&responsiblePerson=&SeaArea=&IFCAArea=. Date** Accessed: 17/01/18

Natural England, Wildside Ecology & Suffolk Coast and Heaths AONB. 2012. A simple method for assessment the risk of disturbance to birds and coastal sites. 32 pp.

Navedo, J.G. & Masero, J.A. 2008. Effects of traditional clam harvesting on the foraging ecology of migrating curlews (*Numenius arquata*). *J. Exp. Mar. Biol. Ecol*., **355**, 1, 59-65.

Nisbet, I. C. T. 2000. Disturbance, habituation, and management of waterbird colonies – Commentary. *Waterbirds: The International Journal of Waterbird Biology,* **23,** 312-332.

Norris, K., Bannister, R.C.A. & Walker, P.W. 1998: Changes In the number of oystercatchers, *Haematopus ostralegus* wintering in the Burry Inlet in relation to the biomass of cockles *Cerastoderma edule* and its commercial exploitation. *J. Appl. Ecol.*, **35**, 75–85.

Piersma, T., Koolhaas, A., Dekinga, A., Beukema, J.J., Dekker, R. & Essink, K. 2001. Long-term indirect effects of mechanical cockle-dredging on intertidal bivalve stocks in the Wadden Sea. *J. Appl. Ecol*. **38**, 976-990.

Poole Harbour Commissioners. 2013. Poole Harbour Aquatic Management Plan. Available at: http://www.pooleharbouraqmp.co.uk/

Ravens, T. M., Thomas, R. C., Roberts, K. A. and Santschi, P. H. 2009. Causes of salt marsh erosion in Galvestion Bay, Texas. *J. Coastal. Res.,* **25**, 265-272

Rees, E. C., Bruce, J. H. & White, G. T. 2005. Factors affecting the behavioural responses of whooper swans (*Cygnus c. cygnus*) to various human activities. *Biol. Cons.,* **121,** 369-382

Riddington, R., Hassall, M., Lane, S.J., Rurner, P.A. & Walters, R. 1996. The impacts of disturbance on the behaviour and energy budgets of Brent Geese *Branta b. bernicla*. *Bird Study*, **43**, 269-279.

Roberts, C., Smith, C., Tillin, H. & Tyler-Walters, H. 2010. Review of existing approaches to evaluate marine habitat vulnerability to commercial fishing activities. Report: SC080016/R3.Environment Agency, Bristol. 150 pp.

Schmechel, F. 2001. Potential impacts of mechanical cockle harvesting on shorebirds in Golden and Tasman Bays, New Zealand. DOC Science Internal Series 19. New Zealand Department of Conservation. 51 pp.

Sewell, J., Harris, R., Hinz, H., Votier, S. & Hiscock, K. 2007. An Assessment of the Impact of Selected Fishing Activities on European Marine Sites and a Review of Mitigation Measures. SR591. Seafish Technology. 219 pp.

Spencer, B.E., Kaiser, M.J. & Edwards, D.B. 1998. Intertidal clam harvesting: benthic community change and recovery. *Aquac. Res.*, 29, 429-437.

Stillman, R. A., Goss-Custard, J. D., West, A. D., Durell, S., McGrorty, S., Caldow, R. W. G., Norris, K. J., Johnstone, I. G., Ens, B. J., Van der Meer, J. & Triplet, P. 2001. Predicting shorebird mortality and population size under different regimes of shellfishery management. *J. Appl. Ecol.,* **38,** 857-868.

Stillman, R., West, A.D., Goss-Custard, J.D., Caldow, R.W.G., McGrorty, S., Durrel, S.E.A. Le V.dit., Yates, M.C., Atkinson, P.W., Clark, N.A., Bell, M.C., Drare, P.J. & Mander, M. 2003. An individual behaviour-based model can predict shorebird mortality using routinely collected shellfishery data, *J. Appl. Ecol.*, **6**, 1090-1101.

Stillman, R.A., West, A.D., Caldow, R.W.G. & Durell, S.E.A. le V. dit. 2007. Predicting the effect of disturbance on coastal birds. *Ibis*, **149** (Suppl. 1), 9-14.

Stillman, R., Cox, J., Liley, D., Ravenscroft, N., Sharp, J. & Wells, M. 2009. Solent disturbance and mitigation project: Phase I report. Report to the Solent Forum. 103 pp.

Stillman, R.A., Moore, J.J., Woolmer, A.P., Murphy, M.D., Walker, P., Vanstaene, K.R., Palmer, D. & Sandersond, W.G. 2010. Assessing waterbird conservation objectives: An example for the Burry Inlet, UK. *Biol. Cons*., **143**, 2617-2630.

Stillman, R. A., West, A. D., Clarke, R. T. & Liley, D. 2012. Solent Disturbance and Mitigation Project Phase II: Predicting the impact of human disturbance on overwintering birds in the Solent. Report to the Solent Forum. 121 pp.

Sutherland, W.J. & Goss-Custard, J.D. 1991. Predicting the consequences of habitat loss on shorebird populations. *Acta Congressus Internationalis Ornithologica*, **20**, 2199-2207.

Thiel, D., Jenni-Eiermann, S., Palme, R. & Jenni, L. 2011 Winter Tourism Increases Stress Hormone Levels in the Capercaillie *Tetrao urogallus*. *Ibis*, **153**, 122–133.

Thompson, J. R. 1994. Report on pilot project to investigate recreational disturbance to overwintering birds in the Solent 1993-94. Hampshire County Council.

Townend, I. H., Wang, Z. B. and Rees, J. G. 2007. Millennial to annual volume changes in the Humber Estuary. *Pro. Royal. Soc. A.,* **463**, 837-854

Townsend, D. J., & O'Connor, D. A. 1993. Some effects of disturbance to waterfowl from bait-digging and wildfowling at Lindisfarne National Nature Reserve, north-east England. In Davidson, N. & Rothwell, P. (Eds). *Disturbance to Waterfowl on Estuaries*. Wader Study Group Bulletin, 68 (Special Issue). pp. 47–52.

van de Wal, D. and Pye, K. 2004. Patterns, rates and possible causes of saltmarsh erosion in the Greater Thames area (UK). *Geomorphology*, **61**, 373-391

van Gils J.A., Piersma T., Dekinga A., Spaans B., Kraan C. 2006. Shellfish dredging pushes a flexible avian top predator out of a marine protected area. *PLoS Biol* **4(12):** pp376. DOI: 10.1371/journal.pbio.0040376

Veale, L.O., Hill, A.S., Hawkins, S.J. & Brand, A.R. 2000. Effects of long-term physical disturbance by commercial scallop fishing on subtidal epifaunal assemblages and habitats. *Mar.Biol*., **137**, 2, 325-337.

Verhulst, S., Oosterbeek, K., Rutten, A.L. & Ens, B.J. 2004. Shellfish fishery severely reduces condition and survival of oystercatchers despite creation of large marine protected areas. *Ecol. Soc*., **9**, 1, 17.

Walker, B. G., Dee Boersma, P. & Wingfield, J. C. 2006. Habituation of Adult Magellanic Penguins to Human Visitation as Expressed through Behaviour and Corticosterone Secretion. *Cons. Biol.,* **20,** 146-154.

West, A. D., Goss-Custard, J. D., Stillman, R. A., Caldow, R. W. G., Durell, S. & McGrorty, S. 2002. Predicting the impacts of disturbance on shorebird mortality using a behaviour-based model. *Biol. Cons.,* **106,** 319-328.

West, A.D., Goss-Custard, J.D., Durell, S.E.A. Le V.dit. & Stillman, R.A. 2005. Maintaining estuary quality for shorebirds: towards simple guidelines. *Biol. Cons*., **123**, 211-224.

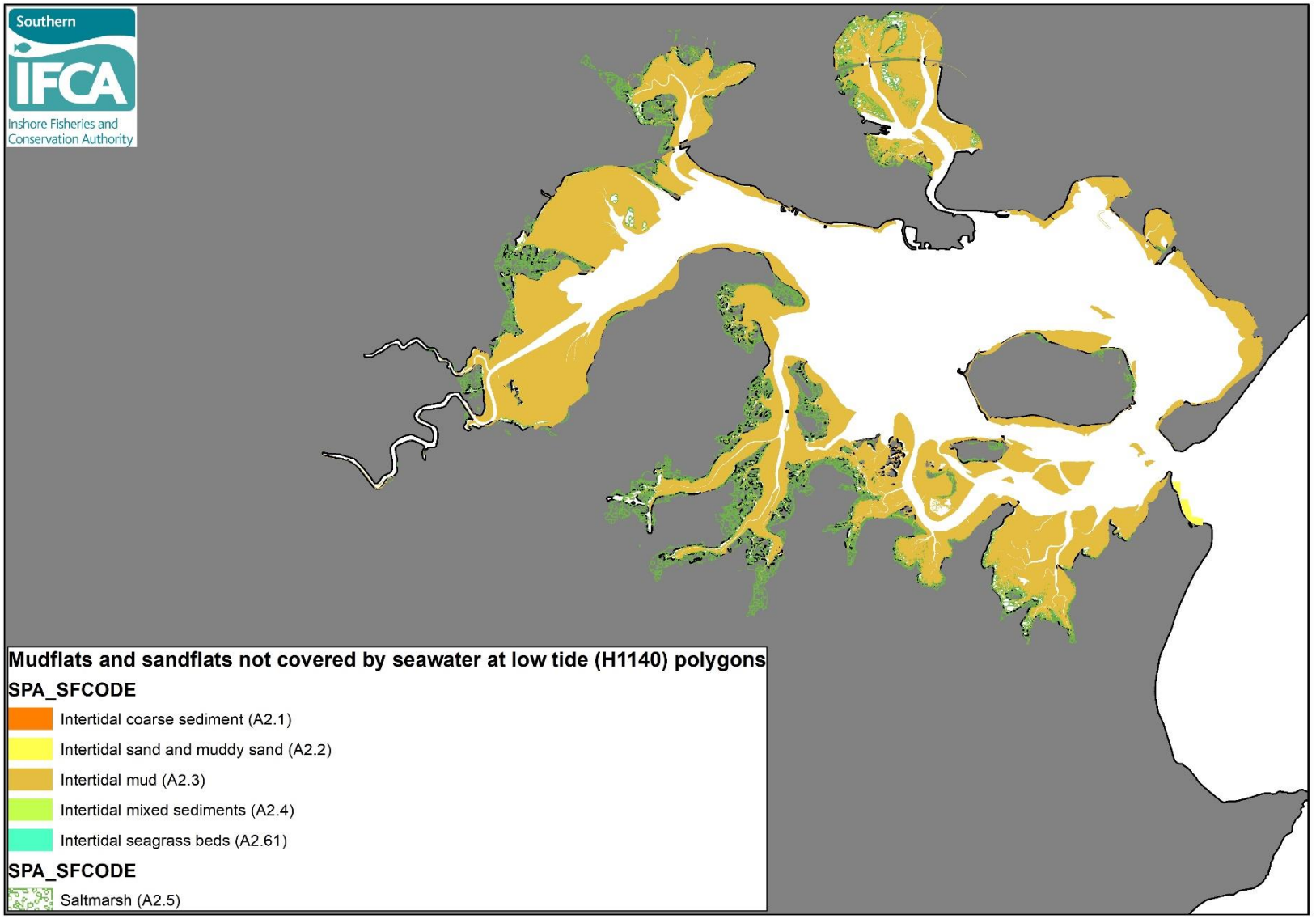
Wheeler, R., Stillman, R.A.S. & Herbert, R.J.H. 2014. Ecological impacts of clam and cockle harvesting on benthic habitats and waterfowl. Report to Natural England. Bournemouth University. 42pp.

