Chichester and Langstone Harbours SPA, Portsmouth Harbour SPA and Solent and Southampton Water SPA – Appropriate Assessment – Solent Dredge Permit Byelaw

Title: Chichester and Langstone Harbours SPA, Portsmouth Harbour SPA and Solent and Southampton Water SPA – Appropriate Assessment – Solent Dredge Permit Byelaw

SIFCA Reference: SIFCA/HRA_PP/SDPByelaw2018

Author: C Smith

Approver: Southern IFCA

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Southern Inshore Fisheries and Conservation Authority (IFCA)

Habitat Regulations Assessment for Plans/Projects

European Marine Site:
Chichester and Langstone Harbours SPA (UK9011011)
Portsmouth Harbour SPA (UK9011051)
Solent and Southampton Water SPA (UK9011061)

Features(s): Non-breeding internationally and nationally important populations of migratory and waterbird assemblage bird species. (Bar-tailed godwit, Black-Tailed Godwit, Curlew, Dark-bellied Brent goose, Dunlin, Grey plover, Pintail, Red-breasted merganser, Redshank, Ringed plover, Sanderling, Shelduck, Shoveler, Teal, Turnstone, Wigeon, Little egret\(^1\))

Supporting Habitats(s): Intertidal coarse sediment, Intertidal mixed sediments, Intertidal mud and Intertidal sand and muddy sand

\(^1\) Little egret is not yet a qualifying feature of Chichester and Langstone Harbours SPA. It has been included within the assessment process however as it was included within the 2001 SPA Review which was published by the Joint Nature Conservation Committee (JNCC).
Technical Summary

Duties under Regulation 63 of the Conservation of Habitats and Species Regulations 2017 require Southern IFCA, as a competent Authority, to make an appropriate assessment of a plan or project likely to have a significant effect on a European site (either alone or in combination with other plans or projects). As such, Southern IFCA must undertake an Appropriate Assessment for the introduction of the Solent Dredge Permit Byelaw. This byelaw will regulate the wild shellfish fishery within the Solent, including Southampton Water, Portsmouth Harbour and Langstone Harbour, through the allocation of permit entitlements. The permit will allow the use of a dredge by means of a relevant fishing vessel and under each permit (Category A Permit, Category B Permit) a number of conditions will be applied. The purpose of this assessment is to determine, whether or not in the view of Southern IFCA, the introduction of the Solent Dredge Permit Byelaw will hinder the achievement of the conservation objectives of the Chichester and Langstone Harbour, Portsmouth Harbour and Solent and Southampton Water SPAs and lead to an adverse effect on site integrity.

A review of research into shellfish dredging impacts identifies that the permitted activity has potential to lead to the abrasion, penetration or disturbance of the seabed, removal of target and non-target species, visual disturbance and smothering, siltation and suspended sediment changes. These potential impacts and risks to the integrity of the site will however be mitigated against a number of conditions applied under the permit. These include an 8-month close season for shellfish dredging throughout the Solent during the spring, summer and autumn months, from 1st March until 31st October inclusive. This closed season allows for the recovery of infaunal habitats and maintains the structure of intertidal and subtidal habitats during a period of highest biological activity, and thus allowing for the quickest possible recovery. Fishing effort is further restricted during the fishing season through a diurnal closure (commencing at 18:00 and ending at 06:00 the following day), whilst also aiding compliance. Both these permit conditions were previously applied through existing byelaws: Solent Dredge Fishing Byelaw and Oyster Close Season Byelaw.

By incorporating existing byelaws into one umbrella permit byelaw, it allows for the adaptive management of these fisheries, providing Southern IFCA with the ability 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 (following an appropriate review procedure), after the permits have been issued. Additional mitigation is provided by the Bottom Towed Fishing Gear 2016 Byelaw through a network of permanent bottom towed fishing gear closure areas which protect sensitive habitats, including low energy sedimentary habitats and saltmarsh. The network of closure areas covers approximately 95.4 km² and equates to approximately 33.9% of the Solent Maritime SAC which includes most of the Solent and Southampton Water and Chichester and Langstone Harbours SPA.

Based on these mitigation measures, in the form of permit conditions (previously applied through existing byelaws) and network of permanent bottom towed fishing gear closures, it was concluded that the introduction of the Solent Dredge Permit Byelaw will not hinder the site from achieving its conservation objectives and as such will not have an adverse effect upon the integrity of the Chichester and Langstone Harbour SPA, Portsmouth Harbour SPA or Solent and Southampton Water SPA.
Table of Contents

Technical Summary ................................................................. 3
1 Introduction .............................................................................. 86
  1.1 Need for a Habitats Regulations Assessment (HRA) .................. 86
  1.2 Management Scheme ........................................................ 86
2 Documents reviewed to inform this assessment .......................... 92
  3.1 Information about the EMSs .................................................. 92
  3.1.1 Chichester and Langstone Harbours SPA .......................... 102
  3.1.2 Portsmouth Harbour SPA ............................................. 108
  3.1.3 Solent and Southampton Water SPA ................................ 119
  3.2 Conservation Objectives .................................................... 119
4 Plan/Project Description ......................................................... 1240
  4.1 Solent Dredge Permit Byelaw .............................................. 1240
    4.1.1 3.1.2, Solent Dredge Permit Access Policy ......................... 1543
  4.2 Technical Gear Specifications ............................................. 1543
    4.2.1 Clam & Cockle Dredging ........................................... 1543
    4.2.2 Oyster dredging ........................................................ 1634
5 Location, Effort and Scale of Fishing Activities ......................... 1745
  5.1 Clam Dredging ............................................................... 1745
  5.2 Oyster Dredging .............................................................. 2042
6 Test of Likely Significant Effect (TLSE) ................................. 2421
7 Appropriate Assessment ........................................................ 2522
  7.1 Co-location of Fishing Activity and Site Features/Supporting habitat(s) .................. 2522
  7.2 Potential Impacts on Birds and Supporting Habitats ................ 2926
    7.2.1 Abrasion/disturbance of the substrate on the surface of the seabed; Penetration and/or disturbance of the substratum below the surface of the seabed, including abrasion 3027
    7.2.2 Removal of non-target species ....................................... 3220
    7.2.3 Removal of target species ............................................ 3633
    7.2.4 Smothering and sediment rate changes; Changes in suspended solids ........................................ 3633
    7.2.5 Changes in prey availability ........................................... 3633
    7.2.6 Visual Disturbance ...................................................... 4441
  7.3 Feature-Specific Seasonality Table .................................... 5046
  7.4 Site Condition ............................................................... 5249
    7.4.1 Condition Assessments ................................................ 5349
    7.4.2 Population Trends ....................................................... 6064
  7.5 Existing Management Measures ....................................... 6257
    7.5.1 Southern IFCA .......................................................... 6257
    7.5.2 Sussex IFCA .............................................................. 6466
  7.6 Classification of Shellfish .................................................. 6558
  7.7 Monitoring .................................................................... 6660
    7.7.1 Solent oyster stock survey ........................................... 6660
    7.7.2 Solent bivalve stock survey ........................................... 6660
  7.8 Table 11, Summary of Impacts ......................................... 6862
8 Conclusion ................................................................... 149443
9 In-combination assessment ................................................... 151446

SIFCA Reference: SIFCA/HRA/_PPSDPByelaw2018
Annex 2: The Key Principles of the SEMS Management Scheme
(http://www.solentms.org.uk/sems/management_scheme/)

Annex 3: Supporting Habitat(s) Site Feature Map for the Solent SPAs (Langstone Harbour only, Portsmouth Harbour and Solent and Southampton Water)

Annex 4: Bottom Towed Fishing Gear 2016 byelaw permanent closure areas in the Solent SPAs (Langstone Harbour only, Portsmouth Harbour, Solent and Southampton Water)

Annex 5: Co-Location of Recent Shellfish Dredging Sightings and Site Feature(s)/Sub-Feature(s) in the Solent SPAs (Langstone Harbour only, Portsmouth Harbour & Solent and Southampton Water)

Annex 6: Low tide WeBS data distribution maps for Grey plover, Dunlin, Redshank, Dark-bellied Brent goose, Shelduck, Teal, Ringed plover, Curlew, Turnstone, Wigeon, Pintail and Shoveler in the Solent taken from Stillman et al., (2009).

Annex 7: WeBS Low Tide Count (LTC) scheme point data distribution maps for the three Solent SPAs bird features (Langstone Harbour and Portsmouth Harbour) Recent Solent and Southampton Water maps not available. https://app.bto.org/webs-reporting/

Annex 8: Bird roosting sites from the Solent Waders and Brent Goose Strategy. Taken from https://solentwbs.wordpress.com/page-2/. Taken on 03/10/2018.

Annex 9: Classification of Bivalve Mollusc Production Areas interacting with the three Solent SPAs: (Langstone Harbour Only, Portsmouth Harbour and Solent and Southampton Water)

Annex 10: Table of recovery rates of prey species taken by bird species which may be impacted by changes in prey availability as a result of clam dredging in Chichester and Langstone Harbour SPA, Portsmouth Harbour, and Solent and Southampton Water SPA. Taken from Ferns et al., (2000).

Annex 11: Seabed scars (shown as numerous lines), visible from Google Earth, potentially caused by clam dredging within Langstone Harbour. These images were taken on 22/04/2015. Source: Google Earth.

Annex 12: Table of studies investigating the impacts of shellfish dredging and recovery rates.

Annex 13: Table of recolonization strategies and reproductive seasons of potential key species in the Solent European Marine Site. These species were selected from the potential species list in Annex 15.

Annex 14: Potential Species List for the Solent European Marine Site (derived from SAC biotopes outlined in the Regulation 33 Conservation Advice Package and prey species of vulnerable (to shellfish dredging) SPA bird species).


Annex 16: TSLE Summary for each feature (and sub-feature)

Technical Summary

1. Introduction
   1.1 Need for a Habitat Regulations Assessment (HRA)
   1.2 Management Scheme

2. Documents reviewed to inform this assessment

3. Information about the EMSs
   3.1 Overview and qualifying features
      3.1.1 Chichester and Langstone Harbours SPA
      3.1.2 Portsmouth Harbour SPA
4.3 Solent Dredge Permit Bylaw

4.3.1 Category A Permit

4.3.2 Category B Permit

4.3.3 Solent Dredge Permit Access Policy

4.2 Technical Gear Specifications

4.2.1 Clam & Cockle Dredging

4.2.2 Oyster dredging

5. Location, Effort and Scale of Fishing Activities

5.1 Clam Dredging

5.2 Oyster Dredging

6. Test of Likely Significant Effect (TLSE)

7. Appropriate Assessment

7.1 Co-location of Fishing Activity and Site Features/Supporting Habitat(s)

7.2 Potential Impacts on Rides and Supporting Habitats

7.2.1 Abrasion/disturbance of the substrate on the surface of the seabed; Penetration and/or disturbance of the substratum below the surface of the seabed, including abrasion

7.2.2 Removal of non-target species

7.2.3 Removal of target species

7.2.4 Smothering and siltation rate changes; Changes in suspended solids

7.2.5 Changes in prey availability

7.2.6 Visual Disturbance

7.3 Feature-Specific Seasonality Table

7.4 Site Condition

7.4.1 Condition Assessments

7.4.2 Population Trends

7.5 Existing Management Measures

7.5.1 Southern IFCA

7.5.2 Sussex IFCA

7.6 Classification of Shellfish

7.7 Monitoring

7.7.1 Solent oyster stock survey

7.7.2 Solent bivalve stock survey

7.8 Table 12: Summary of Impacts

8. Conclusion

9. In-combination assessment

9.1 Other plans and projects

10. Summary of consultation with Natural England

11. Integrity Tests

Annex 1: Reference List

Annex 2: The Key Principles of the SEMS Management Scheme

Annex 3: Supporting Habitat(s) Site Feature Map for the Solent SPAs (Langstone Harbour only; Portsmouth Harbour and Solent and Southampton Water)
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Annex 16: TSLE Summary for each feature (and sub-feature).
1 Introduction

1.1 Need for a Habitats Regulations Assessment (HRA)

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

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

Article 6(3) of the Habitats Directive requires any plan or project likely to have a significant effect on a Natura 2000 site; either individually or in combination with other plans or projects, to undergo an Appropriate Assessment in order to determine whether there may be any adverse impact on 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 Marine Site (either alone or in combination with other plans or projects) and is not directly connected with or necessary to the management of the site in question. The implications of any plan or project must be assessed in view of the site’s conservation objectives.

This document forms the basis of an Appropriate Assessment for the introduction of the Solent Dredge Permit Byelaw. The purpose of this document is to assess whether or not in the view of Southern IFCA, the introduction of the Solent Dredge Permit Byelaw will have a likely significant effect on the features and sub-features of the three SPAs (Chichester and Langstone Harbours, Portsmouth Harbour and Solent and Southampton Water) alone, and in-combination with other plans or projects. The assessment ensures Southern IFCA meets its responsibilities as a competent authority by ensuring the conservation objectives of the three SPAs (Chichester and Langstone Harbours, Portsmouth Harbour and Solent and Southampton Water) will be met and the integrity of the site is not adversely affected.

1.2 Management Scheme

Management of European Marine Sites (EMS) is the responsibility of all competent authorities which have powers or functions which have, or could have, an impact on the marine area within or adjacent to a European Marine Site (EMS). Under section 396 of the Species and Habitats Regulations (2010)7.

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“The relevant authorities, or any of them, may establish for a European Marine Site a management scheme under which their 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.”

Within the Solent EMS such a management scheme has been developed in the form of the SEMS management scheme which was established in 2004. This resulted in the establishment of a framework for the effective management of the Solent EMS so that the conservation objectives are met. The key principles of the management scheme are included in Annex 2.

In the SEMs Management Group 2015 Monitoring Report, fishing activities have been flagged to be a high risk or (Tier 1) activity. High risk activities are considered as potentially representing a high risk and/or not having sufficient “systems in place to ensure they are managed in line with the Habitats Regulations” and, therefore, requiring further management consideration. During the 2015 consultation, a request was made to reduce the risk of fishing activity from high to medium risk. The response from the group was that in order to do this a clear audit and evidence trail would be required to reduce the risk. Assessments for clam and oyster dredging completed under the revised approach, in line with Article 6.2 of the Habitats Directives, formed part of that audit trail, as will this assessment. It was considered that some level of management would be required for high risk activities within the EMS. New management for dredge fishing and bottom towed fishing gear was introduced in November 2017 (see ‘Existing Management’ section).

Evidence of this audit trail and the implementation of new management was considered in the SEMs Annual Monitoring Report in 2017. In this instance, although there was an increase in fishing in some discrete areas, it was agreed that for the risk of ‘Fishing (including shellfisheries)’ no additional management was required. Furthermore, the small areas where an increase in activity was observed would be managed effectively through the implementation of the measures incorporated into the Solent Dredge Fishing byelaw and Bottom Towed Fishing Gear 2016 byelaw. The 2018 report has not been collated at the point, but Southern IFCAs response referencing the audit trail of assessments that have been undertaken and the process for ongoing monitoring to ensure the management is effective and has been submitted.

2 Documents reviewed to inform this assessment

- Reference list (Annex 1)
- Natural England’s Conservation Advice
- Site map(s) – supporting habitat location and extent (Annex 3)
- Fishing activity data (map(s), etc) (Annex 5 & 15)
- Fisheries Impact Evidence Database (FIED)

3 Information about the EMSs

- Chichester and Langstone Harbours SPA (UK9011011)
- Portsmouth Harbour SPA (UK9011051)
- Solent and Southampton Water SPA (UK9011061)

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2 Reference list will include literature cited in the assessment (peer, grey and site-specific evidence e.g. research, data on natural disturbance/energy levels etc)

4 https://designatedsites.naturalengland.org.uk/SiteSearch.aspx
3.1 Overview and qualifying features

3.1.1 Chichester and Langstone Harbours SPA

- **Internationally important populations of the regularly occurring Annex 1 species:** Qualifying features:
  - *Sterna sandvicensis*: Sandwich tern (Breeding)
  - *Sterna hirundo*: Common tern (Breeding)
  - *Sterna albifrons*: Little tern (Breeding)
  - *Pluvialis squatarola*: Grey plover (Non-breeding)
  - *Calidris alba*: Sanderling (Non-breeding)
  - *Calidris alpina alpina*: Dunlin (Non-breeding)
  - *Tringa totanus*: Common redshank (Non-breeding)
  - *Branta bernicla bernicla*: Dark-bellied brent goose (Non-breeding)
  - *Anas crecca*: Eurasian teal (Non-breeding)

- **Internationally important populations of the regularly occurring migratory species:**
  - *Pluvialis squatarola*: Grey plover (Non-breeding)
  - *Calidris alba*: Sanderling (Non-breeding)
  - *Calidris alpina alpina*: Dunlin (Non-breeding)
  - *Tringa totanus*: Common redshank (Non-breeding)
  - *Branta bernicla bernicla*: Dark-bellied brent goose (Non-breeding)
  - *Anas crecca*: Eurasian teal (Non-breeding)

- **Nationally important populations of regularly occurring migratory species:**
  - *Charadrius hiaticula*: Ringed plover (Non-breeding)
  - *Numenius arquata*: Eurasian curlew (Non-breeding)
  - *Limosa lapponica*: Bar-tailed godwit (Non-breeding)
  - *Arenaria interpres*: Ruddy turnstone (Non-breeding)
  - *Anas penelope*: Eurasian wigeon (Non-breeding)
  - *Anas acuta*: Northern pintail (Non-breeding)
  - *Anas clypeata*: Northern shoveler (Non-breeding)
  - *Mergus serrator*: Red-breasted merganser (Non-breeding)

- **Internationally important assemblage of waterfowl (Waterbird assemblage)**

Chichester and Langstone Harbours are located on the south coast of England in Hampshire and West Sussex. They are large, sheltered estuarine basins comprising extensive sand- and mud-flats exposed at low tide. The two harbours are joined by a stretch of water that separates Hayling Island from the mainland. Tidal channels drain the basin and penetrate far inland. The mud-flats are rich in invertebrates and also support extensive beds of algae, especially *Enteromorpha* species, and eelgrasses *Zostera* spp. The basin contains a wide range of coastal habitats supporting important plant and animal communities. The site is of particular significance for waterbirds, especially in migration periods and in winter. It also supports important colonies of breeding terns.\

Please refer to Annex 3 for a map of supporting habitats.

3.1.2 Portsmouth Harbour SPA

- **Nationally and internationally important populations of the regularly occurring migratory species:** Qualifying features:
  - *Branta bernicla bernicla*: Dark-bellied brent goose (Non-breeding)

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5 Those features/sub-features highlighted in bold are those considered likely to interact with the fishing activities that will managed under Solent Dredge Permit byelaw.
6 Those features/sub-features highlighted in bold are those considered likely to interact with the fishing activities that will managed under Solent Dredge Permit byelaw.
➢ Mergus serrator; Red-breasted merganser (Non-breeding)
➢ Calidris alpina-alpina; Dunlin (Non-breeding)
➢ Limosa limosa islandica; Black-tailed godwit (Non-breeding)

Please refer to Annex 3 for a map of supporting habitats.

Portsmouth Harbour is located on the central south coast of England. It is a large industrialised estuary and includes one of the four largest expanses of mud-flats and tidal creeks on the south coast of Britain. The mud-flats support large beds of Narrow-leaved Eelgrass Zostera angustifolia and Dwarf Eelgrass Z. noltii, extensive green algae beds, mainly Enteromorpha species, and Sea Lettuce Ulva lactuca. Portsmouth Harbour has only a narrow connection to the sea via the Solent, and receives comparatively little fresh water, thus giving it an unusual hydrology. The site supports important numbers of wintering Dark-bellied Brent Goose Branta b. bernicla, which feed also in surrounding agricultural areas away from the SPA.8

3.1.3 Solent and Southampton Water SPA

• Internationally important populations of the regularly occurring Annex 1 species: Qualifying features:
  ➢ Sterna sandvicensis; Sandwich tern (Breeding)
  ➢ Sterna hirundo; Common tern (Breeding)
  ➢ Sterna albifrons; Little tern (Breeding)
  ➢ Sterna dougalli; Roseate tern (Breeding)
  ➢ Ichthyaetus melanocephalus; Mediterranean gull (Breeding)

• Internationally important populations of regularly occurring migratory species
  ➢ Branta bernicla bernicla; Dark-bellied brent goose (Non-breeding)
  ➢ Anas crecca; Eurasian teal (Non-breeding)
  ➢ Charadrius hiaticula; Ringed plover (Non-breeding)
  ➢ Limosa limosa islandica; Black-tailed godwit (Non-breeding)

• Internationally important assemblage of waterfowl (Waterbird assemblage)

Please refer to Annex 3 for a map of supporting habitats.

The Solent and Southampton Water are located on the south English coast. The area covered extends from Hurst Spit to Hill Head along the south coast of Hampshire, and from Yarmouth to Whitecliff Bay along the north coast of the Isle of Wight. The site comprises a series of estuaries and harbours with extensive mud-flats and saltmarshes together with adjacent coastal habitats including saline lagoons, shingle beaches, reedbeds, damp woodland and grazing marsh. The mud-flats support beds of Enteromorpha spp. and Zostera spp. and have a rich invertebrate fauna that forms the food resource for the estuarine birds. In summer, the site is of importance for breeding seabirds, including gulls and four species of terns. In winter, the SPA holds a large and diverse assemblage of waterbirds, including geese, ducks and waders. Dark-bellied Brent Goose Branta b. bernicla also feed in surrounding areas of agricultural land outside the SPA.9

3.2 Conservation Objectives

8 http://jncc.defra.gov.uk/default.aspx?page=2036
9 http://jncc.defra.gov.uk/default.aspx?page=2037
The conservation objective for the three SPAs (Chichester and Langstone Harbour, Portsmouth Harbour and Solent and Southampton Water) features:
- Internationally important populations of the regularly occurring migratory species
- Nationally important populations of regularly occurring migratory species
- Internationally important assemblage of waterfowl

Are to ensure that, subject to natural change, the integrity of the site is maintained or restored as appropriate, and 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 populations of qualifying features
- the distribution of qualifying features within the site

The high-level conservation objectives for the three SPAs are available online at: https://designatedsites.naturalengland.org.uk/

4 Plan/Project Description

The Solent Dredge Permit (SDP) Byelaw will regulate the wild shellfish fisheries in the Solent, Southampton Water, Portsmouth Harbour and Langstone Harbour through the allocation of permit entitlements and as such requires a Habitats Regulation Assessment (HRA) for permitting a fishing activity within a European Marine Site (EMS). The SDP Byelaw is designed to encompass a number of existing byelaws and incorporate these into one umbrella byelaw. Existing byelaws include the Solent Dredge Fishing 2016 Byelaw and the Temporary Closure of Shellfish Beds Byelaw.

4.1 Solent Dredge Permit Byelaw

The Solent Dredge Permit Byelaw will allow for the use of a dredge within the Solent. It enables provisions for the following:
- The introduction of a permitted fishery:
  - A Category A Permit: for the harvesting of all bivalves (except oysters);
  - A Category B Permit: for the harvesting of oysters;
    - under paragraph (2) of the permit byelaw it is an offence to use a dredge by means of a relevant fishing vessel within the Solent, unless authorised by either a Category A or Category B permit and in accordance with a daily curfew commencing at 18:00 and ending at 06:00 the following day.
- The ability to introduce ‘flexible permit conditions’ under either a Category A or Category B permit:
  - The permitted scope of the flexible permit conditions enables the following to be introduced in the byelaw:
    - Specified areas known as ‘bivalve harvesting zones’;
    - Specified information, in the form of catch returns;
    - Specified period, in the form of a daily curfew.
  - To limit the number of permits that may be granted;
  - To charge a fee for the permits;
3.2 Solent Dredge Permits

In line with paragraph (156) of the Marine and Coastal Access Act 2009, the flexible permit conditions, which could be introduced under a permit may relate to (but are not limited to) the following matters (paragraph 22):

i. Prohibition or restriction of harvesting in a specified area, or during a specified period;
ii. Limitation on the amount of sea fisheries resources which may be harvested in a specified period;
iii. Limitation on the amount of time spent harvesting;
iv. Prohibiting or restricting any method of harvesting;
v. Provision requiring specified information’s;
vii. Provision to specify a fee for a permit;
vii. Provision to specify the number of permits issued.

The management decisions regarding harvesting will primarily be underpinned by the outcomes of annual/biannual stock assessments; or by any other pathway as identified in the Permit Byelaw; any permits conditions which may be introduced or amended will be in response to the best available evidence that the Authority receive prior to the start of the fishing season.

At time of byelaw implementation, the following conditions will be introduced under the appropriate permit, as specified:

a. Seasonal measure (Category A permit only): This integrates the existing measures that currently exist under the Solent Dredge Byelaw; (fishery closed in Southampton Water, Portsmouth Harbour and Langstone Harbour between 1st March and 31st October);
b. Retention of sea fisheries resources: A restriction on retention of bivalves other than those permitted under the permit;
c. Gear Construction (Category A permit only): this introduces a specified dredge bar spacing;
d. Catch reporting: this introduces the requirement to submit catch returns;

c. Cost of permit.

The Southern IFCA Oyster Closed Season Byelaw will remain a standalone byelaw. It is for this reason that seasonal restrictions are not included in the Category B permit conditions.

Permitting this fishery will enable flexible management of bivalve harvesting and will allow Southern IFCA to review the suitability of the permit conditions as per the Review Procedure outlined in the Byelaw on a regular basis (every three years, or sooner in accordance with procedures specified in the Byelaw). Any changes will be subject to a consultation with permit holders.

As per the Review Procedure (as described in the byelaw), 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;
- any scientific and/or survey data;
- feedback from permit holders during consultation periods;
- any Statutory advice received from Natural England or other such bodies, organisations or persons as the Authority shall deem fit;
- any relevant Habitats Regulation Assessments and any relevant Impact Assessments.

This flexibility in approach will enable amendments, revocations or additions to the permit conditions providing proportionate and bespoke management of the dredge fishery in the Solent whilst achieving the conservation objectives of the site.

Permit conditions, are designed to mitigate any potential impacts of dredge fishing activity on the features of the Solent Maritime SAC and ensures there will be no effect on site integrity. The permit conditions:

- Include the existing seasonal closures which were introduced under the Solent Dredge Byelaw in 2017, being an 8-month close season for shellfish dredging throughout the Solent, covering the designated features/sub-features of the Solent Maritime SAC. The close season prohibits shellfish dredging during the spring, summer and autumn months, 1st March to 31st October inclusive. This closed season enables the recovery of infaunal communities and maintains the structure of intertidal and subtidal habitats, as well as supporting breeding shellfish populations, particularly during the summer months which represent the period of highest biological activity for invertebrate infauna of mudflats. The timing of the recovery period was designed to allow for the quickest recovery possible, this is because the restoration of a community in temperate zones is likely to be more rapid if the cessation of sediment disturbance occurs prior to the spring-summer influx of recruits (Borja et al., 2010). This supports the timing of the reproductive season for key species within the site which generally occurs between spring and autumn (see Annex 10 for reproductive season of key species). Restricting shellfish dredging during winter is likely to aid restoration of infaunal communities if the main recolonisation mechanism is by those who undergo recolonization via larval settlement. This supports the recolonization strategies used by a number of individual species, with a number of species employing both larval settlement and active or passive migration (i.e. Macoma balthica, Hediste diversicolor) (see Annex 10 for recolonization strategies of key species).

<table>
<thead>
<tr>
<th>Permit Category</th>
<th>Conditions</th>
<th>Southampton Water</th>
<th>Portsmouth Harbour</th>
<th>Langstone Harbour</th>
<th>Solent</th>
</tr>
</thead>
<tbody>
<tr>
<td>A (All bivalves except oysters)</td>
<td>Permit: Gear construction (bar spacing and strength)</td>
<td>✔️</td>
<td>✔️</td>
<td>✔️</td>
<td>✔️</td>
</tr>
<tr>
<td></td>
<td>Permit: Catch reporting</td>
<td>✔️</td>
<td>✔️</td>
<td>✔️</td>
<td>✔️</td>
</tr>
<tr>
<td></td>
<td>Permit: Seasonal Restriction (closed between 1 March and 31 October)</td>
<td>✔️</td>
<td>✔️</td>
<td>✔️</td>
<td>❌</td>
</tr>
</tbody>
</table>
Byelaw: Temporal restrictions (closed 18:00 to 06:00) ✔ ✔ ✔ ✔

Permit: Catch Reporting ✔ ✔ ✔ ✔

Byelaw: Temporal restrictions (closed 18:00 to 06:00) ✔ ✔ ✔ ✔

Permit: Spatial restrictions

<table>
<thead>
<tr>
<th><em>Open Bivalve Harvesting Zones</em></th>
<th><em>Open Bivalve Harvesting Zones</em></th>
<th><em>Open Bivalve Harvesting Zones</em></th>
<th><em>Open Bivalve Harvesting Zones</em></th>
</tr>
</thead>
</table>

### 4.1.1 Solent Dredge Permit Access Policy

It is recommended that the Authority do not restrict the number of permits available at the time the permit byelaw is introduced, however, in line with the provisions outlined in the Solent Dredge Access Policy, a number of Introductory Access Criteria must be met to enable fishers to be eligible to apply for a permit at the time the Permit Byelaw is introduced.

As such, access to a Solent Dredge Permit will not be restricted (other than via the criteria contained in the Access Policy) other than through means of requiring the purchase of the permit. Currently there is only a small fleet of vessels who fish for bivalves in the Solent and therefore by not restricting the ability to gain a permit in anyway there will be no incentive for those who do not already fish for clams and oysters to purchase a permit. If unexpectedly, numbers of fishers applying for a permit exceeds that of historical fishing effort, it would however be possible to consider restricting the number of permits sold.

### 4.2 Technical Gear Specifications

#### 4.2.1 Clam & Cockle Dredging

A type of mechanical dredge, known as a box dredge, is used to fish for clam and cockles in the Solent (Williams and Davies, 2018). From now on throughout this document fishing for both species will be referred to as 'clam dredging'. A mechanical dredge consists of a metal frame with a row of metal teeth which are towed through the sediment using a boat (Figure 1) (Wheeler et al., 2014). The dredge is characterised by skis which sit on the base of the dredge and allow it to sit on the seabed whilst being towed. Current management measures do not specify the required configuration of box dredge and as a result the size of a box dredge can widely vary. Box dredges vary from 82 to 122 cm in width, 111 to 130 cm in length and 20 to 36 cm in depth. Some box dredges have a diving plate which helps to stabilise the dredge during deployment. The metal teeth range from 9 to 14 cm (16 cm diagonally) and are situated on the base of the dredge mouth opening. Teeth can be orientated vertically or angled diagonally forward to help cut through the sediment.

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10 The Oyster Closed Season byelaw will not form a part of the category B permit conditions, but will remain in place as a standalone byelaw.
These teeth penetrate into the sediment disturbing the buried clams which are subsequently caught and retained in the dredge. The posterior metal box is made up of bars, whose spacing also varies from 1.4 to 3.4 cm. This allows the dredge to pass through the sediment and unwanted debris can escape through the bars. Spacing may vary depending on the target species, with a larger bar spacing used for the hard-shell American clam, which has a greater minimum legal size than the Manila clam.

Typically, one or two dredges, although up to three has been observed, are deployed side by side, depending on the size of the boat, from the stern. The dredge is typically deployed using a mechanized winch to lower the gear to the sea bed and lift it back onto the vessel. The dredge is attached to the vessel using a rope which is typically tied to the tow riddle (Figure 2). The angle at which the dredge is towed depends on the tow riddle configuration; the further forward the rope is attached to the dredge, the steeper the angle it will penetrate into the sediment. The dredge is towed along the seabed in straight lines in the direction of the boat. Tows can vary in length and a vessel will go back and forth over the same fishing ground. Once back on deck, the dredge is emptied onto a griddle where the catch is, washed, sorted and sized. The griddle spacing is often optimised to allow for undersized clams to return straight back to the seabed.

4.2.2 Oyster dredging

A type of mechanical dredge, known as a ladder dredge is used to fish for oysters in the Solent (Williams and Davies, 2018). A ladder dredge consists of a metal frame with parallel bars at the base of the dredge mouth which form a ‘ladder’, a set of skis at both ends of the dredge base and a posterior mesh chain-link bag used to collect oysters (Figure 1). The skis allow the dredge to sit on the seabed whilst being towed. Unwanted debris passes and sediment pass through the mesh chain-link bag. A diving plate is fitted to the top of the dredge and helps to stabilise the dredge during deployment. The ladder, which reduces penetration into the sediment when compared with toothed dredges such those used for clam dredging in the Solent, can be up to 8.5 cm long, with parallel bars spaced approximately 4.5 cm apart. As stipulated by the ‘Oyster Dredges’ byelaw (see section 6.4), the width of a dredge cannot exceed 1.5 m in width.
One or two dredges are deployed side by side, depending on the size of the boat, from the stern. The dredge is typically deployed using a mechanized winch to lower the gear to the sea bed and lift it back onto the vessel. The dredge is attached to the vessel using a metal wire and is towed along the seabed in straight lines in the direction of the boat. Once back on deck, the dredge is emptied onto sorting table where the catch is sorted and sized.