Yasué, M. 2005. The effects of human presence, flock size and prey density on shorebird foraging rates. *J. Ethol.*, **23,** 199-204.

Zwarts, L., Cayford, J.T., Hulscher, J.B., Kersten, M. & Meire, P.M. 1996a. Prey size selection and intake rate. In Goss-Custard, J.D. (Ed). *The Oystercatcher: From Individuals to Populations*. Oxford, Oxford University Press.

Zwarts, L., Ens, B.J., Goss-Custard, J.D., Hulscher, J.B., Durell. S.E.A. le V.dit. 1996b. Causes of variation in prey profitability and its consequences for the intake rate of the oystercatcher *Haematopus ostralegus*. *Ardea*, **84a**, 229-268.

Annex 2: Supporting Habitat(s) Site Feature Map for Poole Harbour SPA



Annex 3: Poole Harbour Dredge Permit Activity Maps

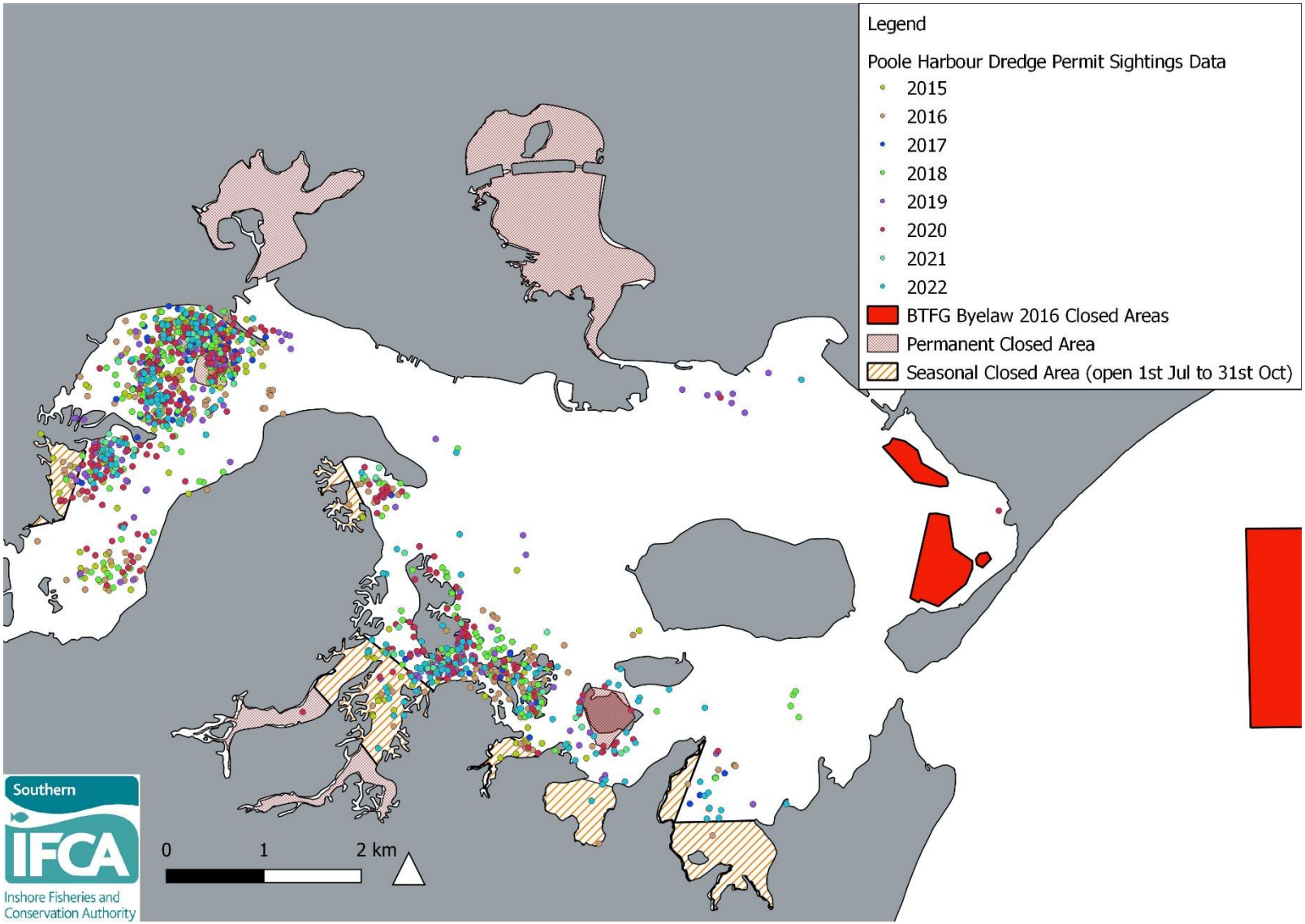


Figure A3: The map shows permit vessel sightings for the 2015/16 to 2022/23 seasons. Prohibited areas, seasonal closed areas and areas of seagrass closed under the Bottom Towed Fishing Gear Byelaw 2016 are also shown (reflects management in place as of 2022/23 season). Where vessel sightings overlap with seasonal closed areas, all sightings occurred during the period when these areas are open for fishing activity (1st July to 31st October). Note that the closed areas at Seagull Island and Green Island were not in place under permit conditions prior to the 2022/23 season.

Annex 4: Natural England's advice on the potential impacts of shellfish dredging on the nature conservation features of Poole Harbour SPA, Ramsar and SSSI.

Date:3rd June 2014

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

Natural England
Sunrise Business Park
Higher Shaftesbury Road
Blandford
DT11 8ST

Dear Rob

Poole Harbour Fishing Dredge Permit byelaw - NEs advice on the potential impacts of shellfish dredging on the nature conservation features of Poole Harbour SPA, Ramsar and SSSI

The following constitutes Natural England's formal advice as to the potential impacts of shellfish dredging on the nature conservation features of Poole Harbour.

1. Legal Requirements

Shellfish dredging 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 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).

This advice is to inform the scope of an assessment required by SIFCA to ensure that sufficient management measures are put in place through the fishing dredge permit byelaw 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 found at 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. **B**reeding 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 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) Potential impacts on 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. Although the study did not focus on the areas where shellfishing activity took place, major fights were observed to occur at Wareham channel and the frequency at which the activity was observed more widely to take place in proximity to important areas for feeding and roosting birds was deemed a concern. It cannot be dismissed therefore that shellfish dredging together with other disturbance factors are not causing 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].

Shellfish dredging activity can 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 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 shellfish dredging takes 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
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 shellfish dredging if it takes place within this habitat. The direct impact of shellfish dredging on seagrass beds is significant through uprooting shoots and cutting through shoots which immediately reduces seagrass density and biomass) (Wheeler et al, 2014). The towed gear byelaw recently introduced to prohibit towed gear over the main eelgrass beds in Poole Harbour is an important mitigation measure to avoid an impact from this activity.

Shellfish dredging if taking place in close proximity to saltmarsh roosts sites could potentially also cause erosion of this supporting non breeding habitat.

iii) 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
Mediterranean gulls nest primarily at Seagull island in the Wareham channel. Shellfish dredging if taking place in close proximity to saltmarsh nesting sites could potentially cause erosion of this supporting breeding habitat. Dyrynda (1995) considered saltmarsh to be a habitat that would be sensitive to baitdragging and similarly the habitat would likely to be sensitive to other towed gear if it takes place here. As with dragging it would be considered unlikely to take place in this habitat although this should be monitored.

[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.

Common and sandwich tern nest at Brownsea Lagoon where there is no fishing access.

iv) Breeding Population (productivity and survival)

Overall breeding productivity and adult survival is at a level which is consistent with maintaining the 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 fishing 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 shellfish dredging (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. This can be through removal (mortality) of target and non target species species and impacts on non target prey availability through changes in habitat structure of the intertidal sediment communities.

Dredging on muddy habitats has generally been found to have a greater impact on benthic communities compared to mobile sands. Dredge scars on deeper, more stable habitats appear to persist longer than more mobile intertidal habitats. Impacts on sediment disturbance are likely to be related to whether the impact takes place at a high energy site or a sheltered site, with sediment recovery slower at the latter. Most small-scale experimental studies have shown that recovery of communities following cessation of fishing can generally occur within months to a year. However the longer-term impacts of broad scale, intensive and frequent disturbances to benthic communities has not been well researched (Wheeler et al,2014)).

The length of time that harvested areas would require for recovery will be a function of the amount of natural disturbance experienced in that environment, and the timing of harvesting in relation to larval recruitment of target and non-target species (Wheeler et al 2004).

Release of sediment contaminants such as heavy metals from sediment disturbance by shellfish dredging could also impact on 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. As stated above physical damage could occur from shellfish dredging if it takes place within this habitat. The direct impact of shellfish dredging on seagrass beds is significant through uprooting shoots and cutting through shoots which immediately reduces seagrass density and biomass) (Wheeler et al, 2014) The towed gear byelaw recently introduced to prohibit towed gear over the main eelgrass beds in Poole Harbour is an important mitigation measure to avoid an impact from this activity.

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. Shellfish dredging activity 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 towed gear could potentially damage this feature if it was to take place over these channels (Dyrynda, 1995).

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*

The management plan sets out the need to manage shellfish dredging in the harbour due to the potential for this activity to displace birds from breeding, feeding & roosting grounds, possible damage to eel grass beds and subtidal habitats by dredging equipment and the detrimental effects on non target species. The importance of SIFCAs byelaws to manage this activity is highlighted as an important management measure.

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. (The Poole Harbour Aquatic Management Plan serves as Poole Harbours European Marine Site Management Scheme).

Bird Sensitive Areas

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

6. Poole Harbour Condition Assessment

SIFCA should also consider the current condition of the site when determining the significance of effect of shellfish dredging 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).

Summary

SIFCA need to take appropriate steps to manage shellfish dredging to avoid the deterioration of natural habitats and habitats of species as well as significant disturbance of the species for which the area has been classified as a SPA and a Ramsar site. Without adequate mitigation measures put in place in SIFCAs fishing dredge permit byelaw a likely significant effect on Poole Harbour Special Protection Area and Ramsar site cannot be excluded, either individually or in combination with other plans or projects. SIFCA need to consider what mitigation measures are needed to exclude this significant effect from shellfish dredging 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, Natural England is of the view that without adequate mitigation measures there would likely be damage to the interest features of the Poole Harbour SSSI from this activity and mitigation measures need to be provided in order to avoid this damage to the SSSI.

7. Potential Mitigation Measures

Natural England's advice is that to protect the SPA, Ramsar interest and SSSI, management should seek to :-

i) Provide a network of areas where there is little or no noise and visual disturbance and sediment disturbance

These areas could include a combination of spatial or temporal areas where potentially disturbing activities are excluded at key times of the year in areas vulnerable to disturbance and sediment disturbance and that are particularly important to securing the SPA and Ramsar and SSSI interests.

Vulnerable/important areas should include:-

- Bird Sensitive Areas,
- Areas where declines in some bird species have been observed eg Brands Bay, Wych and Lytchett Bay,
- Mediterranean gull nesting sites at Seagull island
- Areas where sediment recovery is likely to be slow ie low energy sites
- Fringing saltmarsh, reedbed and lowland water habitats supporting breeding birds

Appendix 5 provides key times of year where SPA, Ramsar and SSSI features may be vulnerable to an impact from cockle and clam dredging through noise/visual disturbance or impacts on prey availability through sediment disturbance.

ii) Exclude or manage intensity where high levels of sediment disturbance could result in release of contaminants eg parts of Holes Bay

iii) Manage shellfish dredging throughout the Harbour in a way that minimises its impact on prey availability and disturbance. For example through restrictions in the number of licences, the design of the pump and dredge used and restrictions in the timing of when the fishery should take place

iv) Ensure measures are taken to protect habitats (ie eelgrass and saltmarsh) and marine invertebrates (eg *Sabella pavonina*) that are potentially sensitive to damage if they are at risk of exposure to shellfish dredging

8) Summary

In summary when SIFCA decide on the management measures to be put under the permit conditions of the dredge byelaw, after consultation with the stakeholders, they will need to consider this advice, and other evidence of the potential effects of shellfish dredging on Poole Harbour SPA and Ramsar site, to ensure the proposed measures are sufficient to be able to conclude no likely significant effect either alone or in combination with other plans and projects.

The effectiveness of any management measures implemented to avoid an adverse effect on Poole Harbour SPA and Ramsar from shellfish dredging should subsequently be monitored and reviewed.

The IFCA 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).

Natural England would be happy to provide further advice on any specific management options put forward and our views as to whether sufficient measures have been put forward to ensure the nature conservation interests of the site have been adequately protected.

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

Yours sincerely

Sue Burton
Lead Marine Adviser
Dorset, Hampshire and Isle of Wight Team
07500 097405
Susan.burton@naturalengland.org.uk

References

Chown D. & Cook, K.(2004) Important Breeding Birds of Poole Harbour. Poole Harbour Study Group

Dyrynda, P. 1995. Impacts of bait dragging on the seabed within Poole Harbour. Report to Southern Sea District Fisheries Committee from the Marine Environmental Research Group, University of Wales, Swansea.

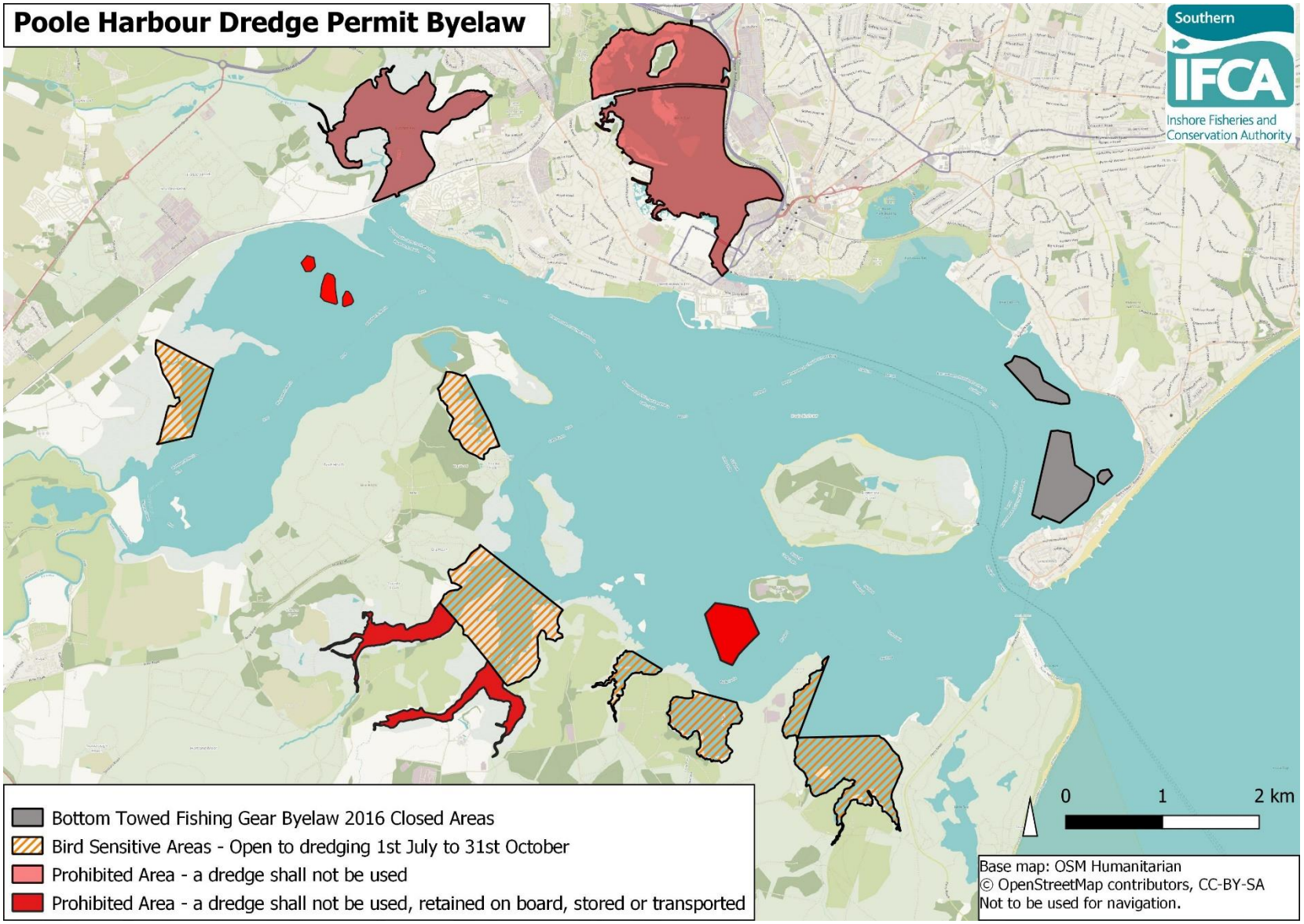
English Nature (2000) English Nature's advice given under Regulation 33(2) of the Conservation (Natural Habitats &c.) Regulations 1994

Liley, D. and Fearnley, H.(2012) Poole Harbour Disturbance Study. Report for Natural England. Footprint Ecology Ltd. Wareham, Dorset

Underhill-Day, J., Underhill-Day, N., White, J. & Gartshore, N. (2010).
Poole Harbour SSSI Condition Assessment. A report to Natural England. Wareham.

Wheeler R, Stillman R, and Herbert R. (2014) Ecological impacts of clam and cockle harvesting on benthic habitats and waterfowl. Report to Natural England. University of Bournemouth.

Annex 5: Poole Harbour Dredge Permit byelaw spatial and temporal restrictions



 SIFCA Reference: SIFCA/HRA_PP/PHDPByelaw202324

Annex 6: Poole Harbour Dredge Permit 2023/24 including permit conditions

Poole Harbour Dredge Permit

This permit authorises the named person in respect to the named vessel, for the period of validity specified below, to use, retain on board, store or transport a dredge within Poole Harbour, subject to the provisions of the Poole Harbour Dredge Permit Byelaw and to the additional conditions listed in this permit.

Vessel Authorised is: **NAME and PLN**

Permit is issued to: **Mr/Mrs X**

Permit Number: **2023-24 XXX**

Vessel length (m):

Vessel engine power (kw):

Cost of Permit: **£675.00**

Permit valid for period: **1st April 2023 – 31st March 2024**

The permit holder should ensure that they have read and understand the Southern IFCA Poole Harbour Dredge Permit byelaw and the Permit Conditions prior to fishing.

Failure to comply with any of the Permit Conditions constitutes contravention of the Poole Harbour Dredge Permit byelaw.

Permit Conditions

1. **Definitions**

1.1 In this permit:

a. “spray bar” means any object that directs a pressurised jet(s) of water;

b. “riddle” means a table with spaced bars for the sorting of shellfish;

c. “tooth bar” means the bar, to which is attached teeth, the ends of which point downwards and are dragged along the sea bed when the dredge is towed;

d. “auxiliary hydraulic equipment” shall include but is not limited to any water pump and associated hoses that are designed for, or capable of being used in connection with a shellfish dredge and any hydraulic lifting equipment, when used in connection with a shellfish dredge.

e. “interaction” means direct contact between any part of the fishing vessel or dredge, as defined in the Poole Harbour Dredge Permit byelaw, and any part of an individual listed as an Endangered, Threatened and Protected (ETP) Species; and

f. “Endangered, Threatened and Protected (ETP) Species” are those species protected by and listed under national and international legislation and listings including but not limited to The Birds Directive (2009/147/EC), The Habitats Direct (92/43/EEC), the Convention on International Trade in Endangered Species (CITES) and the Convention on the Conservation of Migratory Species of Wild Animals (CMS).

2. Catch reporting

2.1 For the months of May, June, July, August, September, October, November and December the permit holder must submit to the Authority a completed catch return using a ‘Poole Harbour Dredge Permit Monthly Catch Return Form’. Completed catch returns must be submitted either in hard copy or as an electronic PDF document and must be received by the Authority no later than the 14th day of the following month.

2.2 For each day of the month the permit holder must state in their catch return:

i. the hours spent fishing; and
ii. the quantity in kilograms of each species caught that day; *and*
iii. the number of the zone(s) in which the quantities of species caught that day have been taken according to the zonation map provided with the catch return form; *and*
iv. the name(s) of the company or individual to whom all parts of the catch was sold.

2.3 If no fishing has taken place during a day, the permit holder must declare that no catch was taken on that day by entering the word "nil" in the column for "Species caught and Quantity”.

2.4 If no fishing has taken place during a month, the permit holder must indicate this to the Southern IFCA by submitting a “nil” catch return.

2.5 If a permit holder has an interaction between their fishing activity and an Endangered, Threatened and Protected (ETP) Species, the permit holder must submit to the Authority a completed interaction form using a 'Poole Harbour Dredge Permit Byelaw Interaction between dredge fishing activity and Endangered, Threatened and Protected (ETP) Species Reporting Form'.