5 Location, Effort and Scale of Fishing Activities

5.1 Clam Dredging

Prior to the introduction of the Solent Dredge Fishing byelaw in November 2017, clam dredging took place all year round within the Solent. The activity predominantly targets the non-indigenous Manila clam (*Ruditapes philippinarum*), although the American hard-shell clam (*Mercenaria mercenaria*) and occasionally cockle (*Cerastoderma edule*) are also targeted. Infrequent catches of the indigenous Grooved Carpet Shell clam (*Ruditapes decussatus*) also occur.

The Manila clam was first brought to Britain in 1980 by the then UK government’s Ministry of Agriculture, Fisheries and Food (MAFF). At introduction there was an assumption the species would not naturalise (because of water temperatures restricting reproduction) however this proved incorrect and Manila clams are now ordinarily resident in the Solent and other English estuaries. It is thought the Manila clam was introduced into the Solent and Southampton Water in around 2005 (Tumnoi, 2012), with a fishery developing shortly after in 2007/08.

Location

Clam dredging takes place in distinct, small spatial areas, where shellfish beds exist. These largely include the eastern harbours and several discrete areas in Southampton Water and Lee on Solent (Annex 5) (Williams and Davies, 2018). These sites occur both intertidally (at high tide) and subtidally, with vessels often operating in very shallow waters.

Sightings
During patrols carried out to monitor and assess the compliance of fishers with the fisheries regulations and byelaws, fisheries officers note sightings of fishing boats actively fishing along with the fishing type being carried out. It is not always possible to record the location georeferenced information and therefore some sightings locations are described using visual ‘markers’ to record the location, which are transcribed into estimated geo referenced locations. This is the method used to record ‘sightings’ referred to throughout this document.

Sightings data in Annex 5 illustrates the distribution of clam dredging activity between 2015 and 2018. Clam dredging is largely shown to occur within the bottom half of Southampton Water, predominantly on the western side in an area known as Ashlett Creek, but also on the eastern side outside the entrance to the Hamble and extending down towards Chilling. Activity also occurs, although to a lesser extent, north of Ashlett Creek in the upper reaches of Southampton Water in an area known as Bird Pile. The reason for which is explained by changes in shellfish classification in the area, which prior to Autumn 2016 prohibited fishing for clams from taking place. In Langstone Harbour, sightings data show clam dredging is concentrated in the north eastern quarter of the harbour within the intertidal zone, including North Lake and South Lake, with a number of sightings extending up into Broad Lake, as well as on the fringes of the subtidal along the main channel. Please note that Southern IFCA’s sightings data may reflect home ports of patrol vessels, high risk areas and typical patrol routes and therefore are only indicative of fishing activity. Over the period covered by the sightings data (2015-18), it is likely the geographical extent of the fishery is well reflected, however, intensity may be skewed by aforementioned factors. In Portsmouth Harbour clam dredging occurs throughout the central areas (Portchester and Bombketch Lakes) of Portsmouth Harbour over mudflats and in the subtidal channels.

Fishing Effort

Over the last three years (2015-2017), it is estimated that the clam fishery has supported between 14 and 20 vessels, some on an ad-hoc basis. The number of vessels was greatest in 2015 at 20 vessels and has declined slightly to 14 in 2016 and 18 in 2017. It is important to note not all vessels engage in the fishery at the same time. On average, 3 to 4 vessels operate on any one day across the whole site on fishable days when weather and tide permit. Due to the tidal restriction on the fishery, vessels are not able to operate at all states (high/low) and sizes (spring/neap) of tide. Vessels that take part in the fishery largely operate out of Portsmouth Harbour, with other vessels operating out of Warsash, Southampton Water and Langstone Harbour.

Landings

Landings data is recorded for first-sale fish and shellfish as part of the Buyers and Sellers legislation and is provided by the Marine Management Organisation (MMO). This landings data was recently analysed and fed into a report on the value of ecosystem services provided by shellfish in the Solent (Table 2) The analysis was conducted by Southern IFCA and involved differentiating the landings data, which is reported by the port of landing, into the different shellfish areas within the Solent, including Portsmouth Harbour, Langstone Harbour, Southampton Water, Southampton Water Approaches and Hill Head. This was undertaken based on sightings, inspections and officer knowledge and as such represent estimates based on best available evidence. A number of assumptions were made in order to estimate the live weight landed from each shellfish area and include the following:
- Vessels who identify Portsmouth as their port of landing fish areas in Portsmouth Harbour, Langstone Harbour, Southampton Water Approaches, Hill Head and Southampton Water, so landings into Portsmouth were split accordingly based on vessel sightings and inspections.
- Landings for Lymington and Keyhaven have been associated with fishing in Southampton Water.
- Vessels who identify Southampton or the Hamble as their ports of landing fish areas in Southampton Approaches, Southampton Water or Hill Head. Landings into Southampton were split accordingly.
- Vessels who identify Langstone as their port of landing fish areas in Langstone Harbour.
- The landings data reported ‘mixed clams’ and based on the lack of other commercially caught clam species this data has been split between Manila and American hard-shell clam.

It should be noted the landings data provided by the MMO may be subject to under reporting and should be treated with caution. The landings for the latter part of 2017 is still provisional and may increase as more data is processed.

**Table 1. Shellfish landings by species and volume from shellfish waters (Southampton Water, Southampton Approach, Hill Head, Portsmouth Harbour and Langstone Harbour) in the Solent from 2015 to 2017.**

<table>
<thead>
<tr>
<th>Shellfish water and year</th>
<th>Landings by species (tonnes)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Manila clam</td>
<td>Hard-shell clam</td>
</tr>
<tr>
<td><strong>Portsmouth Harbour</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2015</td>
<td>36.89</td>
<td>4.5</td>
</tr>
<tr>
<td>2016</td>
<td>6.84</td>
<td>0.58</td>
</tr>
<tr>
<td>2017</td>
<td>19.126</td>
<td>2.37</td>
</tr>
<tr>
<td><strong>Langstone Harbour</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2015</td>
<td>6.88</td>
<td>4.23</td>
</tr>
<tr>
<td>2016</td>
<td>4.13</td>
<td>4.13</td>
</tr>
<tr>
<td>2017</td>
<td>8.56</td>
<td>5.07</td>
</tr>
<tr>
<td><strong>Southampton Water</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2015</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2016</td>
<td>8.78</td>
<td>0.767</td>
</tr>
<tr>
<td>2017</td>
<td>7.57</td>
<td>3.36</td>
</tr>
<tr>
<td><strong>Southampton Approach</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2015</td>
<td>158.85</td>
<td>19.67</td>
</tr>
<tr>
<td>2016</td>
<td>47.62</td>
<td>2.87</td>
</tr>
<tr>
<td>2017</td>
<td>8.93</td>
<td>3.36</td>
</tr>
<tr>
<td><strong>Hill Head</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

11 Pacific oysters have been recently classified in Portsmouth and Langstone Harbour (November 2017) and it seems that they may be landed by fishing vessels in the near future (most likely as a bycatch of other fisheries). Currently this is not reflected in the landings data, and over the 3-year period (2015-17) only 0.385 tonnes have been reported (the origin of which is unknown). It is possible that more landings will be reported for this species based on its recent classification.
The landings data displayed in Table 2 show Manila clam, followed by American hard-shell clam as the most landed species from 2015 to 2017. The highest volume of landings were taken from Southampton Approach and Portsmouth Harbour, with the patterns in landings data different for each area. Landings from Portsmouth Harbour and Langstone Harbour appeared to dip in 2016, the magnitude of which varies depending species and area. In Southampton Approach, landings sharply declined from 2015 to 2017 in both species, whereas landings increased in Southampton Water. The latter can be explained by a change in the shellfish classification. Landings from the Hill Head area appear to be relatively consistent between years.

### 5.2 Oyster Dredging

The native oyster (*Ostrea edulis*) has been historically fished in the Solent since the 18th century. Oyster dredging is an established fishing activity in the Solent and the modern fishery developed during the 1960s. From 1972 until 2006 it was Europe’s largest self-sustaining flat oyster fishery, peaking between 1970 and 1980. From 2007, the population and fishery have been declining. The reason for the decline remains unknown but is likely to be caused by a combination of factors.

The target species of the fishery is the Native oyster (*Ostrea edulis*) although catches may include the non-native Pacific oyster (*Crassostrea gigas*).

Up until 2010, the fishery was managed by the Solent Oyster Fishery Order 1980, a regulating order which limited the vessels entering the vessel and a closed season (1st March – 31st October), which still exists. In 2010, it was decided the regulating order would not be renewed due to the ongoing decline of the fishery and the area is now a public fishery. Management of the fishery after 2010 is summarised in Table 3. This includes closure of the wider Solent (including Southampton Water) from 2013/14 season onwards which was achieved using the ‘Temporary Closure of Shellfish Beds’ byelaw.

**Table 2. Management of the Solent oyster fishery after the Solent Fishery Order 1980 expired in 2010 in response to continued declines in the population.**

<table>
<thead>
<tr>
<th>Season</th>
<th>Management</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010/11</td>
<td>Regulating order expired and fishery became public fishery. Closed season still operated from 1st March till 31st October.</td>
</tr>
<tr>
<td>2011/12</td>
<td>Closed season 1st March till 31st October.</td>
</tr>
<tr>
<td>2012/13</td>
<td>Closed season 1st March till 31st October.</td>
</tr>
<tr>
<td>2013/14</td>
<td>Public fishery was closed in the wider Solent (including Southampton Water) and a shorter season of four weeks from 31st October. Eastern harbours, Langstone and Portsmouth remained open for the shorter season.</td>
</tr>
<tr>
<td>2014/15</td>
<td>Public fishery was closed in the wider Solent (including Southampton Water) and a shorter season of two weeks from 31st October. Eastern harbours, Langstone and Portsmouth remained open for the shorter season.</td>
</tr>
<tr>
<td>2015/16</td>
<td>Public fishery was closed in the wider Solent (including Southampton Water) and a shorter season of two weeks from 31st October. Eastern harbours, Langstone and Portsmouth remained open for the shorter season.</td>
</tr>
<tr>
<td>Year</td>
<td>Description</td>
</tr>
<tr>
<td>--------</td>
<td>---------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>2016/17</td>
<td>Public fishery was closed in the wider Solent (including Southampton Water). Eastern harbours, Langstone and Portsmouth, defaulted to the 'Oyster Close Season' byelaw (i.e. open for four months between November and February).</td>
</tr>
<tr>
<td>2017/18</td>
<td>Public fishery was closed in the wider Solent (including Southampton Water). Eastern harbours, Langstone and Portsmouth, defaulted to the 'Oyster Close Season' byelaw (i.e. open for four months between November and February). Additional closed areas for all types of bottom towed fishing gear were introduced in November 2017, including previously fished areas within Langstone Harbour.</td>
</tr>
<tr>
<td>2018/19</td>
<td>Apart from the Ryde Middle bed and Portsmouth Harbour, a Temporary Closure was applied to all oyster beds in the Solent area and associated harbours.</td>
</tr>
</tbody>
</table>

Location

Oyster dredging takes place in distinct, small spatial areas where shellfish beds exist (Williams and Davies, 2018). Fishing effort is typically focused upon subtidal habitats. Historical oyster beds within the wider Solent and Southampton Water, which have been closed since the 2013/14 season and are illustrated in Figure 4. Remaining areas, located within the SPAs and, subject to fishing occur within Langstone and Portsmouth Harbours. Oyster dredging in Portsmouth Harbour occurs subtidally in the main channels. These areas include the channels running up the north eastern quarter of the harbour, an area known as Sword Sands, located centrally within the harbour and Sinah Lake located in the south east corner of the harbour. Southampton Water has also been closed since 2013/14 season. In the 2018/19 season only Ryde Middle and Portsmouth Harbour areas will be open for the season. Following the introduction of the Bottom Towed Fishing Gear 2016 byelaw in November 2017, a number of areas within Langstone Harbour have been permanently closed to all types of bottom towed fishing gear, including Sinah Creek. See ‘Existing Management’ section for further information. In Portsmouth Harbour this includes the seagrass beds in the north west of the harbour, and small distinct areas of saltmarsh along the north west coast as well as Cams bay.
Sightings

During patrols carried out to monitor and assess the compliance of fishers with the fisheries regulations and byelaws, fisheries officers note sightings of fishing boats actively fishing along with the fishing type being carried out. It is not always possible to record the location georeferenced information and therefore some sightings locations are described using visual ‘markers’ to record the location, which are transcribed into estimated geo referenced locations. This is the method used to record ‘sightings’ referred to throughout this document.

There are limited oyster dredging sightings for the most recent oyster seasons (2015/16, 2016/17, 2017/18). The limited sightings data show oyster dredging to occur within and close to the channels within Langstone Harbour, including the main channel and Russel Lake. Knowledge of the fishery however gives an insight into key areas where oyster dredging takes place. Fishing effort is generally concentrated subtidally within the channels of the north eastern quarter of the harbour. Activity is also known to take place in an area known as Sword Sands, located centrally within the harbour and more recently (2016/17 season) in Sinah Lake in the south east corner of the harbour. Since November 2017, Sinah Lake has been closed to bottom towed fishing gear but is still permitted to occur in the other areas of the harbour. Recent oyster dredging sightings in Portsmouth Harbour shows the activity occurs subtidally in the main channels.

Fishing Effort

Figure 4. Historical Native oyster (Ostrea edulis) grounds in the wider Solent. Source: Palmer & Firmin, 2011.
The number of vessels participating within the fishery has largely declined over the last ten years or more. In 2002/03, the fishery supported 77 licenses and in 2009/10 the number of licenses had declined to 22 (Figure 5). The Solent regulating order expired after the 2009/10 season, removing the need for individual oyster licenses.

More recently, over the last three years (2015-2017), it is estimated that the oyster fishery has supported between 14 and 17 vessels. The number of vessels was greatest in 2016 at 17 vessels and lowest in 2015 at 14 vessels, with the most recent year (2017) supporting 15 vessels. It is important to note that typically a large proportion of vessels will engage in the fishery in the first 1 to 3 days of the fishery, and thereafter the number of vessels will rapidly decrease, leaving on average 1 to 2 fishing on any one day for the remainder of the season, weather and conditions permitting.

Figure 3. The number of licenses taken out for the Solent oyster fishery between 2000 and 2010 from the Southern Sea Fisheries Committee (SSFC). Source: Kamphausen, 2012.

Landings

Recent landings data (2015-2017) for the native oyster is displayed in table 2. Please also refer to the associated text for this landings data in section 3.3.1.4.

The landings data displayed in table 2 show the two areas open to oyster fishing in recent years; Portsmouth Harbour and Langstone Harbour. Landings from Portsmouth Harbour appear to be relatively consistent, peaking slightly in 2016. Landings from Langstone Harbour on the other hand fluctuate between years, with the highest quantities of native oyster landed in 2016 at 24.5 tonnes;
the majority of which came from one area known as Sinah Lake. Sinah Lake was permanently closed to bottom towed fishing gear in November 2017 so could not be fished in the 2017/18 oyster season.

6 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 a plan or project will cause a likely significant effect on an EMS\textsuperscript{12}. Each feature/supporting habitat was subject to a TLSE, a summary table is provided in Annex 17. Only those features and sub features where there was a potential for likely significant effect have been included.

\textsuperscript{12} Managing Natura 2000 sites: \url{http://ec.europa.eu/environment/nature/natura2000/management/guidance_en.htm}
7 Appropriate Assessment

Note: this is only to be undertaken if the Test for LSE (section 7) concluded ‘Yes’ or ‘Uncertain’ for LSE, either alone or in-combination.

7.1 Co-location of Fishing Activity and Site Features/Supporting habitat(s)

Key areas favoured by designated bird species in the Chichester and Langstone Harbours SPA are summarised in Table 8.