3. Catch Restrictions

3.1 No person shall fish for or take from Poole Harbour any Native oyster (*Ostrea edulis*).

4 Gear types

4.1 Dredge designs are restricted to a basket size not exceeding 460 mm in width by 460 mm in depth by 300 mm high excluding any pole or attachments.

5 Gear construction and restrictions

5.1 Dredges must be constructed of rigid bars having spaces of not less than 18 mm between them. Any cross pieces used to strengthen the basket must have minimum spaces of 40 mm between them.

5.2 Only one dredge is allowed to be used at any one time on each vessel.

5.3 The contents of the dredge may only be removed after the dredge has been lifted into the vessel.

5.4 A second dredge may be carried on board but it must be inboard, stowed and disconnected.

5.5 Only one pump is permitted on board any vessel and any hoses connected to the pump and/or dredge should have a diameter of no greater than a 3 inch inlet and a 3 inch diameter outlet.

5.6 The maximum horsepower of the pump is 15 (fifteen).

5.7 A maximum of one spray bar is permitted to be used per dredge and must be fixed to the dredge. When using a dredge fitted with a tooth bar any associated spray bar must direct the flow of water towards the rear of the basket and at no times directly towards the seabed.

5.8 A riddle with 18mm bar spacing is mandatory for the sorting of shellfish. Any shell discards are to be re-deposited forthwith.

6 Spatial and temporal restrictions

6.1 Closed Season

6.1.1 A dredge shall not be used, retained on board, stored or transported in any area of Poole Harbour from 1st April to 24th May 2023, both days inclusive, and from 24th December 2023 to 31st March 2024, both days inclusive.

6.2 Daily Fishing Hours

6.2.1 A dredge shall not be used in any area of Poole Harbour between 18.00 and 06.00 each day.

6.2.2 A dredge shall not be used in any area of Poole Harbour during all Sundays.

6.3 Seasonal Closure Areas

6.3.1 A dredge shall not be used, retained on board, stored or transported in the following areas from 25th May to 30th June, both days inclusive and from 1st November to 23rd December, both days inclusive, in the same year:

AREA 1 – NEWTON BAY
The area enclosed by a line drawn from:
Point 1 (50 Degrees 40.351 minutes North, 001 Degrees 59.493 minutes West) to
Point 2 (50 Degrees 40.402 minutes North, 001 Degrees 59.750 minutes West)
From point 2 along the coast at the level of mean high water spring tide to point 1

AREA 2 – OWER BAY
The area enclosed by a line drawn from:
Point 3 (50 Degrees 40.522 minutes North, 002 Degrees 00.101 minutes West) to
Point 4 (50 Degrees 40.670 minutes North, 002 Degrees 00.464 minutes West)
From point 3 along the coast at the level of mean high water spring tide to point 4

AREA 3 – WYCH LAKE AND MIDDLEBERE LAKE
The area enclosed by a line drawn from:
Point 5 (50 Degrees 41.255 minutes North, 002 Degrees 01.755 minutes West) to
Point 6 (50 Degrees 40.891 minutes North, 002 Degrees 01.030 minutes West)
From point 6 along the coast at the level of mean high water spring tide to point 7
Point 7 (50 Degrees 40.468 minutes North, 002 Degrees 01.529 minutes West) to
Point 8 (50 Degrees 40.795 minutes North, 002 Degrees 01.911 minutes West) to
Point 9 (50 Degrees 40.896 minutes North, 002 Degrees 02.157 minutes West)
From point 9 along the coast at the level of mean high water spring tide to point 5

AREA 4 – ARNE BAY
The area enclosed by a line drawn from:
Point 10 (50 Degrees 41.941 minutes North, 002 Degrees 01.651 minutes West) to
Point 11 (50 Degrees 42.204 minutes North, 002 Degrees 01.843 minutes West)
From point 11 along the coast at the level of mean high water spring tide to point 10

AREA 5 – KEYSWORTH
The area enclosed by a line drawn from:

Point 12 (50 Degrees 42.400 minutes North, 002 Degrees 04.510 minutes West) to
Point 13 (50 Degrees 42.264 minutes North, 002 Degrees 04.078 minutes West) to
Point 14 (50 Degrees 41.890 minutes North, 002 Degrees 04.259 minutes West) to
Point 15 (50 Degrees 41.842 minutes North, 002 Degrees 04.555 minutes West)
From point 15 along the coast at the level of mean high water spring tide to point 12

AREA 6 - BRANDS BAY SOUTH
The area enclosed by a line drawn from:
Point 16 (50 Degrees 40.156 minutes North, 001 Degrees 58.984 minutes West) to
Point 17 (50 Degrees 40.156 minutes North, 001 Degrees 58.249 minutes West)
From point 16 along the coast at the level of mean high water spring tide to point 17

AREA 7 – BRANDS BAY WEST
The area enclosed by a line drawn from:
Point 16 (50 Degrees 40.156 minutes North, 001 Degrees 58.984 minutes West) to
Point 18 (50 Degrees 40.610 minutes North, 001 Degrees 58.702 minutes West)
From point 18 along the coast at the level of mean high water spring tide to point 16

6.4 Closed Areas

6.4.1 A dredge shall not be used in the following areas at all times:

AREA 8 - LYCHETT BAY
The area enclosed by a line drawn from:
Point 19 (50 Degrees 43.212 minutes North, 002 Degrees 02.412 minutes West) to
Point 20 (50 Degrees 43.205 minutes North, 002 Degrees 02.439 minutes West) From point 20 along the coast at the level of mean high water spring tide to point 19

AREA 9 - HOLES BAY
The area enclosed by a line drawn from:
Point 21 (50 Degrees 42.771 minutes North, 001 Degrees 59.539 minutes West) to
Point 22 (50 Degrees 42.734 minutes North, 001 Degrees 59.591 minutes West)
From point 22 along the coast at the level of mean high water spring tide to point 21

6.4.2 A dredge shall not be used, retained on board, stored or transported in the following areas at all times:

AREA 10 – WYCH LAKE
The area enclosed by a line drawn from:
Point 7 (50 Degrees 40.468 minutes North, 002 Degrees 01.529 minutes West) to
Point 8 (50 Degrees 40.795 minutes North, 002 Degrees 01.911 minutes West)
From point 8 along the coast at the level of mean high water spring tide to point 7

AREA 11 – MIDDLEBERE LAKE
The area enclosed by a line drawn from:
Point 8 (50 Degrees 40.795 minutes North, 002 Degrees 01.911 minutes West) to
Point 9 (50 Degrees 40.896 minutes North, 002 Degrees 02.157 minutes West)
From point 9 along the coast at the level of mean high water spring tide to point 8

AREA 12 – GREEN ISLAND
The area enclosed by a line drawn from:
Point 1 (50 Degrees 40.876 minutes North, 001 Degrees 59.407 minutes West) to

Point 2 (50 Degrees 40.809 minutes North, 001 Degrees 59.357 minutes West) to
Point 3 (50 Degrees 40.739 minutes North, 001 Degrees 59.310 minutes West) to
Point 4 (50 Degrees 40.684 minutes North, 001 Degrees 59.398 minutes West) to
Point 5 (50 Degrees 40.626 minutes North, 001 Degrees 59.490 minutes West) to
Point 6 (50 Degrees 40.567 minutes North, 001 Degrees 59.550 minutes West) to
Point 7 (50 Degrees 40.580 minutes North, 001 Degrees 59.600 minutes West) to
Point 8 (50 Degrees 40.594 minutes North, 001 Degrees 59.650 minutes West) to
Point 9 (50 Degrees 40.640 minutes North, 001 Degrees 59.670 minutes West) to
Point 10 (50 Degrees 40.732 minutes North, 001 Degrees 59.724 minutes West) to
Point 11 (50 Degrees 40.852 minutes North, 001 Degrees 59.780 minutes West) to
Point 12 (50 Degrees 40.913 minutes North, 001 Degrees 59.690 minutes West) to
Point 13 (50 Degrees 40.898 minutes North, 001 Degrees 59.550 minutes West) to
Point 1.

AREA 13 – SEAGULL ISLAND NORTH

The area enclosed by a line drawn from:
Point 1 (50 Degrees 42.880 minutes North, 002 Degrees 03.233 minutes West) to
Point 2 (50 Degrees 42.869 minutes North, 002 Degrees 03.174 minutes West) to
Point 3 (50 Degrees 42.818 minutes North, 002 Degrees 03.161 minutes West) to
Point 4 (50 Degrees 42.792 minutes North, 002 Degrees 03.200 minutes West) to
Point 5 (50 Degrees 42.791 minutes North, 002 Degrees 03.249 minutes West) to
Point 6 (50 Degrees 42.839 minutes North, 002 Degrees 03.287 minutes West) to
Point 1.

AREA 14 – SEAGULL ISLAND CENTRE

The area enclosed by a line drawn from:
Point 1 (50 Degrees 42.781 minutes North, 002 Degrees 03.056 minutes West) to
Point 2 (50 Degrees 42.769 minutes North, 002 Degrees 03.005 minutes West) to
Point 3 (50 Degrees 42.749 minutes North, 002 Degrees 02.990 minutes West) to
Point 4 (50 Degrees 42.680 minutes North, 002 Degrees 02.987 minutes West) to
Point 5 (50 Degrees 42.613 minutes North, 002 Degrees 02.971 minutes West) to
Point 6 (50 Degrees 42.606 minutes North, 002 Degrees 02.986 minutes West) to
Point 7 (50 Degrees 42.626 minutes North, 002 Degrees 03.086 minutes West) to
Point 8 (50 Degrees 42.649 minutes North, 002 Degrees 03.120 minutes West) to
Point 9 (50 Degrees 42.715 minutes North, 002 Degrees 03.108 minutes West) to
Point 10 (50 Degrees 42.768 minutes North, 002 Degrees 03.079 minutes West) to
Point 1.

AREA 15 – SEAGULL ISLAND SOUTH

The area enclosed by a line drawn from:
Point 1 (50 Degrees 42.679 minutes North, 002 Degrees 02.897 minutes West) to
Point 2 (50 Degrees 42.678 minutes North, 002 Degrees 02.875 minutes West) to
Point 3 (50 Degrees 42.661 minutes North, 002 Degrees 02.853 minutes West) to
Point 4 (50 Degrees 42.628 minutes North, 002 Degrees 02.831 minutes West) to
Point 5 (50 Degrees 42.618 minutes North, 002 Degrees 02.832 minutes West) to
Point 6 (50 Degrees 42.605 minutes North, 002 Degrees 02.849 minutes West) to
Point 7 (50 Degrees 42.592 minutes North, 002 Degrees 02.911 minutes West) to
Point 8 (50 Degrees 42.599 minutes North, 002 Degrees 02.928 minutes West) to
Point 9 (50 Degrees 42.645 minutes North, 002 Degrees 02.925 minutes West) to
Point 1.

Date .....