<table>
<thead>
<tr>
<th>Common Name</th>
<th>Latin Name</th>
<th>Favoured Area(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Black tailed Godwit</td>
<td>Limosa limosa</td>
<td>Important roosting areas include Southampton Water and the North-West Solent, particularly important feeding areas for black-tailed godwit include Beaulieu Estuary, Newtown Harbour, and North-West Solent. In Portsmouth Harbour the largest numbers feed along the western shores of the Harbour, at Cams Bay and Paulsgrove Lake. Important roost sites are located at the RSPB Islands, Farlington Marshes, the Langstone Oyster beds, Sword Sands and Kench Spit in Langstone Harbour.</td>
</tr>
<tr>
<td>Bar-tailed godwit</td>
<td>Limosa lapponica</td>
<td>In Langstone harbour, at low tide, the great concentrations occur on sandy sediments north and south of the RSPB islands, at Sward and Mallard Sands, North of Sinah Lake, around the Oyster beds and along the harbour's west shore. Roosts are on RSPB Islands, Farlington Marshes, the Langstone Oyster beds, Sword Sands and Kench Spit in Langstone Harbour.</td>
</tr>
<tr>
<td>Curlew</td>
<td>Numenius arquata</td>
<td>In Langstone Harbour at low tide Curlew spread throughout the harbour mudflats, with slightly denser groups around the RSPB islands. Farlington Marshes, the Oyster beds, the RSPB islands and Kench Spit provide important roost habitat for curlew overwintering in Langstone Harbour. Dark-bellied Brent geese roost on the water overnight. During the day, they exhibit sub-population preferences and will roost close to preferred feeding areas.</td>
</tr>
<tr>
<td>Species</td>
<td>Scientific Name</td>
<td>Description</td>
</tr>
<tr>
<td>-----------------------</td>
<td>-----------------------</td>
<td>----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Dark-bellied Brent goose</td>
<td><em>Branta bernicla bernicla</em></td>
<td>In Langstone Harbour Brent geese feed throughout the harbour's mudflats with denser groups at Chalkdock Lake, south of Sinah Lake, south of North Binness Island and around the oyster beds. Important supporting habitat is also found on Hayling and Portsea Islands. In Portsmouth Harbour the largest numbers feed along the north, and north western shores particularly Paulsgrove Lake, as well as at Tipner Lake, and Forton and Haslar Lakes. Dark-bellied Brent goose roost on the water overnight. During the day, they exhibit sub-population preferences and will roost close to preferred feeding areas. Important feeding sites in the Solent include south of the Hamble estuary mouth, Calshot marshes, Lepe Country Park and Newtown harbour. Roosting sites in Solent and Southampton Water SPA include Southampton Water, Beaulieu Estuary, Newtown Estuary, and North-West Solent. Important seagrass beds are found at Hurst, Calshot and Stubbington in the Solent and Southampton Water SPA.</td>
</tr>
<tr>
<td>Dunlin</td>
<td><em>Calidris alpina</em></td>
<td>At low tide, dunlin are found in high densities throughout Langstone Harbour particularly north of Sinah Lake, around the RSPB Islands and along stoke shore. In Portsmouth Harbour the largest numbers feed in high densities along the north coast of the harbour specifically around Halfebb lake and Bombketch lake mudflats as well as Paulsgrove lake. In Langstone Harbour, dunlin roost throughout the harbour on Farlington Marshes, the Oyster beds, Kench Spit and Railway Bank and at Eastney Lake Spit.</td>
</tr>
<tr>
<td>Grey plover</td>
<td><em>Pluvialis squatarola</em></td>
<td>At low tide, grey plover occur sparsely throughout the harbour particularly south of the RSPB Islands and around the oyster beds in Langstone Harbour. Farlington Marshes, the Oyster beds, the Kench Spit &amp; Railway Bank are important roosts for grey plover in Langstone Harbour.</td>
</tr>
<tr>
<td>Pintail</td>
<td><em>Anas acuta</em></td>
<td>Localised flocks are found in and around Farlington Marshes and in Chalkdock Lake in north Langstone Harbour. In Langstone Harbour, they roost on the RSPB Islands, Farlington Marshes, the Oyster beds and Southmore Spit and on open water.</td>
</tr>
<tr>
<td>Red-breasted merganser</td>
<td><em>Mergus serrator</em></td>
<td>In Portsmouth Harbour, at low tide, the largest numbers are found in the main Channel and Paulsgrove Lake Channel as well as Portchester Lake Channel. The majority of birds in Langstone Harbour are found in the Deeps, and the main channels. Red breathing merganser favour deeper waters to the east of Farlington Marshes and towards Langstone Bridge.</td>
</tr>
<tr>
<td>Redshank</td>
<td><em>Tringa totanus</em></td>
<td>Low tide WeBS distribution maps reveal sparse populations of redshank throughout the harbour including with the highest densities occurring in Chalkdock Lake, on the upper western side of Hayling Island near to North Hayling Oyster Beds and around Farlington Marshes. Redshank roost on the RSPB Islands, Farlington Marshes, Oyster beds, Kench Spit, Kench Railway Bank, Eastney Lake Spit and on the beach on the north side of Kendall’s Wharf in Langstone Harbour.</td>
</tr>
<tr>
<td>Bird Type</td>
<td>Scientific Name</td>
<td>Distribution and Roosting Information</td>
</tr>
<tr>
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<td>--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Ringed plover</td>
<td>Charadrius hiaticula</td>
<td>Ringed plover are widespread at low tide with small numbers around most of Langstone Harbour. In Langstone Harbour roosts are on the RSPB islands, Farlington Marshes, the Oyster beds, the Kench Spit and Railway Bank and the Eastern Road bridge. The main roosting areas for ringed plover in Solent and Southampton Water SPA are Southampton Water, the North-West Solent, Beaulieu Estuary and Newtown Harbour.</td>
</tr>
<tr>
<td>Sanderling</td>
<td>Calidris alba</td>
<td>Sanderling distribution is related to sediment. At low tide, populations are concentrated at Sword Sands in Langstone Harbour. In Langstone Harbour, they roost in the main bird areas such as the RSPB Islands, Farlington Marshes, the Oyster beds, the Kench and Sword Sands.</td>
</tr>
<tr>
<td>Shelduck</td>
<td>Tadorna tadorna</td>
<td>At low tide, shelduck spread throughout the harbour's mudflats and channels in low densities, with the greatest concentrations occurring around Chalkdock Lake and along stoke shores in Langstone Harbour. They roost on the RSPB islands in Langstone Harbour as well as at Farlington Marshes.</td>
</tr>
<tr>
<td>Shoveler</td>
<td>Anas clypeata</td>
<td>Shoveler are found in very low densities in the northern reaches of Langstone Harbour at low tide. In Langstone Harbour they roost on the RSPB Islands, Farlington Marshes, the Oyster beds and Southmore spit.</td>
</tr>
<tr>
<td>Teal</td>
<td>Anas crecca</td>
<td>At Low tide, in Langstone Harbour, the highest densities of teal are found sparsely in the north and west of the harbour, around Farlington Marshes and in Chalkdock Lake. In Langstone Harbour, they roost across Farlington Marshes and the intertidal creeks. Important roost sites include Southampton Water, Beaulieu Estuary, Newtown Harbour, and North-West Solent. Important feeding sites in Solent and Southampton Water SPA include Southampton Water and Newtown Harbour.</td>
</tr>
<tr>
<td>Turnstone</td>
<td>Arenaria interpres</td>
<td>Low tide WeBS distribution maps reveal low densities of turnstone along on the western side of Hayling Island, the eastern side of Portsea Island and around the oyster beds in Langstone Harbour. In Langstone Harbour they roost on the RSPB Islands and Farlington Marshes, as well as at the Kench Spit and Railway Bank, the west side of the Kench and Mullberry Harbour.</td>
</tr>
<tr>
<td>Wigeon</td>
<td>Anas penelope</td>
<td>Wigeon flock in high densities in the north of Langstone harbour, around Farlington Marshes, the oyster beds and Chalk Dock Lake. In Langstone Harbour, the main roost concentrations are seen to the west of Langstone Bridge and east of Farlington Marshes.</td>
</tr>
<tr>
<td>Water Bird</td>
<td>Native and migratory species</td>
<td>Specific Information not available. See individual bird accounts.</td>
</tr>
</tbody>
</table>
Bird roosting sites from the Solent Waders and Brent Goose Strategy are presented in Annex 9.

A map of shellfish dredging and supporting habitats can be found in Annex 5.

Sightings data in Annex 5 for clam dredging reveal where fishing activity occurs between 2015 and 2018 in relation to supporting habitats of the site. Clam dredging occurs mainly on intertidal mud on the western side of Southampton Water, and although a number of sightings appear to be located in areas of saltmarsh, the nature of this activity and the draft of the fishing vessels engaged in this activity, would eliminate this from occurring within these areas. Therefore, these sightings are most likely to be explained by inaccurate reporting. Clam dredging also occurs on the eastern side of Southampton Water, and to a lesser extent, north of Ashlett Creek in the upper reaches of Southampton Water in an area known as Bird Pile. The reason for which is explained by changes in shellfish classification in the area, which prior to Autumn 2016 prohibited fishing for clams from taking place. Clam dredging also takes place outside the entrance to the River Hamble and south towards Chilling over intertidal mixed sediments and intertidal sand and muddy sand. Clam dredging also takes places in the north eastern quarter of Langstone Harbour largely over intertidal mud and also subtidal mixed where activity occurs on the fringe of the main channel as well as throughout the central areas of Portsmouth Harbour over mudflats and in the subtidal channels. Please note that Southern IFCA’s sightings data may reflect home ports of patrol vessels, high risk areas and typical patrol routes and therefore are only indicative of fishing activity. Over the period covered by the sightings data (2015-18), it is likely the geographical extent of the fishery is well reflected; however, intensity may be skewed by aforementioned factors.

There is a lack of oyster dredging sighting for the most recent oyster seasons (2015/16, 2016/17, 2017/18) for areas within the Solent. These seasons represent recent fishing grounds and levels of fishing effort. The means that sightings data cannot be used to illustrate the co-location of oyster dredging fishing activity and site feature/sub-features within the Solent. Knowledge of the fishery however gives us an insight into the key areas where oyster dredging takes place. Fishing effort is generally concentrated sub tidally (and on the fringes of the intertidal) within the main channels in the north eastern quarter of Langstone Harbour; it is also known to occur in an area known as Sword Sands, located centrally within the harbour and more recently in Sinah Lake in the south east corner of the harbour. Since November 2017, Sinah Lake has been closed to bottom towed fishing gear but is still permitted to occur in the other areas of the harbour. Supporting habitats within these areas are largely made up of subtidal mixed sediments (occurring within the main channels), intertidal mud and intertidal sand and muddy sand. Using knowledge presented in table 4, low tide WeBS data distribution maps (presented in Annex 6 & 7) oyster dredging may have some effect on sites used by black-tailed godwit, bar-tailed godwit, curlew, dark-bellied Brent geese, dunlin, grey plover, pintail, red-breasted merganser, redshank, ringed plover, shelduck, shoveler, teal, turnstone and wigeon. The sites used by these species, which occur in relatively close proximity to oyster dredging, include Chalkdock Lake and around the Oyster beds, the Deeps and the Langstone Channel in Langstone Harbour. It is important to note that low tide WeBS data, illustrated in Annex 6 & 7, will be indicative on when birds are feeding are low tide and oyster dredging occurs at high tide, so it is likely that oyster dredging will have very little direct impact on the disturbance of designated bird species feeding on the intertidal mudflats.
In Portsmouth Harbour, oyster dredging is shown to occur within the main channels, with a number of sightings on the fringes of intertidal mud and very limited number of sightings occurring on the intertidal mud. As oyster dredging is concentrated sub tidally, it is unlikely that the activity will have any effect (through disturbance or changes to prey availability) on feeding sites that are utilised by a number of designated bird species at low tide.

Southampton water has been closed to oyster dredging since 2013, the wider Solent has been closed since at least 2014, with the exception of this 2018/19 season in which one bed, Ryde Middle will be open. As Southampton water and all but one bed (Ryde Middle – which is not located close to any SPA) are closed to oyster dredging, and that which can occur is concentrated sub tidally, it is unlikely that the activity will have any effect (through disturbance or changes to prey availability) on feeding sites that are utilised by a number of designated bird species at low tide.

7.2 Potential Impacts on Birds and Supporting Habitats

Using the pressures outlined in 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.

<table>
<thead>
<tr>
<th>Pressure</th>
<th>Relevant Attribute</th>
<th>Generic Relevant Target</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abrasion/disturbance of the substrate on the</td>
<td>Supporting habitat: quality of supporting</td>
<td>Maintain the structure, function and availability of the following habitats which support</td>
</tr>
<tr>
<td>surface of the seabed</td>
<td>non-breeding habitat</td>
<td>the assemblage feature for all stages (moultting, roosting, loafing, feeding) of the</td>
</tr>
<tr>
<td></td>
<td></td>
<td>non-breeding period.</td>
</tr>
<tr>
<td>Penetration and/or disturbance of the</td>
<td>Supporting habitat: quality of supporting</td>
<td>Maintain the structure, function and availability of the following habitats which support</td>
</tr>
<tr>
<td>substratum below the surface of the seabed,</td>
<td>non-breeding habitat</td>
<td>the assemblage feature for all stages (moultting, roosting, loafing, feeding) of the</td>
</tr>
<tr>
<td>including abrasion</td>
<td></td>
<td>non-breeding period.</td>
</tr>
<tr>
<td>Removal of non-target species</td>
<td>Supporting Habitat: Food availability;</td>
<td>Maintain the distribution, abundance and availability of key food and prey items.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Removal of Target Species</td>
<td>Supporting Habitat: Food availability;</td>
<td>Maintain the distribution, abundance and availability of key food and prey items.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Visual Disturbance</td>
<td>Disturbance caused by human activity</td>
<td>Reduce the frequency, duration and / or intensity of disturbance affecting roosting,</td>
</tr>
<tr>
<td></td>
<td></td>
<td>foraging, feeding, moulting and/or loafing birds so that they are not significantly</td>
</tr>
<tr>
<td></td>
<td></td>
<td>disturbed.</td>
</tr>
</tbody>
</table>
Above Water Noise | 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.

Wheeler et al. (2014) identified a knowledge gap on the effects of shellfish dredging due to a lack of research. The scale of impact caused by shellfish dredging depends on a number of factors which include the scale and intensity of harvest, the size of targeted shellfish, species taken, season, weather, availability of alternative foraging sites, competition and extent of alternate food resources (Stillman et al., 2001; Goss-Custard et al., 2004; Verhulst et al., 2004; West et al., 2005).

7.2.1 Abrasion/disturbance of the substrate on the surface of the seabed; Penetration and/or disturbance of the substratum below the surface of the seabed, including abrasion

Mechanical shellfish dredges can lead to physical disturbance through a number of mechanisms including an increase in sediment suspension above background levels, an increase in turbidity as a result of resuspension, the creation of sediment plumes, changes in sediment composition and alteration to seabed topography (Mercaldo-Allen & Goldberg, 2011; Natural England, 2014; Wheeler et al., 2014).

Topography

Typically impacts include the creation of depressions and trenches and the smoothing of ripples or creation of ridges within sand environments (Wheeler et al., 2014). The depth and width of a trench is largely determined by the mode of fishing, gear type and target species (Wheeler et al., 2014). Mobile gear in general can penetrate from 5 to 30 cm into the substrate under usual fishing conditions (Johnson, 2002). Dredges can disturb the top 2 to 6 cm (Thrush & Dayton, 2002). The more benign traditional, lightweight oyster dredges towed at slow speeds, usually in estuaries, however have a relatively low impact (Sewell & Hiscock, 2005). Intertidal shellfish dredging can result in furrows up to tens of centimetres deep (Kaiser et al., 2006). An investigation into the effects of clam dredging in Langstone Harbour, where a modified oyster dredge was used, reported a clear disturbance of sediment (muddy gravel) down to a depth of 15 to 20 cm (EMU, 1992). In southern Portugal, passage of a clam dredge produced a depression 30 cm wide and 10 cm deep (Constantino et al., 2008). Impacts of trawling can leave tracks of 1 to 8 cm depth in mixed sediment habitats (Freese et al., 1999; Roberts et al., 2010). The presence of dredge tracks may exist for days (Gasper et al., 2003), weeks (Manning and Dunnington, 1955; Mercaldo-Allen & Goldberg, 2011) or months (Wheeler et al., 2014). The persistence of dredge tracks may depend on the depth at which they occur. In the Portugal-based study, dredge tracks caused by clam dredging were no longer distinguishable after 24 hours at 6 m depth but remained visible for 13 days at a depth of 18 m (Constantino et al., 2009). The magnitude of disturbance is based on
the method of harvest, depth of gear penetration (i.e. length of teeth), fishing frequency, towing speed and method of deployment (Mercaldo-Allen & Goldberg, 2011).

Sediment composition

Bottom towed fishing gears have been shown to alter the sedimentary characteristics of varying substrate types including subtidal muddy sand and mud habitats (Roberts et al., 2010). Experimental clam dredging activity in Langstone Harbour, using a modified oyster dredge, led to the removal of the coarse fraction of the sediment and larger sand and fine sediment fraction, with minor differences in the silt component (EMU, 1992). The sediment type for this area was muddy gravel (EMU, 1992). In contrast, a study assessing the impacts of suction dredging for common cockle in the Dutch Wadden Sea, revealed a loss of fine silts and subsequent increase in median grain size from 166.2 µm in 1988 to 179.1 µm in 1994 (Piersma et al., 2001). The sediment type in the study was sand. In addition, it was speculated that the loss of adult shellfish stocks as a result of suction dredging, may have also resulted in a reduction in the production of faeces and pseudo faeces which contribute to the silt component of the sediment (Piersma et al., 2001).

A study by Clarke et al. (2018a), used a Before-After-Control-Impact (BACI) sampling design to assess the impacts of pump-scoop dredging on sediment characteristics in Poole Harbour. 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. The organic content and 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.

Clarke et al. (2018b) undertook a similar study using a nested BACI study to assess the impacts of mechanical shellfish dredging (using a box dredge and ladder dredge) on sediment characteristics in Langstone Harbour subject to three different management regimes for bottom towed fishing gear. Samples were taken on 29th November 2016 and 18th April 2017 from areas open to shellfish dredging for four months of the year (November to February) (impact treatment 1), areas recently closed to bottom towed fishing gear (permanently) (impact treatment 2) and areas historically closed to bottom towed fishing gear (permanently from January 2014) (control treatment). The timing of this study was designed to coincide with the introduction of two new byelaws; Solent Dredge Fishing byelaw, which introduces a 4-month open season (November to February) and Bottom Towed Fishing Gear 2016 byelaw which introduces additional areas permanently closed to bottom towed fishing gear. Unfortunately, there were unforeseen delays with the introduction of the new byelaws and they did not come into force until November 2017. As such, effects of the closed season could not be captured by the study, but comparisons could be between the control treatment and two impact treatments. The organic content and volume of finer sediments increased in control samples throughout the study period, small increases in organic content were also observed in the dredged area although no significant term was identified between control and dredged treatments. There was little difference in sediment composition in the dredged area over the study period.

The resuspension and dispersal of fine particles can lead to long term effects on particular sieve fraction (Pranovi & Giovanardi, 1994); potentially decreasing the clay portion of the sediment (Maier et al., 1998). Other changes in sediment character may also include a lack of consolidation of sediments (Aspden et al., 2004), the removal of stones and the removal of taxa that produce structure (i.e. tube-dwelling and burrowing organisms) (Johnson, 2002; Mercaldo-Allen & Goldberg, 2011). Such physical alterations can cause a reduction in sediment heterogeneity and structure available to biota as habitat (Johnson, 2002). In soft sediments, impacts on benthic fauna are likely to change sediment characteristics and vice versa (Piersma et al., 2001).

### 7.2.2 Removal of non-target species

Bottom towed fishing gear has been shown to reduce biomass, production and species richness and diversity (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 studies investigating the effect of intertidal dredging, it was common to observe 100% removal of biogenic fauna (Collie et al., 2000). This was observed in an experimental study conducted in Langstone Harbour, where the fauna were seen to either be completed removed or considerably reduced by the dredging activity using a modified oyster dredge (EMU, 1992). In the same study, species richness was also found to decrease with a mean number of 6.5 species in the control site compared with 4.4 in the dredge site (EMU, 1992). Another study based in the River Exe in Devon, found that harvesting of manila clams (*Tapes philippinarum*) by hand raking and suction dredging caused an initial reduction of 50% and 90% respectively, in species diversity and abundance (Spencer, 1997). The meta-analysis found that 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 areas that are intensively fished (more than three times per year), the faunal community is likely to be maintained in a permanently altered state and inhabited by fauna adapted to frequent physical disturbance (Collie et al., 2000). There is likely to be a shift from communities dominated by relatively high biomass species towards the dominance of high abundances of small-sized organisms (Collie et al., 2000). Kaiser et al., 2000 reported that regular fishing activity, in the vicinity of the Isle of Man, excluded large-bodied individuals and the resulting benthic community was dominated by smaller bodied organisms more adapted to physical disturbance (Johnson, 2002). The mortality of target and non-target species can also cause an increase in opportunistic species (Wheeler et al., 2014). For example, in the initial period after dredging activities, scavenging organisms have been recorded feeding on damaged prey (Gaspar et al., 2003).

Whilst dredging causes direct mortality to small and large infaunal and epifaunal organisms, many small benthic organisms such as crustaceans, polychaetes and molluscs, have short generation times and high fecundities, both of which enhance their capacity for rapid recolonization (Coen, 1995). In such instances, the effect of dredging may only be short term. It is thought that short-term and localized depressions in infaunal populations is not a primary concern within subtidal habitats (Coen, 1995).

**Vulnerable groups and species**

The relative impact of shellfish dredging on benthic organisms 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, mobile or sessile and soft-bodied or hard-shelled (Mercaldo-Allen & Goldberg, 2011). Epifaunal organisms inhabiting the seabed surface are subject to crushing or at risk of being buried, in addition to effects of smothering; whilst infaunal 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. 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, maxillopoa, 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 is highly incapable of movement in response to disturbance and therefore takes 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 Lanice 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 Nephys 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 Nephys 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% (Clarke et al., 2017).

The aforementioned 8 year decline in Macoma following suction dredging for the common cockle on intertidal sand between 1989 and 1996, was also accompanied by a loss of Cerastoderma edule (Piersma et al., 2001). Declines of bivalve stocks were caused by a particularly low rate of settlement in fished areas (Piersma et al., 2001). It is speculated the reason for a lack of settlement was caused by sediment re-working from suction dredging, in particular the loss of fine-grained sediments which are conducive to bivalve settlement (Piersma et al., 2001).

Site-specific studies

Clarke et al. (2018b) investigated the impacts of mechanical shell dredging (using a box and ladder dredge) on infaunal communities in Langstone Harbour, subject to three management regimes (outlined in section 5.2.1, Sediment composition). A spatially nested BACI designed was used to estimate and account for spatial variation in benthic community compositions. Samples were taken towards the start and end of the dredge season from three treatments (two impact and one control, outlined in section 5.2.1). In each treatment, two stations (200-250m apart) were sampled and in each station five cores were taken. This spatially nested sampling design allows the assessment of within- and between-
treatment differences and this allows any dredging effects to be isolated from spatial variation in community structure. Multivariate analyses on benthic community data was performed to assess the amount of variation and differences between treatments, stations and patches.

The results show the dredged site was dominated by higher abundances of polychaetes (including *Melinna palmata*, *Tharyx* sp., *Nephtys hombergii* and *Streblospio* sp.) and the oligochaete *Tubificoides benedii*, compared with the control site which was dominated by the mudsnail *Peringia ulvae*, oligochaete *T. benedii* and aggregations of *Ampharetidae lindstroemi*, a polychaete. Differences in the relative abundance of certain species between the control and dredged sites were evident, including *P. ulvae*, *Cerastoderma edule* and *Capitella* sp. (Figure 6). Generally, there a higher abundance of small annelid worms in the dredged site, whilst the abundance of molluscs was greater in the control site. These results are in broad agreement with outcomes of recent work on the impacts of novel dredge gear in Poole Harbour, where reductions in mollusc species and increase in opportunistic polychaete species were also reported. Whilst relative abundances show clear differences across treatment areas, this cannot be considered to be a result of the three management regimes.

Multidimensional scaling ordination of infaunal samples show a clear grouping of control samples, whilst samples from dredged sites were less closely grouped, demonstrating increased variation in patches from the dredged site when compared to the control site. Multivariate analyses on community composition revealed no effect of treatment (impact versus control), station (north versus south) or sampling time (November versus April), however there was a significant effect of individual sampling patch (5 within each station). This indicates high levels of spatial variation and patchiness in community composition, although this cannot be attributed to an effect of dredging activity. A significant interaction between sampling time and patch was also reported, indicating the level of change in community composition between sampling times varies between patches. As such, these results demonstrate the patchiness of the environment, which could have been mistaken as a treatment effect (i.e. caused by dredging) if variation at a smaller spatial scale (between scales and patches) was not accounted for using a spatially nested BACI survey design. High levels of variability observed across stations and treatments may be attributed to differences in environmental conditions, rather than the three management regimes.
Having said this, disturbance events, either natural or human-induced, can increase variability which could be in the case in dredged sites where higher variability was evident.

Interpretation of these results should be in the context of natural variability within the survey area, the short monitoring period and lack of management due to unforeseen delays in the introduction of the new byelaws.

7.2.3 Removal of target species

Dredging for clams leads to a reduction in the average clam length, with the heaviest fished areas leading to the largest decreases (Clarke, 2018). During a dredging season of six months, up to 95 percent of the legal harvestable clams (>35mm) as well as a large proportion of those slightly undersize (30 – 35 mm) can be removed. However, recruitment can continue to take place irrespective of harvesting intensity. The change in abundance of clams after a dredge season is much greater in a heavily fished site (Clarke, 2018). Similarly, the level of secondary productivity is significantly lower in a heavily dredged site compared to a control, and site dredged at moderate intensity (Clarke, 2018).

7.2.4 Smothering and siltation rate changes; Changes in suspended solids

The resuspension of sediment can impact upon benthic communities through smothering, burial and increased turbidity. These effects may extend to organisms living a distance away from the fished area (Kyte & Chew, 1975). If high levels of sediment are resuspended and exposure to such events is regular, impacts may be severe (Mercaldo-Allen & Goldberg, 2011). Increased turbidity can inhibit respiratory and feeding functions of benthic organisms, in addition to causing hypoxia or anoxia (Morgan & Chuenpagdee, 2003). Sediment resuspension can jeopardise the survival of bivalves and fish as a result of clogged gills and inhibition of burrowing activity (Dorsey & Pederson, 1998). Small organisms and immobile species are particularly vulnerable to smothering (Manning, 1957). A redistribution of finer sediment can also hinder the settlement of organisms if shell or cultch material is buried (Tarnowski, 2006). The severity of such impacts are largely determined by sediment type, the level of sediment burden and the tolerance of organisms which is largely related to their biology (i.e. size, relationship to substrate, life history, mobility) (Coen, 1995).

7.2.5 Changes in prey availability

Prey availability can be modified directly through the targeted removal of shellfish species that also form a prey item of designated bird species; and indirectly through physical disturbance or damage to supporting habitats which can result in changes to community structure, the removal and mortality of non-target organisms through interaction with fishing gear and smothering of prey species through increased sedimentation (Natural England, 2014).
**Direct competition**

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. 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 where cockle fisheries are known to 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).

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 Burrey 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 Burrey 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 spend 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 than hard-raking or hand-picking (Stillman et al., 2001). Sixty suction dredges could kill all the Burrey 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).

Indirect effects

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 studies investigating the effect of intertidal dredging, it was common to observe 100% removal of biogenic fauna (Collie et al., 2000). This was observed in an experimental study conducted in Langstone Harbour, where the fauna were seen to either be completely removed or considerably reduced by the dredging activity using a modified oyster dredge (EMU, 1992). In the same study, species richness was also found to decrease with a mean number of 6.5 species in the control site compared with 4.4 in the dredge site (EMU, 1992). 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 became particularly apparent 21 and 45 days after harvest (Figure 4). 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).

In areas that are intensively fished (more than three times per year), the faunal community is likely to be maintained in a permanently altered state and inhabited by fauna adapted to frequent physical disturbance (Collie et al., 2000). There is likely to be a shift from communities dominated by relatively high biomass species towards the dominance of high abundances of small-sized organisms (Collie et al., 2000). Kaiser et al., 2000 reported that regular fishing activity, in the vicinity of the Isle of Man, excluded large-bodied individuals and the resulting benthic community was dominated by smaller bodied organisms more adapted to physical disturbance (Johnson, 2002). Whilst dredging causes direct mortality to small and large infaunal and epifaunal organisms, many small benthic organisms such as crustaceans, polychaetes and molluscs, have short generation times and high fecundities, both of which enhance their capacity for rapid recolonization (Coen, 1995). These shifts in the faunal communities can be reflected in the associated waterbird assemblage (Atkinson et al., 2010). In the Wash, a lack of recruitment and heavy fishing pressure led to low stock levels of cockles and mussels (Bannister, 1998; 1999). During this period of stock collapse, the waterbird assemblage underwent a shift from one dominated by species with a high proportion of bivalves and ‘other’ prey such as crustaceans and fish in their diet, to those with a higher...
proportion of worms, with the oystercatcher, knot and shelduck showing the highest levels of decline (Atkinson et al., 2010). Under intense dredging pressure, research suggests that benthic invertebrates such as worms, which are characterised by rapid growth and short generation times, should predominate over species such as bivalves with slower growth and longer generation times (Atkinson et al., 2010).

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, mobile 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. 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

Figure 7. 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
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.

An ongoing study conducted by Leo Clarke at the University of Bournemouth investigated the impacts of clam dredging in Poole Harbour using a BACI (Before-After-Control-Impact) methodology. 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 ('chronic' fishing site); an area that has historically been closed to dredging but will be opened for a five month season ('acute' fishing site); and an area that remains permanently closed to dredging (control site). Interim results indicate a significant effect of site (regardless of time) and of time (regardless of site). Organic content and the volume of fine sediments were found to be highest in the control site and lowest in the chronic fishing site during the study period. Additionally, both organic content and fine sediment volume were observed to decrease in all sites during the study. However, the interaction term between time and site, which would indicate an overall impact of dredging activity in terms of relative change, appears non-significant. While incomplete at the time of writing, the analysis of biological assemblage data indicates that a significant shift in community structure occurred within the acute fishing site during the study period. This shift is characterised by an increase in the abundance of polychaete worm species, but does not constitute a change to the overall benthic composition observed during the study.

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 Lanice 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 Nephys 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).

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 recovery is slow, 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. Annulids 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 recover 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 reconolonization 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).

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 12). 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.

Ferns et al. (2000) examined the recovery rates of individual species and found the rate of recovery varied between sediment types (muddy sand versus clean sand). Recovery rates reported for relevant species (i.e. those likely to form prey species) are presented in Annex 10.

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 know 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 7
provides details of prey items taken by designated bird species within the Chichester and Langstone Harbours 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. 1996a & b). 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 4. Typical prey items known to be taken by designated bird species in the three SPAs (Chichester and Langstone Harbours, Portsmouth Harbour and Solent and Southampton Water). Information on general prey preference was obtained from the SPA Tool Kit. Specific information on prey species was taken from the Solent EMS Regulation 33 Advice and from Portsmouth Harbour SPA Draft Regulation 35 Advice.