Signed .....
Chief / Deputy Chief Officer
Southern Inshore Fisheries and Conservation Authority

Annex 7: TLSE summary for each feature (and supporting habitats)

Feature	Supporting Habitat	Pressures	Common tern	Mediterranean gull	In/Out	Relevant Attributes
Surface-feeding birds	Water column	Abrasion/disturbance of the substrate on the surface of the seabed			Out	N/A
Mediterranean gull	Saltmarsh features	Changes in suspended solids (water clarity)	S	NS	Out	N/A
Common tern	Intertidal mixed sediment (Mediterranean gull only)	Penetration and/or disturbance of the substratum below the surface of the seabed, including abrasion			Out	N/A
Sandwich tern	Intertidal mud (Mediterranean gull only)	Removal of non-target species			Out	N/A
Black-headed gull	Intertidal sand and muddy sand (Mediterranean gull only)	Removal of target species			Out	N/A
		Smothering and siltation rate changes (Light)			Out	N/A
		Visual disturbance	S	S	In	Supporting habitat: disturbance caused by human activity
		Above water noise	S	S	In	
		Collision ABOVE water with static or moving objects not naturally found in the marine environment	S	S	Out	N/A
		Collision BELOW water with static or moving objects not naturally found in the marine environment	S	S	Out	N/A
		Deoxygenation			Out	N/A
		Hydrocarbon and PAH contamination	IE	IE	Out	N/A
		Introduction of light	IE	IE	Out	N/A
		Introduction of microbial pathogens	S	S	Out	N/A
		Introduction or spread of invasive non-indigenous species	S	S	Out	N/A
		Litter	S	S	Out	N/A
		Nutrient enrichment			Out	N/A
		Organic enrichment			Out	N/A
		Physical change (to another sediment type)			Out	N/A
		Synthetic compound contamination (incl. pesticides, antifoulants, pharmaceuticals)	IE	IE	Out	N/A

		Transition elements and organo-metal (e.g. TBT) contamination	IE	IE		Out	N/A
		Underwater noise changes	IE	IE		Out	N/A

Feature	Supporting Habitat	Pressures	Pied avocet	Black-tailed godwit	Shelduck	In/Out	Relevant Attributes
Estuarine birds	Water column	Abrasion/disturbance of the substrate on the surface of the seabed				Out	N/A
Pied avocet	Saltmarsh features	Changes in suspended solids (water clarity)				Out	N/A
Little egret	Intertidal mixed sediment	Penetration and/or disturbance of the substratum below the surface of the seabed, including abrasion				Out	N/A
Eurasian spoonbill	Intertidal mud	Removal of non-target species				Out	N/A
Shelduck	Intertidal sand and muddy sand	Removal of target species				Out	N/A
Black-tailed godwit		Smothering and siltation rate changes (Light)				Out	N/A
Dunlin		Visual disturbance	S	S	S	In	Supporting habitat: disturbance causd by human activity
Dark-bellied Brent goose		Above water noise	S	S	S	In	
Teal		Collision ABOVE water with static or moving objects not naturally found in the marine environment	S	S	S	Out	N/A
Goldeneye		Collision BELOW water with static or moving objects not naturally found in the marine environment				Out	N/A
Red-breasted merganser		Deoxygenation				Out	N/A
Curlew		Hydrocarbon and PAH contamination	IE	IE	IE	Out	N/A
Spotted redshank		Introduction of light	S	S	S	Out	N/A
Greenshank		Introduction of microbial pathogens	S	S	S	Out	N/A
Redshank		Introduction or spread of invasive non-indigenous species	NS	S	S	Out	N/A
Pochard		Litter	IE	IE	IE	Out	N/A
		Nutrient enrichment				Out	N/A
		Organic enrichment				Out	N/A

		Physical change (to another sediment type)				Out	N/A
		Synthetic compound contamination (incl. pesticides, antifoulants, pharmaceuticals)	IE	IE	IE	Out	N/A
		Transition elements and organo-metal (e.g. TBT) contamination	S	S	S	Out	N/A
		Underwater noise changes			IE	Out	N/A

Feature	**Supporting Habitat**	Pressures	Med. & thermo-Atl. Halophilous scrub	Atlantic salt meadows	Spartina swards	In/Out	Relevant Attributes
Surface feeding birds Estuarine birds	Meditteranean and thermo-Atlantic halophilous scrubs Atlantic salt meadows Spartina swards	Abrasion/disturbance of the substrate on the surface of the seabed				Out	N/A
		Changes in suspended solids (water clarity)				Out	N/A
		Penetration and/or disturbance of the substratum below the surface of the seabed, including abrasion				Out	N/A
		Removal of non-target species				Out	N/A
		Removal of target species				Out	N/A
		Smothering and siltation rate changes (Light)				Out	N/A
		Visual disturbance				Out	N/A
		Above water noise				Out	N/A
		Collision ABOVE water with static or moving objects not naturally found in the marine environment				Out	N/A
		Collision BELOW water with static or moving objects not naturally found in the marine environment				Out	N/A
		Deoxygenation		NS	NS	Out	N/A
		Hydrocarbon and PAH contamination		NS	NS	Out	NN
		Introduction of light				Out	N/A
		Introduction of microbial pathogens				Out	N/A
		Introduction or spread of invasive non-indigenous species				Out	N/A
		Litter		IE	IE	Out	N/A
		Nutrient enrichment		NS	NS	Out	N/A

-		Organic enrichment		S	S	Out	N/A
		Physical change (to another sediment type)			S	In	Supporting habitat: extent and distribution of supporting non-breeding habitat; Supporting habitat: extent and distribution of supporting habitat for the breeding season
		Synthetic compound contamination (incl. pesticides, antifoulants, pharmaceuticals)		NS	NS	Out	N/A
		Transition elements and organo-metal (e.g. TBT) contamination		NS	NS	Out	N/A
		Underwater noise changes				Out	N/A

Feature	Supporting Habitat	Pressures	Intertidal mixed sediments	In/Out	Relevant Attributes
Surface feeding birds Estuarine birds	Intertidal mixed sediments	Abrasion/disturbance of the substrate on the surface of the seabed	S	In	No relevant attributes.
		Changes in suspended solids (water clarity)	S	Out	N/A
		Penetration and/or disturbance of the substratum below the surface of the seabed, including abrasion	S	In	No relevant attributes.
		Removal of non-target species	S	In	Supporting habitat: food availability within supporting habitat (avocet); Supporting habitat: food availability within the intertidal (Black-tailed godwit; Shelduck)
-		Removal of target species	NA	Out	N/A
-		Smothering and siltation rate changes (Light)	S	Out	N/A

		Visual disturbance		Out	N/A
		Above water noise		Out	N/A
		Collision ABOVE water with static or moving objects not naturally found in the marine environment		Out	N/A
		Collision BELOW water with static or moving objects not naturally found in the marine environment		Out	N/A
		Deoxygenation	S	Out	N/A
		Hydrocarbon and PAH contamination	NS	Out	N/A
		Introduction of light	IE	Out	N/A
		Introduction of microbial pathogens	S	Out	N/A
		Introduction or spread of invasive non-indigenous species	S	Out	N/A
		Litter	NA	Out	N/A
		Nutrient enrichment	NS	Out	N/A
		Organic enrichment	NS	Out	N/A
		Physical change (to another sediment type)	S	Out	N/A
		Synthetic compound contamination (incl. pesticides, antifoulants, pharmaceuticals)	NS	Out	N/A
		Transition elements and organo-metal (e.g. TBT) contamination	NS	Out	N/A
		Underwater noise changes		Out	N/A
Feature	Supporting Habitat	Pressures	Intertidal mud	In/Out	Relevant Attributes
Surface feeding birds Estuarine birds	Intertidal mud	Abrasion/disturbance of the substrate on the surface of the seabed	S	In	No relevant attributes.
		Changes in suspended solids (water clarity)	S	Out	N/A
		Penetration and/or disturbance of the substratum below the surface of the seabed, including abrasion	S	In	No relevant attributes.

		Removal of non-target species	S	In	Supporting habitat: food availability within supporting habitat (avocet); Supporting habitat: food availability within the intertidal (Black-tailed godwit; Shelduck)
		Removal of target species	NA	Out	N/A
		Smothering and siltation rate changes (Light)	S	Out	N/A
		Visual disturbance		Out	N/A
		Above water noise		Out	N/A
		Collision ABOVE water with static or moving objects not naturally found in the marine environment		Out	N/A
		Collision BELOW water with static or moving objects not naturally found in the marine environment		Out	N/A
		Deoxygenation	NS	Out	N/A
		Hydrocarbon and PAH contamination	NS	Out	N/A
		Introduction of light	NS	Out	N/A
		Introduction of microbial pathogens	S	Out	N/A
		Introduction or spread of invasive non-indigenous species	S	Out	N/A
		Litter	NA	Out	N/A
		Nutrient enrichment	NS	Out	N/A
		Organic enrichment	NS	Out	N/A
		Physical change (to another sediment type)	S	Out	N/A
		Synthetic compound contamination (incl. pesticides, antifoulants, pharmaceuticals)	NS	Out	N/A
		Transition elements and organo-metal (e.g. TBT) contamination	NS	Out	N/A
		Underwater noise changes		Out	N/A
Feature	Supporting Habitat	Pressures	Intertidal mud and muddy sand	In/Out	Relevant Attributes

Surface feeding birds Estuarine birds	Intertidal mud and muddy sand	Abrasion/disturbance of the substrate on the surface of the seabed	S	In	No relevant attributes.
		Changes in suspended solids (water clarity)	S	Out	N/A
		Penetration and/or disturbance of the substratum below the surface of the seabed, including abrasion	S	In	No relevant attributes.
		Removal of non-target species	S	In	Supporting habitat: food availability within supporting habitat (avocet); Supporting habitat: food availability within the intertidal (Black-tailed godwit; Shelduck)
		Removal of target species	NA	Out	N/A
		Smothering and siltation rate changes (Light)	S	Out	N/A
		Visual disturbance	NA	Out	N/A
		Above water noise		Out	N/A
		Collision ABOVE water with static or moving objects not naturally found in the marine environment		Out	N/A
		Collision BELOW water with static or moving objects not naturally found in the marine environment		Out	N/A
		Deoxygenation	S	Out	N/A
		Hydrocarbon and PAH contamination	NS	Out	N/A
		Introduction of light	S	Out	N/A
		Introduction of microbial pathogens	S	Out	N/A
		Introduction or spread of invasive non-indigenous species	S	Out	N/A
		Litter	NA	Out	N/A
		Nutrient enrichment	NS	Out	N/A
		Organic enrichment	NS	Out	N/A
		Physical change (to another sediment type)	S	Out	N/A
		Synthetic compound contamination (incl. pesticides, antifoulants, pharmaceuticals)	NS	Out	N/A

		Transition elements and organo-metal (e.g. TBT) contamination	NS	Out	N/A
		Underwater noise changes		Out	N/A