<table>
<thead>
<tr>
<th>Common Name</th>
<th>Latin Name</th>
<th>General Prey Preference</th>
<th>Prey Species</th>
</tr>
</thead>
<tbody>
<tr>
<td>Black-tailed godwit</td>
<td>Limosa limosa</td>
<td>Insects, plants/grasses/seeds</td>
<td>Hediste diversicolor, Cerastoderma edule, Macoma baltica, Cardium, Nereis</td>
</tr>
<tr>
<td>Grey plover</td>
<td>Pluvialis squatarola</td>
<td>Molluscs, crustaceans, worms</td>
<td>Cerastoderma edule, Nereis diversicolor, Macoma baltica, Hydrobia ulvae, Arenicola marina, Retusa obtusa, Corophium volutator</td>
</tr>
<tr>
<td>Sanderling</td>
<td>Calidris alba</td>
<td>Molluscs, crustaceans, worms</td>
<td>Scolelepis squamata, Bathyporeia, Eurydice pulchra, Cerastoderma edule, Hediste diversicolor, Hydrobia spp.</td>
</tr>
<tr>
<td>Dunlin</td>
<td>Calidris alpina</td>
<td>Molluscs, insects, worms</td>
<td>Macoma, Hydrobia spp., Nereis, Crangon, Carcinus</td>
</tr>
<tr>
<td>Redshank</td>
<td>Tringa totanus</td>
<td>Molluscs, crustaceans, insects, worms</td>
<td>Corophium, Hydrobia, Nereis</td>
</tr>
<tr>
<td>Dark-bellied brent goose</td>
<td>Branta bernicla bernicla</td>
<td>Plants/grasses/seeds</td>
<td>Zostera spp., Enteromorpha, Ulva lactuca</td>
</tr>
<tr>
<td>Shelduck</td>
<td>Tadorna tadorna</td>
<td>Molluscs, crustaceans, insects</td>
<td>Hydrobia ulvae, Enteromorpha</td>
</tr>
<tr>
<td>Teal</td>
<td>Anas crecca</td>
<td>Plants/grasses/seeds</td>
<td>Enteromorpha spp., Ulvae spp.</td>
</tr>
<tr>
<td>Species</td>
<td>Scientific Name</td>
<td>Diet</td>
<td>Notes</td>
</tr>
<tr>
<td>-------------------------</td>
<td>---------------------</td>
<td>-----------------------------------</td>
<td>--------------------------------------------</td>
</tr>
<tr>
<td>Ringed plover</td>
<td>Charadrius hiaticula</td>
<td>Molluscs, crustaceans, insects, worms</td>
<td>Gammarus spp., Tubifex</td>
</tr>
<tr>
<td>Curlew</td>
<td>Numenius arquata</td>
<td>Molluscs, crustaceans, insects, worms</td>
<td>Lack of information regarding prey species.</td>
</tr>
<tr>
<td>Bar-tailed godwit</td>
<td>Limosa lapponica</td>
<td>Insects, worms</td>
<td>Nereis, Arenicola spp., Macoma, Cardium</td>
</tr>
<tr>
<td>Turnstone</td>
<td>Arenaria interpres</td>
<td>Insects, worms</td>
<td>Cerastoderma edule, Corophium, Nerine4</td>
</tr>
<tr>
<td>Turnstone</td>
<td>Arenaria interpres</td>
<td>Insects, worms</td>
<td>Cerastoderma edule, Corophium, Nerine4</td>
</tr>
<tr>
<td>Turnstone</td>
<td>Arenaria interpres</td>
<td>Insects, worms</td>
<td>Cerastoderma edule, Corophium, Nerine4</td>
</tr>
<tr>
<td>Wigeon</td>
<td>Anas penelope</td>
<td>Plants/grasses/seeds</td>
<td>Enteromorpha spp., Ulva spp.</td>
</tr>
<tr>
<td>Pintail</td>
<td>Anas acuta</td>
<td>Insects, plants/grasses/seeds</td>
<td>Lack of information regarding prey species.</td>
</tr>
<tr>
<td>Shoveler</td>
<td>Anas clypeata</td>
<td>Insects</td>
<td>Lack of information regarding prey species.</td>
</tr>
<tr>
<td>Red-breasted merganser</td>
<td>Mergus serrator</td>
<td>Fish</td>
<td>Gobies, flatfish, herring fry (&lt;11cm), shrimp, sticklebacks, Nereis spp.</td>
</tr>
<tr>
<td>Little egret</td>
<td>Egretta garzetta</td>
<td>Fish, amphibians, insects</td>
<td>Lack of information regarding prey species.</td>
</tr>
</tbody>
</table>

1 Information obtained from Durrell & Kelly (1990)
2 Information obtained from Cox et al. (2014)
3 Information obtained from European Commission (2009)
4 Information obtained from Brearey (1982)

7.2.6 Visual Disturbance

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, 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-tailed 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).

Species-specific response

Responsiveness to disturbance is thought to be a species-specific trait (Yasué, 2005). Garthe 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 (Garthe & 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 8 provides available sensitivity scores of species within Chichester and Langstone Harbours SPA, with details of scores given for the species vulnerability to disturbance by ship and helicopter traffic.
Table 5. Sensitivity scores for designated bird species in the Three SPAs (Chichester and Langstone Harbour, Portsmouth Harbour and Solent and Southampton Water) 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).

<table>
<thead>
<tr>
<th>Species</th>
<th>Total sensitivity score</th>
<th>Disturbance by ship and helicopter traffic (1 – very flexible in habitat use, 5 – reliant on specific habitat characteristics)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dark-bellied Brent Goose</td>
<td>21.7</td>
<td>2</td>
</tr>
<tr>
<td>Black-tailed godwit</td>
<td>9.9</td>
<td>1</td>
</tr>
<tr>
<td>Red-breasted Merganser</td>
<td>21.0</td>
<td>3</td>
</tr>
<tr>
<td>Shoveler</td>
<td>6.7</td>
<td>1</td>
</tr>
<tr>
<td>Redshank</td>
<td>6.7</td>
<td>1</td>
</tr>
<tr>
<td>Pintail</td>
<td>6.3</td>
<td>1</td>
</tr>
<tr>
<td>Bar-tailed Godwit</td>
<td>5.7</td>
<td>1</td>
</tr>
<tr>
<td>Curlew</td>
<td>5.7</td>
<td>1</td>
</tr>
<tr>
<td>Ringed plover</td>
<td>5.3</td>
<td>1</td>
</tr>
<tr>
<td>Sanderling</td>
<td>5.3</td>
<td>1</td>
</tr>
<tr>
<td>Shelduck</td>
<td>5.3</td>
<td>1</td>
</tr>
<tr>
<td>Grey plover</td>
<td>4.7</td>
<td>1</td>
</tr>
<tr>
<td>Teal</td>
<td>3.8</td>
<td>1</td>
</tr>
<tr>
<td>Dunlin</td>
<td>3.3</td>
<td>1</td>
</tr>
<tr>
<td>Wigeon</td>
<td>2.7</td>
<td>1</td>
</tr>
</tbody>
</table>

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 species-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 Chichester and Langstone Harbours SPA, with Table 9 providing details of response distances in relation to different types of activities.
### Table 6. Distances from disturbance stimuli (in metres) at which study waterbird species took flight. Taken from Kirby et al., 2004 in WWT Consulting 2012.

<table>
<thead>
<tr>
<th>Study</th>
<th>Activity</th>
<th>Distance measure</th>
<th>Species</th>
<th>Median</th>
<th>Range</th>
<th>Mean</th>
<th>Range</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tydeman 1978</td>
<td>Boats</td>
<td>Min</td>
<td>Brent goose</td>
<td>105</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Cooke 1980</td>
<td>Researcher</td>
<td>Mean</td>
<td>Shelduck</td>
<td>126</td>
<td></td>
<td>148</td>
<td>250</td>
<td></td>
</tr>
<tr>
<td>Tensen and van Zoest</td>
<td>People</td>
<td>Mean</td>
<td>Wigeon</td>
<td>115</td>
<td></td>
<td>230</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wattmough 1983[b,b]</td>
<td>Researcher</td>
<td>Mean</td>
<td>Teal</td>
<td>400</td>
<td>86</td>
<td></td>
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<tr>
<td>Smit and Visser 1993</td>
<td>People</td>
<td>Mean</td>
<td>Shoveler</td>
<td>200</td>
<td>126</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Smit and Visser 1993</td>
<td>Kayaks</td>
<td>Mean</td>
<td>Ringed plover</td>
<td>47</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Smit and Visser 1993</td>
<td>Surfers</td>
<td>Mean</td>
<td>Grey plover</td>
<td>124</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Smit and Visser 1993</td>
<td></td>
<td>Mean</td>
<td>Dunlin</td>
<td>30</td>
<td></td>
<td>77/163</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Bar-tailed Godwit</td>
<td>75</td>
<td>40</td>
<td>107/219</td>
<td>200</td>
<td>230</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Curlew</td>
<td>95</td>
<td></td>
<td>211/339</td>
<td>220</td>
<td>400</td>
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<td></td>
<td></td>
<td></td>
<td>Redshank</td>
<td>92</td>
<td>95</td>
<td>175</td>
<td>260</td>
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<td></td>
<td></td>
<td></td>
<td>Turnstone</td>
<td>47</td>
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</tbody>
</table>

### Table 7. Comparison, by species, of distances (in metres) at which no response or disturbance events (i.e. alert, short walk/swim, short flight or major flight) occurred to recreational activities in the Solent. Significance column indicates results from Mann-Whitney statistical tests. Source: Lilley et al., 2010.

<table>
<thead>
<tr>
<th>Species</th>
<th>No response</th>
<th>Disturbance occurred</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Median</td>
<td>Range</td>
<td>Median</td>
</tr>
<tr>
<td>Brent goose</td>
<td>97</td>
<td>17-215</td>
<td>51.5</td>
</tr>
<tr>
<td>Redshank</td>
<td>90</td>
<td>20-200</td>
<td>75-150</td>
</tr>
<tr>
<td>Curlew</td>
<td>100</td>
<td>40-200</td>
<td>75</td>
</tr>
<tr>
<td>Turnstone</td>
<td>80</td>
<td>16-200</td>
<td>50</td>
</tr>
<tr>
<td>Grey plover</td>
<td>80.5</td>
<td>22.5-200</td>
<td>75</td>
</tr>
<tr>
<td>Little egret</td>
<td>150</td>
<td>40-200</td>
<td>75</td>
</tr>
<tr>
<td>Wigeon</td>
<td>125</td>
<td>45-200</td>
<td>75.5</td>
</tr>
</tbody>
</table>
In a study by Liley et al. (2010), which formed phase II of the Solent Disturbance & Mitigation Project, there was no clear set-back distance that would result in no response. There were instances where no response occurred within a few metres and there were instances where major flight occurred when birds when over 200 m from the disturbance source (Liley et al., 2010). Having said this, the proportion of events resulting in the displacement of birds declined beyond 100 m (Liley et al., 2010).

**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).
### 7.3 Feature-Specific Seasonality Table

Table 9 below indicates (highlighted in grey) when significant numbers of each mobile designated feature are most likely to be present at the site during a typical calendar year. Periods highlighted in grey are likely to require consideration of mitigation to minimise impacts to qualifying bird features during these principal periods of site usage by those features. The months which are not highlighted in grey do not necessarily indicate when features are absent, rather that features may be present in less significant numbers than in typical years.

Table 8. Presence of mobile designated features in the three Solent SPAs (Chichester and Langstone Harbour, Portsmouth Harbour and Solent and Southampton Water). Grey indicates periods of presence in significant numbers whereas blank (white) indicates either periods of absence or of presence but only in numbers of less significance (Natural England 2018, 2018a & 2018b)

<table>
<thead>
<tr>
<th>Site</th>
<th>Feature name</th>
<th>Life Stage</th>
<th>Jan</th>
<th>Feb</th>
<th>Mar</th>
<th>Apr</th>
<th>May</th>
<th>Jun</th>
<th>Jul</th>
<th>Aug</th>
<th>Sep</th>
<th>Oct</th>
<th>Nov</th>
<th>Dec</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chichester and Langstone Harbour</td>
<td>Bar-tailed godwit</td>
<td>Non-breeding</td>
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<td>Solent and Southampton Water</td>
<td>Black-tailed godwit</td>
<td>Non-breeding</td>
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<tr>
<td>Portsmouth Harbour</td>
<td>Black-tailed godwit</td>
<td>Non-breeding</td>
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<tr>
<td>Chichester and Langstone Harbour</td>
<td>Curlew</td>
<td>Non-breeding</td>
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<tr>
<td>Solent and Southampton Water &amp; Chichester and</td>
<td>Dark-bellied Brent goose</td>
<td>Non-breeding</td>
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<td>Langstone Harbour</td>
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<td>Portsmouth Harbour</td>
<td>Dark-bellied Brent goose</td>
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<td>Langstone Harbour only</td>
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<td>Portsmouth Harbour</td>
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<tr>
<td>Chichester and Langstone Harbour</td>
<td>Redshank</td>
<td>Non-birding</td>
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<tr>
<td>Solent and Southampton Water &amp; Chichester and Langstone Harbour</td>
<td>Ringed plover</td>
<td>Non-birding</td>
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<tr>
<td>Chichester and Langstone Harbour</td>
<td>Sanderling</td>
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<tr>
<td>Chichester and Langstone Harbour</td>
<td>Shoveler</td>
<td>Non-birding</td>
<td></td>
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</tr>
<tr>
<td>Solent and Southampton Water &amp; Chichester and Langstone Harbour</td>
<td>Teal</td>
<td>Non-birding</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Chichester and Langstone Harbour</td>
<td>Turnstone</td>
<td>Non-birding</td>
<td></td>
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<tr>
<td>Chichester and Langstone Harbour</td>
<td>Wigeon</td>
<td>Non-birding</td>
<td></td>
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<tr>
<td>Chichester and Langstone Harbour</td>
<td>Common tern, Breeding</td>
<td>Breeding</td>
<td></td>
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</tr>
</tbody>
</table>
Solent and Southampton Water & Chichester and Langstone Harbour

| Solent and Southampton Water & Chichester and Langstone Harbour | Mediterranean gull | Breeding |

| Solent and Southampton Water | Roseate tern | Breeding |

| Solent and Southampton Water & Chichester and Langstone Harbour | Sandwich tern | Breeding |

### 7.4 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 Protection Areas (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.

An indication of the condition of site supporting habitats can be inferred, if available, from assessments of Sites of Specific Scientific Interest (SSSIs) that underpin the SPA. There are a number of SSSIs which exist in the area covered by the three SPAs (Chichester and Langstone Harbours, Portsmouth Harbour and Solent and Southampton Water), and these, along with relevant feature condition assessments are summarised in Table 6. Note that only SSSI sites (and the units therein) have been chosen where shellfish dredging is known to occur.
7.4.1 Condition Assessments

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 for the Solent Maritime SAC has been supplied to Southern IFCA to aid with the completion of the HRA. Much of the area of the Solent Maritime SAC overlap with that of Chichester and Langstone Harbour SPA and Solent and Southampton water SPA and therefore the condition of the SPA supporting habitats can be inferred from the analysis of the condition of the SAC. An indication of the condition of site interest features can be inferred, if available, from assessments of Sites of Specific Scientific Interest (SSSIs) that underpin SPAs. The SSSI units which exist in the area covered by the Portsmouth Harbour SPA, along with relevant feature condition assessments from the Solent Maritime SAC are summarised in Table 6. Note that only SSSI sites (and the units therein) have been chosen where shellfish dredging is known to occur.

Table 9. Condition assessments of SAC features and Sub features (which overlap with Chichester and Langstone Harbour and Solent and Southampton Water SPA supporting habitats) and SSSI units within Portsmouth Harbour SPA, the Three SPAs (Langstone Harbour Only, Portsmouth Harbour and Solent and Southampton Water).

<table>
<thead>
<tr>
<th>Feature</th>
<th>Sub-feature</th>
<th>Condition</th>
<th>Confidence</th>
<th>Adverse Condition Reasons</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sandbanks which are slightly covered by sea water all the time</td>
<td>Subtidal coarse sediment</td>
<td>Unfavourable No Change</td>
<td>Medium</td>
<td>Introduction or spread of invasive non-indigenous species (INIS)</td>
</tr>
<tr>
<td></td>
<td>Subtidal mixed sediments</td>
<td>Unfavourable No Change</td>
<td>Medium</td>
<td>Nutrient enrichment</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Transition elements &amp; organo-</td>
</tr>
<tr>
<td>Environment</td>
<td>Impacted Ecological Habitat</td>
<td>Development</td>
<td>Threats</td>
<td></td>
</tr>
<tr>
<td>----------------------</td>
<td>--------------------------------------</td>
<td>-------------</td>
<td>-------------------------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>Subtidal sand</td>
<td>Subtidal seagrass beds</td>
<td>Unfavourable</td>
<td>Abrasion/disturbance of the substrate on the surface of the seabed</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Unknown</td>
<td>Transition elements &amp; organo-metal (e.g. TBT) contamination</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Medium</td>
<td>Nutrient enrichment</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Introduction or spread of invasive non-indigenous species (INIS)</td>
<td></td>
</tr>
<tr>
<td>Estuaries</td>
<td>Intertidal coarse sediment</td>
<td>Unfavourable</td>
<td>Nutrient enrichment</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Intertidal mixed sediments</td>
<td>Unfavourable</td>
<td>Transition elements &amp; organo-metal (e.g. TBT) contamination</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Intertidal mud</td>
<td>Unfavourable</td>
<td>Abrasion/disturbance of the substrate on the surface of the seabed</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Intertidal sand and muddy sand</td>
<td>Unfavourable</td>
<td>Transition elements &amp; organo-metal (e.g. TBT) contamination</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Intertidal seagrass beds</td>
<td>Unfavourable</td>
<td>Nutrient enrichment</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Unknown</td>
<td>Abrasion/disturbance of the substrate on the surface of the seabed</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Medium</td>
<td>Transition elements &amp; organo-metal (e.g. TBT) contamination</td>
<td></td>
</tr>
<tr>
<td>Environment</td>
<td>Sediment Type</td>
<td>Impact</td>
<td>Risk</td>
<td>Effects</td>
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<td>----------------------------------</td>
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<td>--------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Estuaries</td>
<td>Subtidal coarse sediment</td>
<td>Unfavourable No Change</td>
<td>Medium</td>
<td>Nutrient enrichment, Transition elements &amp; organo-metal (e.g. TBT) contamination, Introduction or spread of invasive non-indigenous species (INIS)</td>
</tr>
<tr>
<td></td>
<td>Subtidal mixed sediments</td>
<td>Unknown</td>
<td>Medium</td>
<td>Abrasion/disturbance of the substrate on the surface of the seabed, Transition elements &amp; organo-metal (e.g. TBT) contamination</td>
</tr>
<tr>
<td></td>
<td>Subtidal sand</td>
<td>Unfavourable Unknown</td>
<td>Medium</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Subtidal seagrass beds</td>
<td>Unfavourable No Change</td>
<td>Medium</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Intertidal coarse sediment</td>
<td>Unfavourable No Change</td>
<td>Medium</td>
<td></td>
</tr>
<tr>
<td>Mudflats and sandflats not</td>
<td>Intertidal mixed sediments</td>
<td>Unfavourable No Change</td>
<td>Medium</td>
<td></td>
</tr>
<tr>
<td>covered by seawater at low tide</td>
<td></td>
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</tbody>
</table>
Overall, the condition assessment appears to suggest that sediments within SAC/SPAs are unfavourable no change, with a number unfavourable - unknown. It appears that the reasons are largely down to nutrient enrichment, transition elements & organo-metal (e.g. TBT) contamination, abrasion/disturbance of the substrate on the surface of the seabed and introduction or spread of invasive non-indigenous species (INIS). The features are experiencing elevated nutrient levels, elevated aqueous contaminant levels including TBT and low Infaunal Quality Index (IQI) scores. Elevated contaminant levels are most likely due to historic use of antifouling paint rather than current activity levels. Furthermore, there are high levels of invasive non-native species most notably the slipper limpet (Crepidula Fornicata) found in particularly in the subtidal sediments. Seagrass beds are showing a reduced extent when compared to historic extent and distribution.