Advice on Operations Sensitivity Key

SENSITIVITY CATEGORY DESCRIPTION	INTERACTION TYPE	
	DIRECT[1]	INDIRECT[2]
SENSITIVE: The evidence base suggests the feature is sensitive to the pressure at the benchmark. This activity-pressure-feature combination should therefore be taken to further assessment.	S	S*
INSUFFICIENT EVIDENCE TO ASSESS: The evidence base is not considered to be developed enough for assessments to be made of sensitivity at the pressure benchmark. This activity-pressure-feature combination should therefore be taken to further assessment. The best available evidence, relevant to the activity in question, at the time of application, should be sourced and considered in any further assessment.	IE	IE*
NOT ASSESSED: A sensitivity assessment has not been made for this feature to this pressure. However, this activity-pressure-feature combination should not be precluded from consideration. The best available evidence, relevant to the activity in question, at the time of application, should be sourced and considered in any further assessment.	NA	NA*

NOT SENSITIVE AT THE BENCHMARK: The evidence base suggests the feature is not sensitive to the pressure at the benchmark. However, this activity-pressure-feature combination should not be precluded from consideration (e.g. thought needs to be given to activity specific variations in pressure intensity and exposure, in-combination and indirect effects). The best available evidence, relevant to the activity in question, at the time of application, should be sourced and considered in any further assessment.	NS	NS*
NOT RELEVANT: The evidence base suggests that there is no interaction of concern between the pressure and the feature OR the activity and the feature could not interact		

[1] *An activity which exerts pressures that interact with a feature within the spatial and/or temporal footprint of the operation*
[2] *An activity which exerts pressures that interact with a feature not associated with the immediate spatial and/or temporal footprint of the operation*

Risk Profile of Pressures Key

RISK CATEGORY	RECOMMENDATION
High to Medium Risk	Pressure is commonly induced by activity at a level that needs to be considered further as part of an assessment
Low Risk	Unless there are evidence based case or site-specific factors that increase the risk, or uncertainty on the level of pressure on a receptor, this pressure generally does not occur at a level of concern and should not require consideration as part of an assessment.

Annex 8: Co-Location of Shellfish Dredging and Site Feature(s)/Sub-feature(s)

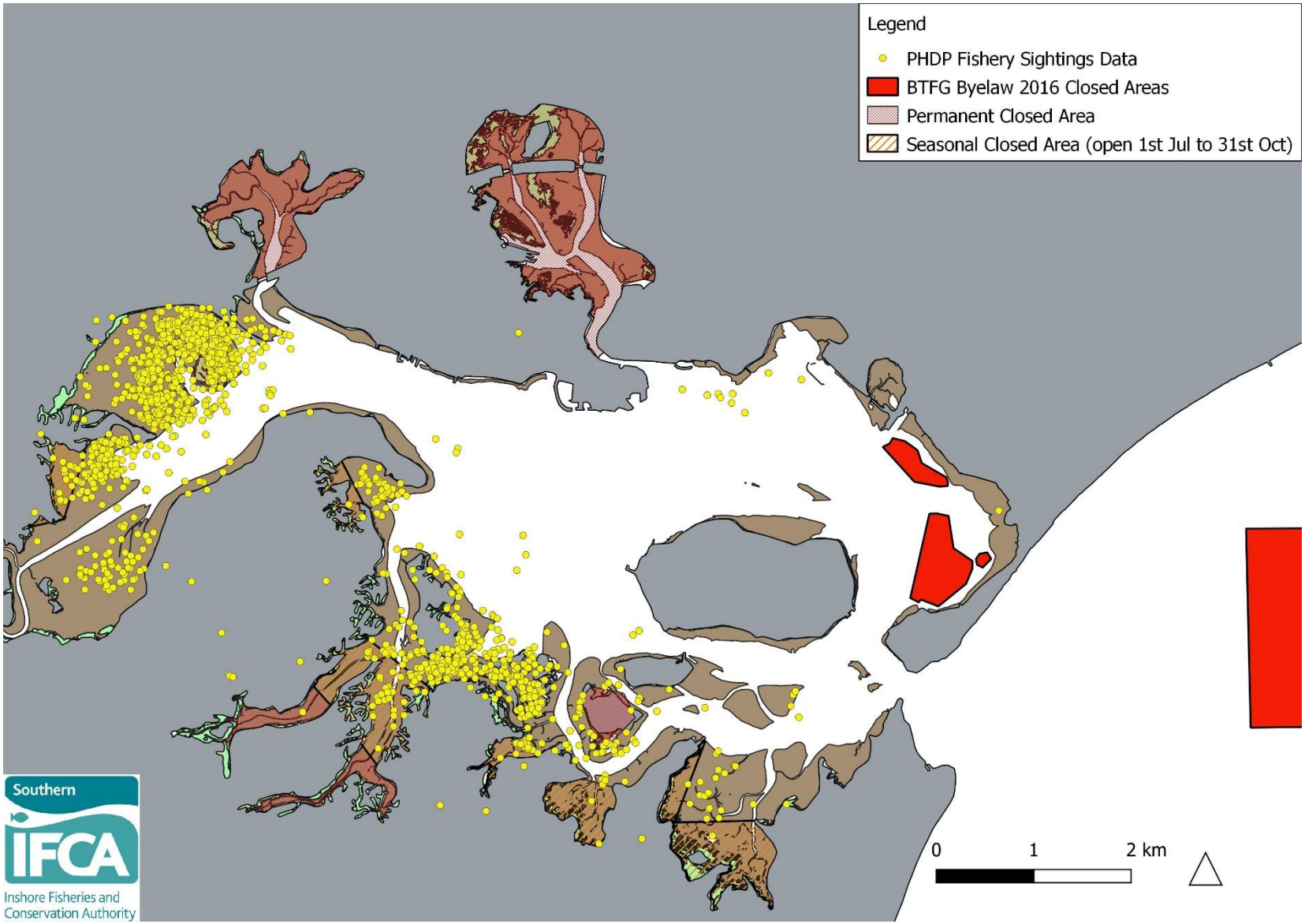


Figure A8: The map shows permit vessel sightings for the 2015/16 to 2022/23 seasons. Prohibited areas, seasonal closed areas and areas of seagrass closed under the Bottom Towed Fishing Gear Byelaw 2016 are also shown (reflects management in place as of 2022/23 season) as well as layers showing supporting habitats for the SPA. Where vessel sightings overlap with seasonal closed areas, all sightings occurred during the period when these areas are open for fishing activity (1st July to 31st October). Note that the closed areas at Seagull Island and Green Island were not in place under permit conditions prior to the 2022/23 season.

Annex 9: Table of studies investigating the impacts of shellfish dredging and recovery rates.

Study	Location and Exposure	Gear Type and Target Species	Sediment Type	Recovery Period	Species-Specific Recovery
Ferns, P.N., Rostron, D.M. & Sima, H.Y. 2000. Effects of mechanical cockle harvesting on intertidal communities. *Journal of Applied Ecology*, 37, 464-474.	Burry Inlet, South Wales	Tractor-towed cockle harvester Common cockle -*Cerastoderma edule*	Intertidal clean sand and muddy sand	Recovery was considered with invertebrate sampling conducted 15 and 86 days after harvesting in both sediment types and 174 days in muddy sand only. Unfortunately sampling was not continued long enough to determine how long invertebrate communities took to recover. Movement of adults or passive transport as a result of sediment movements, was sufficient to allow recovery of modest invertebrate populations in clean sand, but inadequate to allow recovery of large populations in muddy sand. See species-specific recovery.	Muddy sand: *Pygospio elegans* - >174 days *Hydrobia ulvae* - >174 days *Nephtys hombergii* – 51 days *Bathyporeia pilosa* – 51 days *Lanice conchilega* – 0 days *Corophium arenarium* – 0 days *Macoma balthica* - >86 days Cerastoderma edule - >174 days *Pygospio elegans* - >86 days *Crangon creangon* - >86 days *Retusa obtusa* - >86 days Clean sand: *Bathyporeia pilosa* – 39 days *Macoma balthica* - <86 days Cerastoderma edule – 0 days

					Pygospio elegans - >86 days *Nephtys homergii* - <86 days *Carcinus maenas* - <86 days
Kaiser, M.J., Edwards, B. & Spencer, B.E. 1996. Infaunal community changes as a result of commercial clam cultivation and harvesting. *Aquatic Living Resources*, 9, 57-63.	Whitestable, Kent, south-east England	Suction dredge Manila clam – *Tapes philippinarum*	Clay interspersed with patches of shell debris and lignin deposits (from local paper mill) overlaid with fine sand and silt. Exposed to prevailing north easterly winds.	Seven months after harvesting, no significant differences in infaunal communities were found between the harvested clam lay and either of the control sites (near and far). After seven months, sediment fractions in the harvested plot did not significantly differ from the sediment in control areas, as sedimentation had nearly restored sediment structure.	*Nephtys hombergii* contributed to the most similarity between samples taken from the clam lay 7 months after harvesting and was also dominant in control areas.
Hall, S.J. & Harding, M.J.C. 1997. Physical disturbance and marine benthic communities: the effects of mechanical harvesting of cockles on non-target benthic	Auchencairn Bay, Solway Firth, Dumfries, Scotland	Suction dredge & tractor dredge Common cockle – *Cerastoderma edule*	Sediments generally become coarser in the centre of the bay and low water mark (median diameter = 3.5ø, 88μm) (near to the study area). Silt/clay fraction	Suction dredge – statistically significant effects were present, but overall faunal structure in distributed plots recovered after 56 days. This occurred against a background of seasonal response.	Suction dredge - significant treatment (disturbed versus undisturbed) effects were reported for *Pygospio elegans* and *Cerastoderma edule*. There were also a significant time effect and significant time-treatment interaction for *Pygospio elegans*.

infauna. *Journal of Applied Ecology*, 34, 497-517.			(<62.5 μm) ranges from 25 to 60% in the centre.	Tractor dredge – no statistically significant effects on total abundance and number of species and overall faunal structure in distributed plots recovered after 56 days. This occurred against a background of general seasonal decline.	Tractor dredge – mean abundance of *P. elegans* remained higher in the undisturbed treatment until day 56. No significant treatment effect occurred for any species but a significant time treatment occurred for *P. elegans*, *Nepthys* sp. and *C. edule*, with a significant time treatment interaction for *P. elegans*.
Spencer, B.E., Kaiser, M.J. & Edwards, D.B. 1998. Intertidal clam harvesting: benthic community change and recovery. *Aquaculture Research*, 29, 429-437.	River Exe, England (see Spencer *et al*., 1996; 1997)	Suction dredge Manila clam – *Tapes philippinarum*	Unknown – study refers to stable sediment and protection from onshore winds by a sand dune bar.	Recovery of sediment structure and invertebrate infaunal communities occurred 12 months after harvesting. Four months after harvesting, significant differences between the harvested plot, previously net-covered plot and control plot were detectable (67% similarity between treatments), although there were indication of recruitment or migration. Eight months after harvesting, similarity between treatments increased to 85%, however significant	*Pygospio elegans* abundance was greater in the harvested plot than any other four months after harvesting, whilst *Nephtys hombergii* abundance remained lower.

				differences were still apparent between treatment and control plots (excluding previously net-covered plot and the harvested plot). Trenches (10 cm deep) left by suction dredging were infilled within 2 to 3 months.	
Peterson, C.H., Summerson, H.C. & Fegley, S.R. 1987. Ecological consequences of mechanical harvesting of clams. *Fishery Bulletin*, 85, 2, 281-298.	Back Sound, North Carolina, USA	'Clam kicking' – mechanical form of clam harvest involving the modification of boat engines to direct propeller wash downwards to suspend bottom sediments and clams into a plume and collected in a trawl net towed behind the boat. American hard shell clam - *Mercencaria mercenaria*	Seagrass bed and sandflat	Monitored the impact of different intensities of clam kicking, as well as clam raking, for up to four years. Clam harvesting had no impact on the density or species composition of small benthic macroinvertebrates, largely made up of polychaetes. The study concluded that polychaetes recover rapidly from disturbance and as such the communities are unlikely to be adversely affected by clam harvesting.	-

Annex 10: Southern IFCA's Poole Harbour Roosting Sites Code of Practice

Poole Harbour Saltmarsh Protection Code of Practice

Within Poole Harbour, to prevent disturbance to breeding and roosting birds and to protect their supporting habitat, **no person should fish using a dredge within 10 metres of saltmarsh**, as mapped in figures 1 and 2.

EXPLANATORY NOTE

This Code of Practice (CoP) aims to avoid disturbance to breeding and roosting bird species and promote protection of supporting habitat within specific areas of Poole Harbour. Saltmarsh is a supporting habitat of the Poole Harbour Special Protection Area and is identified as being at risk. Dredge fishing over saltmarsh will likely lead to the erosion of this habitat. The Authority has a duty under the Conservation of Habitats and Species Regulations 2019, to ensure that fishing activity does not disturb or have an adverse effect on the wildlife for which a site in the National Site Network is legally protected. This CoP was developed as a first alternative to statutory measures. Where there is evidence of immediate risk to the habitat, statutory measures, in the form of Poole Harbour Dredge Permit Conditions, have been developed to protect areas of saltmarsh around Green Island and Seagull Island. This CoP will be reviewed at least annually and, should the CoP prove ineffective, Southern IFCA will consider the introduction of statutory measures. To further reduce the risk of disturbance to bird species, fishers are advised to avoid these areas of saltmarsh between fishing activities and to avoid the use of excessive noise when close by.

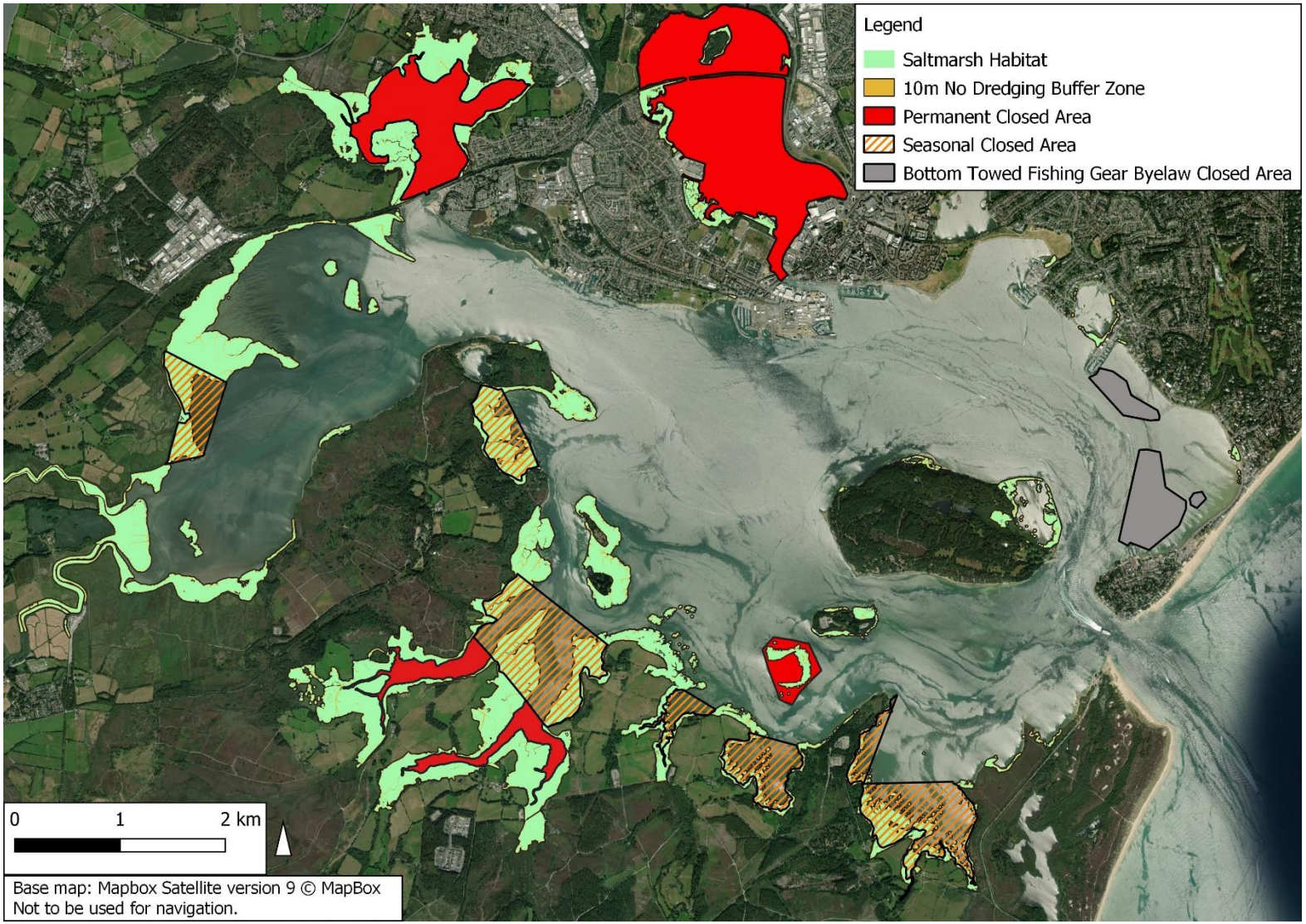
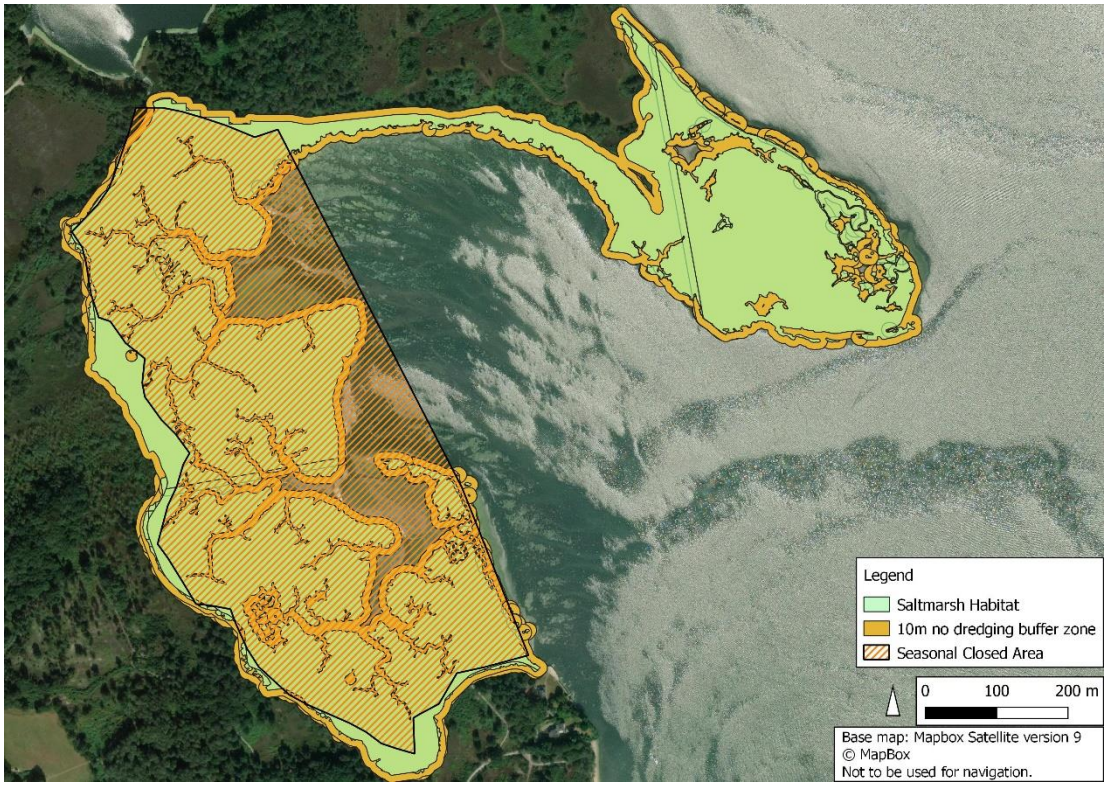


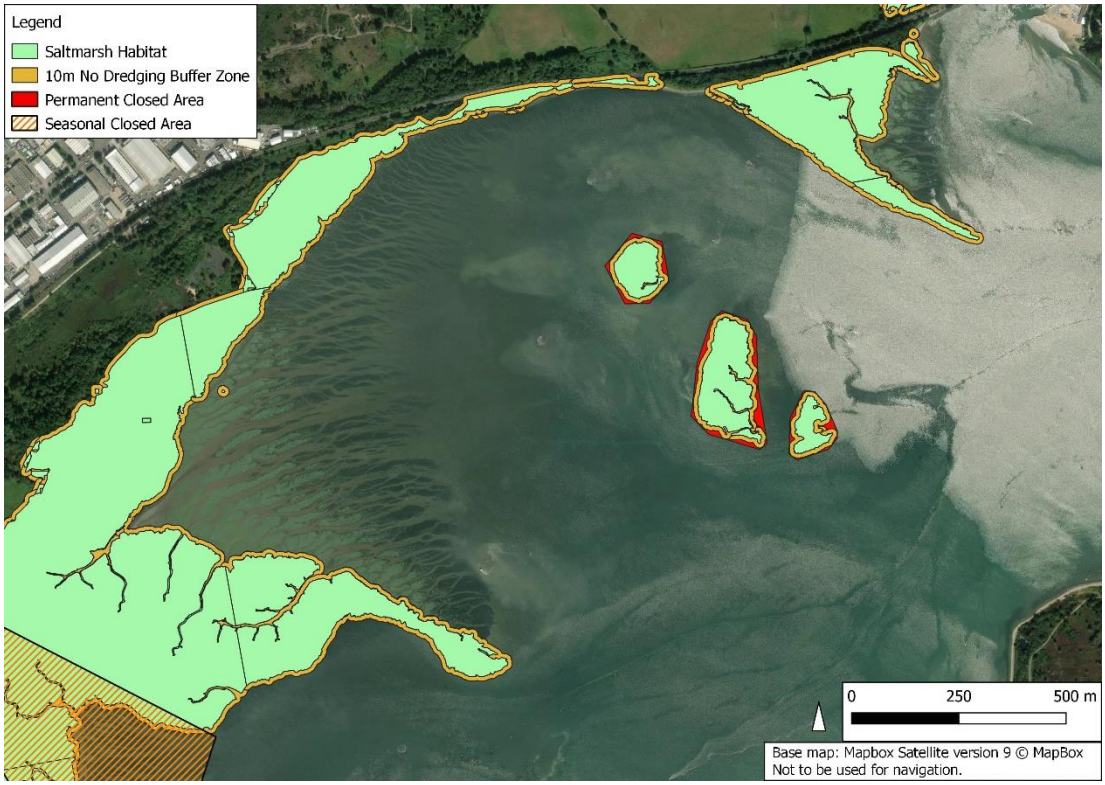
Figure 1: Saltmarsh in Poole Harbour with a 10m buffer zone, also shown are regulations under the Poole Harbour Dredge Permit and the Bottom Towed Fishing Gear Byelaw 2016.