<table>
<thead>
<tr>
<th>SSSI Site Name</th>
<th>Unit Number</th>
<th>Unit Name</th>
<th>Condition</th>
<th>Condition Threat Risk</th>
<th>Habitat</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lee-on-the-solent to itchen estuary</td>
<td>9 and 16</td>
<td>HAMBLE SPIT and CHILLING FORESHORE</td>
<td>Favourable</td>
<td>High</td>
<td>LITTORAL SEDIMENT</td>
<td></td>
</tr>
</tbody>
</table>
Assessed in combination with Southampton Water, the Hamble sub-estuary contributes to achieving WFD Moderate status on mean winter inorganic nitrogen and WFD High status on phytoplankton. Within the Hamble sub-estuary the abundance of macroalgae achieves WFD Moderate status and there can be areas of dense opportunistic green macroalgae (>75% cover density) and a wet biomass exceeding 1 kg/m². The water environment of the unit is assessed as unfavourable for the interest features on the water body due to its inorganic nitrogen and biological indication of eutrophication shown by macroalgae abundance. A large part of the nitrogen load input is carried by the River Hamble and by tidal flow from Southampton Water and the Solent. There is poor evidence of a reducing nutrient status adequate to substantially prevent the growth of dense macroalgae mats.

Nutrient source trends, and efficacy of measures across the Solent are subject to ongoing analysis through the Judicial Review consent order implementation and other programmes. Condition trend may therefore be subject to change by end of March 2018.

North Solent

<table>
<thead>
<tr>
<th>Site Code</th>
<th>Site Name</th>
<th>Status</th>
<th>Trend</th>
<th>Condition</th>
<th>Threat</th>
</tr>
</thead>
<tbody>
<tr>
<td>15</td>
<td>OPEN COAST (11); HCC</td>
<td>Unfavourable</td>
<td>No identified</td>
<td>Condition Initial</td>
<td>LITTORAL ROCK</td>
</tr>
</tbody>
</table>

233 ha of intertidal sediment was mapped and there is no evidence of significant decline in extent. Five distinct biotopes were identified as well as a mussel bed in Stanswood Bay. The character of intertidal sediment is variable and appears influenced by the interplay of differential rates of erosion between defended and undefended sections. In defended sections, active erosion of the unconsolidated Headon Hill formation sands and gravel exposed in the cliffs is evident in some areas (e.g., at Lepe Beach). The sediments along the open coast consist of predominately medium to coarse sand with variable mixed gravel. The fine (sand) fraction of the sediments tends to be moderately to well sorted, and reflects the prevailing low wave energy. At several locations active erosion of salt marsh is apparent with significant areas of marsh reverting to mudflat, particularly around the seaward areas of the Beaulieu River estuary. Fringing marsh areas do not appear to be eroding to the same degree in the estuary as in more exposed sections of the open coast. However, there is observational evidence to suggest intrusion of saline water in the form of dying mature trees. There are marked differences between faunal diversity profiles of sediment in the Beaulieu estuary and the open coast. The upper estuarine sediment has low species richness and variable abundance. In contrast, sediment along the open coast supports a high diversity of fauna in reasonable abundance. Fauna recorded includes various molluscs, crustaceans and polychaetes, with no particularly dominant taxa. Of note is the presence of the Northern Quahog at Calshot. This introduced bivalve has its largest remaining population in Britain in the Solent. The sediment is characterised by abundant laver spire shell Hydrobia ulvae. Zostera marina was found in Stanswood Bay, confirming

its continued presence. It was not observed at Beaulieu possibly indicating a decline in distribution.

**Hythe to Calshot Marshes**

<table>
<thead>
<tr>
<th>3 and 5</th>
<th>HWT / ESSO (N) SALTMARSHES and ASHLETT / FAWLEY SALTMARSHES</th>
<th>Unfavourable - Recovering</th>
<th>High</th>
</tr>
</thead>
</table>

Assessed in combination with other units in Southampton Water, this unit achieves WFD Moderate status on mean winter inorganic nitrogen and WFD High status on phytoplankton. The abundance of macroalgae along Southampton Water as a whole achieves WFD Good (borderline) status, but in some years there can be areas of dense opportunistic green macroalgae (>75% cover density) and a wet biomass exceeding 1 kg/m². The water environment of the unit is assessed as borderline favourable for the interest features on the weight of evidence on inorganic nitrogen and some but not consistently strong biological indication of eutrophication shown by macroalgae abundance. A large part of the nitrogen load input is carried by the inflowing rivers and by tidal flow from the Solent. The unit is considered at future risk of failing a favourable situation on the water environment as it is unclear whether the nutrient status is adequate to substantially prevent the growth of dense macroalgae mats with a wet weight biomass exceeding WFD Good status, especially if there is change in environmental conditions.

**Hythe to Calshot Marshes**

<table>
<thead>
<tr>
<th>6</th>
<th>CALSHOT MARSHES LNR</th>
<th>Unfavourable - No change</th>
<th>Medium</th>
</tr>
</thead>
</table>

Assessed in combination with other units in Southampton Water, this unit achieves WFD Moderate status on mean winter inorganic nitrogen and WFD High status on phytoplankton. The abundance of macroalgae along Southampton Water as a whole achieves WFD Good (borderline) status, but in some parts where environmental conditions are probably more conducive to macroalgae growth, such as along tidal saltmarsh creeks within this unit, there can be a wider presence of dense opportunistic green macroalgae (>75% cover density) and this may have a wet biomass exceeding 1 kg/m². The water environment of the unit is assessed as unfavourable for the interest features on the on the weight of evidence on inorganic nitrogen and biological indication of eutrophication shown by macroalgae abundance. A large part of the nitrogen load input is carried by the inflowing rivers and by tidal flow from the Solent. There is poor evidence of a reducing nutrient status adequate to substantially prevent the growth of dense macroalgae mats.

**Langstone Harbour**

<table>
<thead>
<tr>
<th>6 and 13</th>
<th>LANGSTONE HBR EAST and North Binness Island</th>
<th>Unfavourable - Recovering</th>
<th>High</th>
</tr>
</thead>
</table>

Assessed in combination with other Langstone Harbour units, this part of the harbour achieves WFD Good (borderline) status on mean winter inorganic nitrogen, WFD High status on phytoplankton and WFD Good (borderline) status on opportunistic green macroalgae. However, in this unit there can be areas with a dense cover of opportunistic green macroalgae (>75% cover density), more so than in some parts of the harbour. The water environment of the unit is assessed as unfavourable for the interest features on the weight of evidence on inorganic nitrogen and biological indication of eutrophication shown by macroalgae abundance. A large part of the nitrogen load input is carried by the inflowing rivers and by tidal flow from the Solent. There is poor evidence of a reducing nutrient status adequate to substantially prevent the growth of dense macroalgae mats.

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SIFCA Reference: SIFCA/HRA/_PPSDPByelaw2018
<table>
<thead>
<tr>
<th>Portsmouth Harbour</th>
<th>8, 23, 24</th>
<th>Frater, Portchester and Bomketch Lake</th>
<th>Unfavourable - No change</th>
<th>Medium</th>
<th>Littoral Sediment</th>
</tr>
</thead>
</table>

Assessed in combination with other Portsmouth Harbour units, this part of the harbour achieves WFD Moderate status on mean winter inorganic nitrogen and WFD Good to High status on phytoplankton. There can be areas of dense opportunistic green macroalgae (>75% cover density) in this unit, and across the harbour as a whole the abundance of macroalgae achieves WFD Moderate status.

The water environment of the unit is assessed as unfavourable for the interest features on the weight of evidence on elevated levels of inorganic nitrogen and biological indication of eutrophication shown by the abundance of macroalgae. There is poor evidence of a reducing nutrient status adequate to substantially prevent the growth of dense macroalgae mats. A large part of the nitrogen load input is carried by tidal flow from the Solent but relatively very little by minor rivers into the head of the harbour.

<table>
<thead>
<tr>
<th>Portsmouth Harbour</th>
<th>14, 18</th>
<th>Port Solent to Horsea Island and Whale Island</th>
<th>Unfavourable - Recovering</th>
<th>Medium</th>
<th>Littoral Sediment</th>
</tr>
</thead>
</table>

Assessed in combination with other Portsmouth Harbour units, this part of the harbour achieves WFD Moderate status on mean winter inorganic nitrogen and WFD Good to High status on phytoplankton. There is not generally a dense cover of opportunistic green macroalgae (>75% cover density) in this unit but dense mats occur elsewhere and the harbour overall fails to achieve WFD Good status on macroalgae.

The water environment of the unit is assessed as borderline favourable for the interest features on the weight of evidence on elevated levels of inorganic nitrogen but here with no strong biological indication of eutrophication shown by phytoplankton and macroalgae. A large part of the nitrogen load input is carried by tidal flow from the Solent but relatively very little by minor rivers into the head of the harbour.

The unit is considered at future risk of failing a favourable situation on the water environment as it is unclear whether the nutrient status is adequate to substantially prevent the growth of dense macroalgae mats in this part of the harbour if there is change in environmental conditions.


Page 59 of 236
Overall, the SSSI condition assessments appear to suggest that littoral sediments within selected SSSI sites are unfavourable, but recovering or no change. When examining reasons for this, it appears from the condition assessment comment that the reasons for this are largely down to the weight of evidence on inorganic nitrogen and biological indication of eutrophication shown by macroalgae abundance and active saltmarsh erosion.

7.4.2 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/](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. This identifies nine species which exhibit a strong or site-specific decline, the details of which are given in table 13.

Table 10. Population abundance targets for the bird species found in the three Solent SPAs (Chichester and Langstone Harbours, Portsmouth Harbour and Solent and Southampton Water). Please note all information presented in this table has been taken from Natural England’s Conservation Advice Packages available at: [https://designatedsites.naturalengland.org.uk/](https://designatedsites.naturalengland.org.uk/). These do not represent condition assessments.

<table>
<thead>
<tr>
<th>Site</th>
<th>Species</th>
<th>Target</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chichester and Langstone Harbour</td>
<td>Bar-tailed godwit</td>
<td>Restore</td>
<td>The population size (as measured by the delta GAM mean metric) has declined by between 25% and 50%.</td>
</tr>
<tr>
<td>Chichester and Langstone Harbour</td>
<td>Curlew</td>
<td>Maintain</td>
<td>The population size (as measured by the delta GAM mean metric) has increased since classification.</td>
</tr>
<tr>
<td>Chichester and Langstone Harbour</td>
<td>Dark-bellied brent goose</td>
<td>Maintain</td>
<td>The population size (as measured by the delta GAM mean metric) has not decreased by more than 25% since classification.</td>
</tr>
<tr>
<td>Chichester and Langstone Harbour</td>
<td>Dunlin</td>
<td>Restore</td>
<td>The population size (as measured by the delta GAM mean metric) has declined by between 25% and 50%.</td>
</tr>
<tr>
<td>Chichester and Langstone Harbour</td>
<td>Grey plover</td>
<td>Restore</td>
<td>The population size (as measured by the delta GAM mean metric) has declined by between 25% and 50%.</td>
</tr>
<tr>
<td>Chichester and Langstone Harbour</td>
<td>Pintail</td>
<td>Maintain</td>
<td>The population size (as measured by the delta GAM mean metric) has increased since classification.</td>
</tr>
<tr>
<td>Location</td>
<td>Species</td>
<td>Status</td>
<td>Population Size Change</td>
</tr>
<tr>
<td>--------------------------------</td>
<td>--------------------------------</td>
<td>-----------</td>
<td>------------------------</td>
</tr>
<tr>
<td>Chichester and Langstone Harbour</td>
<td>Red-breasted merganser</td>
<td>Maintain</td>
<td>The population size (as measured by the delta GAM mean metric) has increased since classification.</td>
</tr>
<tr>
<td>Chichester and Langstone Harbour</td>
<td>Redshank</td>
<td>Maintain</td>
<td>The population size (as measured by the delta GAM mean metric) has not decreased by more than 25% since classification.</td>
</tr>
<tr>
<td>Chichester and Langstone Harbour</td>
<td>Ringed plover</td>
<td>Restore</td>
<td>The population size (as measured by the delta GAM mean metric) has declined by between 25% and 50%.</td>
</tr>
<tr>
<td>Chichester and Langstone Harbour</td>
<td>Sanderling</td>
<td>Restore</td>
<td>The population size (as measured by the delta GAM mean metric) has declined by between 25% and 50%.</td>
</tr>
<tr>
<td>Chichester and Langstone Harbour</td>
<td>Shelduck</td>
<td>Restore</td>
<td>The population size (as measured by the delta GAM mean metric) has declined by over 50%.</td>
</tr>
<tr>
<td>Chichester and Langstone Harbour</td>
<td>Shoveler</td>
<td>Maintain</td>
<td>The population size (as measured by the delta GAM mean metric) has not decreased by more than 25% since classification.</td>
</tr>
<tr>
<td>Chichester and Langstone Harbour</td>
<td>Teal</td>
<td>Maintain</td>
<td>The population size (as measured by the delta GAM mean metric) has not decreased by more than 25% since classification.</td>
</tr>
<tr>
<td>Chichester and Langstone Harbour</td>
<td>Turnstone</td>
<td>Maintain</td>
<td>The population size (as measured by the delta GAM mean metric) has not decreased by more than 25% since classification.</td>
</tr>
<tr>
<td>Chichester and Langstone Harbour</td>
<td>Wigeon</td>
<td>Maintain</td>
<td>The population size (as measured by the delta GAM mean metric) has increased since classification.</td>
</tr>
<tr>
<td>Chichester and Langstone Harbour</td>
<td>Waterbird Assemblage</td>
<td>Restore</td>
<td>The population size (as measured by the delta GAM mean metric) has declined by between 25% and 50%.</td>
</tr>
<tr>
<td>Portsmouth Harbour</td>
<td>Dark-bellied Brent goose</td>
<td>Maintain</td>
<td>The population size increased and then have remained stable.</td>
</tr>
<tr>
<td>Portsmouth Harbour</td>
<td>Dunlin</td>
<td>Restore</td>
<td>The population size (as measured by the delta Known Natural Fluctuation (KNF) method) has declined by between 25% and 50%.</td>
</tr>
<tr>
<td>Portsmouth Harbour</td>
<td>Red-breasted merganser</td>
<td>Maintain</td>
<td>The population size has remained relatively stable although there are on average fewer individuals using the site.</td>
</tr>
<tr>
<td>Portsmouth Harbour</td>
<td>Black Tailed Godwit</td>
<td>Maintain</td>
<td>The population size has steadily increased.</td>
</tr>
<tr>
<td>Solent and Southampton Water</td>
<td>Black-Tailed Godwit</td>
<td>Maintain</td>
<td>The population size (as measured by the delta GAM mean metric) has not decreased by more than 25% since classification.</td>
</tr>
<tr>
<td>-------------------------------</td>
<td>---------------------</td>
<td>----------</td>
<td>-----------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Solent and Southampton Water</td>
<td>Dark-bellied Brent goose</td>
<td>Maintain</td>
<td>The population size (as measured by the delta GAM mean metric) has not decreased by more than 25% since classification.</td>
</tr>
<tr>
<td>Solent and Southampton Water</td>
<td>Ringed Plover</td>
<td>Maintain</td>
<td>The population size (as measured by the delta GAM mean metric) has not decreased by more than 25% since classification.</td>
</tr>
<tr>
<td>Solent and Southampton Water</td>
<td>Teal</td>
<td>Maintain</td>
<td>The population size (as measured by the delta GAM mean metric) has not decreased by more than 25% since classification.</td>
</tr>
<tr>
<td>Solent and Southampton Water</td>
<td>Waterbird Assemblage</td>
<td>Maintain</td>
<td>The population size (as measured by the delta GAM mean metric) has not decreased by more than 25% since classification.</td>
</tr>
</tbody>
</table>

It is important to note that the time periods of data used to inform conservation advice packages vary and therefore this data may not have captured the effects of fishing activities that have since commenced or altered since publication. The effects of fishing activities may not necessarily be captured in the next population abundance targets due to the time lag between cause and effect. With respect to clam and oyster dredging, the level of fishing effort has been seen to decrease in recent years and therefore any effects of fishing activity are likely to be reduced when compared to the date of those quoted in the Conservation Advice packages.