Figure 2: Key areas where saltmarsh habitat is found in Poole Harbour and the 10m no dredging zone. Note that this 10m no dredging zone applies to all saltmarsh in Poole Harbour, the following maps are provided to aid fishermen in areas where fishing activity occurs in proximity to saltmarsh areas

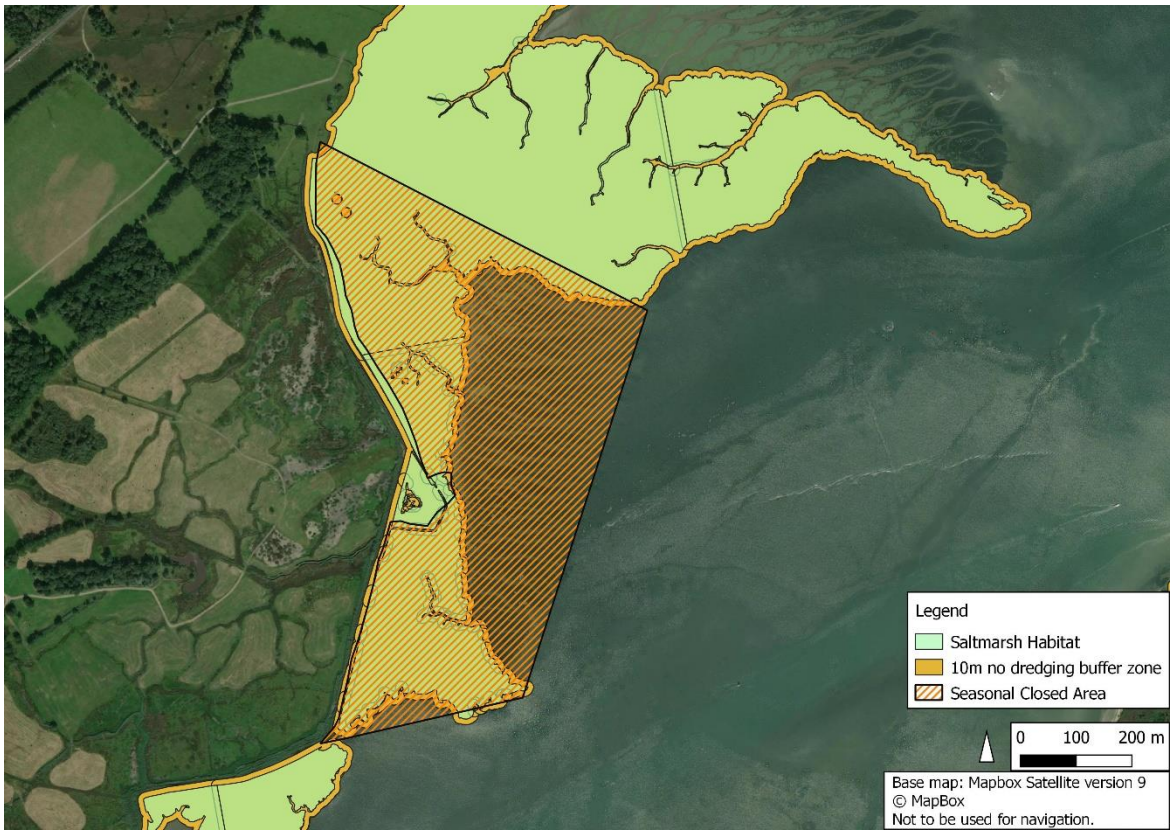
Arne Bay



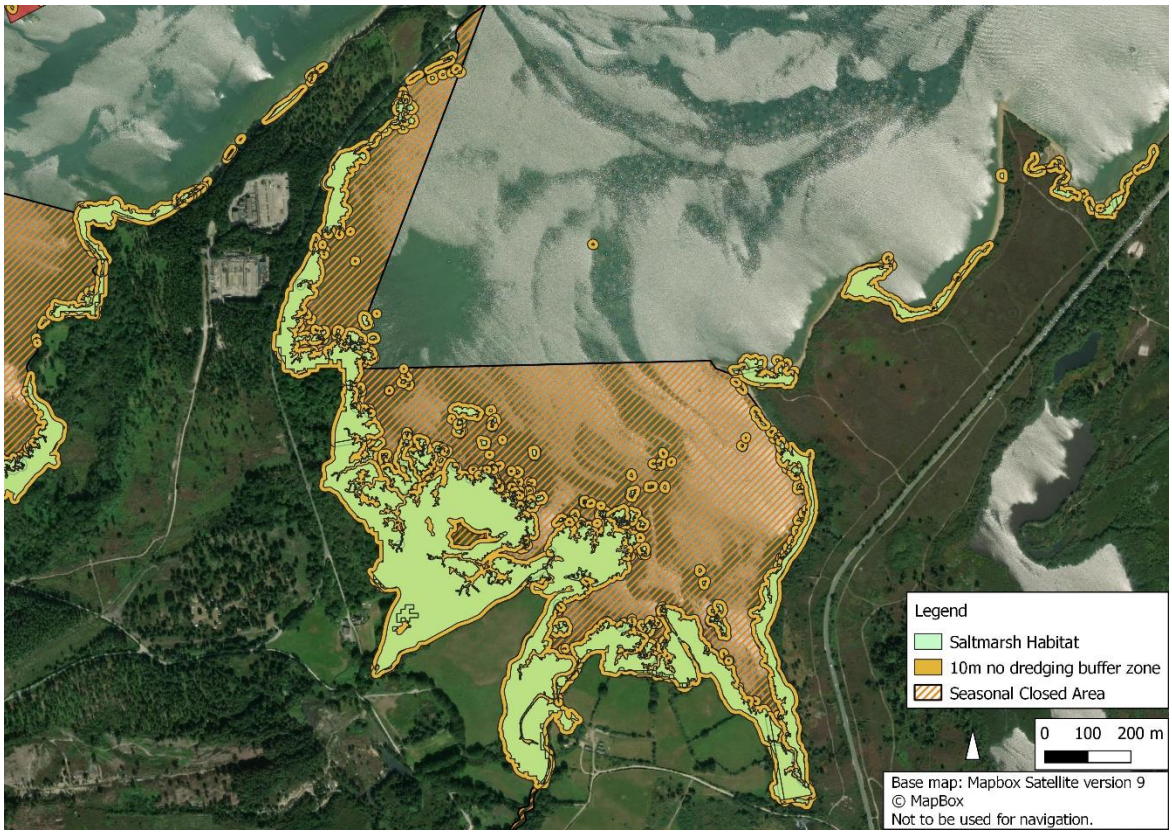
Holton Mere



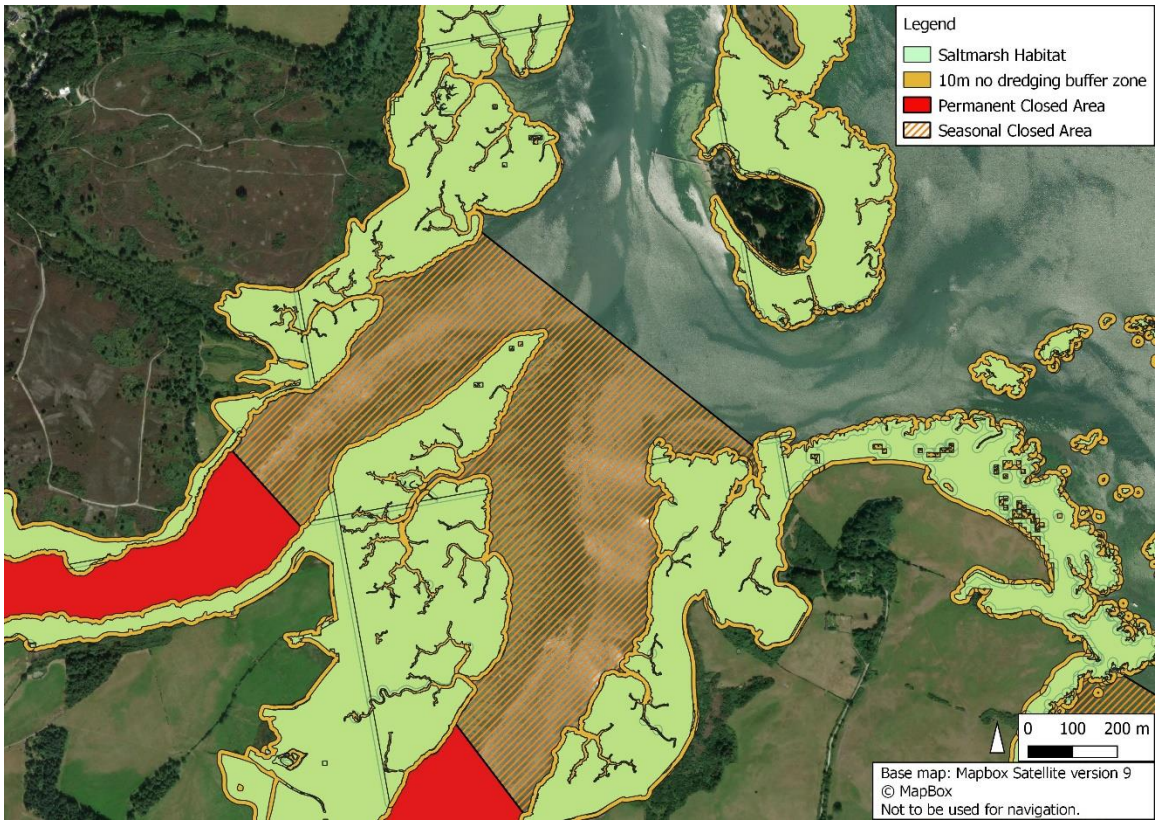
Keysworth



Brands Bay



Wych Lake and Middlebere Lake



The Wards