**7.5 Existing Management Measures**

**7.5.1 Southern IFCA**

- **Bottom Towed Fishing Gear 2016 byelaw** – introduced in November 2017 as a result of the revised approach to the management of commercial fisheries in European Marine Sites, prohibits bottom towed fishing gear over sensitive habitats. The Bottom Towed Fishing Gear byelaw was introduced in January 2014 to protect sensitive reef and seagrass habitats across the Southern IFCA district. In November 2017, this byelaw was revoked and the Bottom Towed Fishing Gear 2016 byelaw was introduced. This byelaw protects the same network of closure areas as the previous byelaw, in addition new closures to protect reef and subtidal sediment habitats within tranche 1 Marine Conservation Zones and Solent European Marine Site. Within the Solent EMS, the network of permanent bottom towed gear closure areas protects good examples of SAC habitat, including intertidal and subtidal sediments and saltmarsh, in order to maintain site integrity and offer long-term stability against the effects of fishing effort displacement. The network of closure areas within the Solent EMS covers approximately 95.4 km$^2$ (including those in the original Bottom Towed Fishing Gear byelaw) and equates to approximately 33.9% of the Solent Maritime SAC. Factors considered in the identification of permanent closure areas include existing levels of human disturbance, energy levels, habitat type and recoverability. A number of low-energy areas were identified as being most suitable for the permanent closures. Good examples
of estuarine habitat including intertidal mud, subtidal mud and saltmarsh form the permanent closure areas to all types of bottom towed fishing gear. This network of areas, includes the River Hamble, Sinah Lake, Broom Channel, Russell’s Lake, the River Medina, King’s Quay, Newtown Creek, the Yar (Yarmouth), and parts of Langstone Harbour, Ashlett Creek, Hythe foreshore, the Test, Lymington and Keyhaven. Areas.

- **Solent Dredge Fishing** byelaw – introduced in November 2017 as a result of the revised approach to the management of commercial fisheries in European Marine Sites, this byelaw covers three dredge fishing management areas (Langstone Harbour, Southampton Water and Portsmouth Harbour), where shellfish dredging is prohibited for 35 weeks of the year during spring, summer and autumn months (1st March to 31st October inclusive). This closed season enables the recovery of infaunal communities and maintains the structure of intertidal and subtidal habitats, as well as supporting breeding shellfish populations, particularly during the summer months which represent the period of highest biological activity for invertebrate infauna of mudflats. The timing of the recovery period was designed to allow for the quickest recovery possible, this is because the restoration of a community in temperate zones is likely to be more rapid if the cessation of sediment disturbance occurs prior to the spring-summer influx of recruits (Borja et al., 2010). This supports the timing of the reproductive season for key species within the site which generally occurs between spring and autumn (see Annex 13 for reproductive season of key species). Restricting shellfish dredging during winter is likely to aid restoration of infaunal communities if the main recolonisation mechanism is by those who undergo recolonization via larval settlement. This supports the recolonization strategies used by a number of individual species, with a number of species employing both larval settlement and active or passive migration (i.e. *Macoma balthica, Hediste diversicolor*) (see Annex 13 for recolonization strategies of key species). In addition, this byelaw permits shellfish dredging to take place between 07:00 and 17:00 in order to further manage fishing effort and to aid compliance.

- **Oyster Close Season** prohibits any person from dredging or fishing for or taking from the fishery any oysters during the period from the 1st day of March to the 31st of October in any year.

- **The Cockles** byelaw states that no person shall fish for or take from a fishery any cockle between 1st day of February and 30th of April and when the cockle bed is covered by water only a dredge less than 460 mm in width can be used. In addition, no person shall remove a cockle that is able to pass through a gauge with a square opening measuring 23.8 mm along each side.

- **Vessels Used in Fishing** byelaw – prohibits commercial fishing vessels over 12 metres from the Southern IFCA district. The reduction in vessel size also restricts the type of gear that can be used, with smaller vessels often used lighter towed gear.

- **The Solent European Marine Site (Prohibition of Method of Dredging) Order 2004** prohibits any fishing boat from deploying or carrying a dredge (unless inboard, secured and stowed) in any part of the Solent European Marine Site. Within the order ‘dredge’ refers to any form of shellfish dredge used in conjunction with any means of injecting water into the dredge or into the vicinity of the dredge. The reason the order was originally created was to protect seagrass but also restricts this type of shellfish dredging over other protected habitats within the EMS, including intertidal areas.

- **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 vessel’s 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 Clam** 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 mouth so designed to take shellfish only when towed along the sea bed.

• **Oyster Dredge** byelaw – in dredging or fishing for oysters is any fishery no dredge shall be used which has a front edge or blade exceeding 1.5 metres in length and if two or more dredges are in dredging or fishing for oysters used at the same time or in from the same boat or vessel the total length of the front edges or blades of such dredges when added together shall not exceed 3.0 metres.

• **Oysters** byelaw – no person shall remove from a public or regulated fishery any oyster (other than Portuguese or Pacific oysters) which will pass through a circular ring of 70 mm in internal diameter.

• **Temporary Closure of Shellfish Beds** byelaw allows the authority to temporarily close any bed or part of a bed of shellfish where it is the opinion of the Committee that it is severely depleted and as such required temporary closure in order to ensure recovery, or any bed or part of bed containing mainly immature or undersized shellfish which is in the interest of protection and development of the fishery, or any bed of transplanted shellfish that ought not to be fished until it becomes established. In the context of this byelaw, ‘shellfish’ refers to mussels, oysters and clams. Currently this byelaw is used to close certain areas of the Solent to oyster dredging (see Table 3).

• **American Hard Shelled Clams – Minimum Size** byelaw – no person shall remove from a fishery any clams of the species *Mercenaria mercenaria* which measures less than 63 mm across the longest part of the shell.

7.5.2 **Sussex IFCA**

Chichester Harbour spans the districts of Southern and Sussex IFCA. It has been agreed the oyster fishery within Chichester Harbour will be managed by Sussex IFCA through a section 167 agreement.

• **Fishing Instrument** byelaw – specifies the fishing methods that can be used in the Sussex IFCA district. Only dredging for oysters and scallops is permitted and by virtue dredging for other shellfish species (clam, cockle) is prohibited.

• **Dredging for, fishing for and taking of oysters & clams and removal of cultch** byelaw – no person shall dredge for, fish or take oysters from any public fishery on any day between the 1st of May and the 31st day of October both days inclusive or during the period commencing half an hour after sunset on any day and a half an hour before sunrise on the following day. No person shall remove any oyster (other than a Portuguese Oyster) which can be passed through a circular ring having an internal diameter of 70 mm.

• **Chichester Harbour Oyster Permit** byelaw - establishes a permit-based system for the commercial exploitation of native oyster stocks by dredging. The permit has a number of conditions which restrictions on gear and dredge configuration and these include an overall width dimension not exceeding 1.2 metres and if two or more dredges are used the total overall width dimension shall not exceed 2.4 metres, no teeth attached to the dredge along all or any part of the lower dredge mouth frame, any parallel bars forming a ‘ladder’ at the bottom of the dredge mouth must have a minimum gap of 60 mm between the bars, no diving blade is fitted to the dredge, the dredges are clearly marked with the fishing vessels registration or the permit number and the maximum weight of the dredge shall not exceed 50 kg. Other permit conditions include catch restrictions, spatial restrictions and temporal restrictions. Catch restrictions include the prohibition of
removing any undersized oyster (except for Portuguese and Pacific Oysters), whose maximum dimension will pass through a circular ring of 70 mm in internal diameter. Time restrictions include a diurnal closure, with fishing only allowed to occur from Monday to Friday, 08:00 until 2:00 pm and a seasonal closure from 1st day of March to the 31st day of October. Spatial restrictions utilise a zoned approach, including a prohibition to oyster dredging in long-term brood stock zones and specified fishing area which is further split into two zones. Restrictions in the specified fishing area are annually reviewed and typically access to these zones has been staggered. Access to (prior to the oyster season) and closure of these zones following fishing is based upon a harvest control threshold approach, using a minimum catch per unit effort.

7.6 Classification of Shellfish

EC Regulations 853/2004 and 854/2004 set out criteria relating to the commercial production and sale of live bivalve molluscs (clams, cockles, oysters, mussels etc.) from classified production areas. These regulations form part of UK law and are implemented by means of the Food Safety and Hygiene (England) Regulations 2013. CEFAS coordinate the classification of shellfish beds on behalf of the FSA. Local Authorities are responsible for implementing sampling plans and are empowered to enforce the regulations.

Shellfish production areas are classified according to the extent to which shellfish sampled from the area are contaminated with potentially harmful bacteria. The classification of a production area determines the treatment required before the molluscs may be marketed and the classes are as follows:

A class - bivalve molluscs can be harvested for direct human consumption.
B class - bivalve molluscs can be marketed for human consumption after purification in an approved plant or after relaying in an approved class A relaying area or after being subjected to an EC approved heat treatment process.
C class - bivalve molluscs can be marketed for human consumption only after relaying for at least two months in an approved relaying area followed, where necessary, by treatment in a purification centre, or after an EC approved heat treatment process.
Prohibited areas - molluscs must not be subject to production or be collected.

Currently within the Solent EMS there are a number of areas where bivalve species are classified for harvesting. Within these areas there are a number where the harvesting of shellfish has been prohibited due to high E. Coli Levels. The sampling regime for shellfish classification is dependent on the Local Authority.

Included in Annex 9 are the classification maps produced by CEFAS for bivalve species that interact with Southampton Water and Langstone Harbour. The classification of these, and all areas included in the maps are subject to regular sampling and the maps included are correct as of September 2018. In Portsmouth Harbour and Langstone Harbour, due to the restrictive nature of the season, the area is temporarily declassified.
out of the season and sampling reduced to quarterly, until two months prior to the season when regular samples are taken. Within these areas there are a number where harvesting of shellfish has been prohibited due to high E. Coli levels.

7.7 Monitoring

7.7.1 Solent oyster stock survey

The Solent oyster population has been monitored on an annual basis since the late 1970s. Up until 2011, the annual stock survey was undertaken by CEFAS when it was discontinued. The stock survey recommenced in 2014 and since then has been undertaken annually by Southern IFCA, initially with guidance from CEFAS. The survey is used to consider the current status of the oyster fishery against an existing time series. Using a local fishing vessel and gear, the survey samples historically harvested shellfish beds, in addition to other areas highlighted by the fishing industry, to ascertain the current densities of oysters in these areas in the Solent. This stock survey informs the Authorities management decisions.

7.7.2 Solent bivalve stock survey

In October 2017, prior to the introduction of new management for shellfish dredging, Southern IFCA carried out the first bivalve stock survey in Southampton Water using a local vessel and gear to sample bivalve species recording quantities and sizes of individuals caught from a range of defined shellfish beds. The first survey was carried out in Southampton Water and following this, the survey was extended to encompass Portsmouth Harbour and Langstone Harbour. The surveys are timed to coincide with the beginning and end of the season (October and April) to determine how the bivalve populations change and new shellfish dredge management has affected bivalve populations in the Solent.

In Spring 2018, the Solent bivalve stock assessment was again carried out following the closure of dredge fishing in the harbour areas (Southern Inshore Fisheries and Conservation Authority, 2018). In October 2018 the Autumn Solent bivalve stock assessment will also be completed.

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18 http://www.southern-ifca.gov.uk/research-and-evidence-reports - Solent oyster stock survey
19 http://www.southern-ifca.gov.uk/research-and-evidence-reports - Solent bivalve stock survey
7.8 Table 11. Summary of Impacts

The potential pressures, associated impacts, level of exposure and mitigation measures are summarised in table 12. Only relevant attributes identified through the TLSE process have been considered here.

<table>
<thead>
<tr>
<th>Feature</th>
<th>Supporting habitat(s)</th>
<th>Attribute</th>
<th>Target</th>
<th>Potential Pressure(s) and Associated Impacts</th>
<th>Nature and Likelihood of Impacts</th>
<th>Mitigation measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Waterbird Assemblage and Non-breeding qualifying features</td>
<td>Intertidal mud, sand and muddy sand</td>
<td>Food availability</td>
<td>Maintain the distribution, abundance and availability of key food and prey items</td>
<td>Removal of non-target and target species were identified as potential pressures. Shellfish dredging is known to cause a number of potential impacts on benthic communities. Dredging results in the direct removal/mortality of infaunal and epifaunal organisms – both target and non-target species. There are also indirect effects through the alteration of topography and sediment character and the resuspension of sediments. Bottom towed gear has been shown to reduce biomass, production, species richness and diversity (Veale et al., 2000; Hiddink et al., 2003) and increase variation in community structure (Clarke et al., 2018b). Alterations in the size structure and dynamics of populations and communities are also known to occur (Robert et al., 2010). A monitoring study by Clarke et al., (2018b) reported, a higher abundance of small annelid worms in the dredged site, whilst the abundance of molluscs was greater in the control site.</td>
<td>Using available information on the diet of designated bird species and WeBS low tide count data distribution maps, designated bird species sensitive to changes in food availability within intertidal mudflats and sandflats subject to shellfish dredging include Bar-tailed godwit, Black-tailed Godwit, Curlew, Dark Bellied Brent goose, Dunlin, Grey plover, Pintail, Ringed plover, Redshank, Teal, Turnstone, Sanderling, Shelduck, Shoveler and Wigeon. The sites used by these species, which occur in close proximity to shellfish dredging, are concentrated within the north eastern quarter of Langstone harbour and include west of the Oyster beds, and the mid Langstone Channel. In Portsmouth Harbour they include Bombketch and Portchester lake, whilst is Southampton water the activity is focused along the west shore from Hythe to Calshot and to a lesser extent due to the more mixed/sandier substrate either side of the Hamble Estuary mouth. Prey preferences exhibited by the dark-bellied Brent goose, teal and wigeon include plants, grasses and</td>
<td>The Solent Dredge Permit Byelaw will apply to all areas of Langstone Harbour, Portsmouth Harbour, Southampton Water and the wider Solent. Under this new byelaw, shellfish dredging will be prohibited for 35 weeks of the year during spring, summer and autumn months (1st March to 31st October inclusive). This closed season enables the recovery of sedimentary habitats, including infaunal communities which supports food availability and helps to maintain the structure of intertidal and subtidal habitats. Additionally, it supports breeding shellfish populations. The timings of the recovery period were designed to allow for the quickest period of recovery over the summer months, which represents the period of highest biological activity for invertebrate fauna of sedimentary habitats. The permit byelaw will only allow shellfish dredging to take place between 06:00 and 18:00 in order to further manage fishing effort and aid compliance. Conditions which govern the bar spacing and strength will also form a part of the permit. These will reduce the number of undersized shellfish being brought up for sorting and therefore reduce the likelihood of damage and mortality to</td>
</tr>
</tbody>
</table>

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20 Detail how this reduces/removes the potential pressure/impact(s) on the feature e.g. spatial/temporal/effort restrictions that would be introduced.

Page 68 of 236

SIFCA Reference: SIFCA/HRA/_PPSDPByelaw2018
In a meta-analysis of 39 studies, those investigating the effect of intertidal dredging commonly reported 100% removal of biogenic fauna and were reported to have the most severe initial impact (Collie et al., 2000). Intertidal dredging may refer to other types of dredge including suction dredging. This was also observed in an experimental study conducted in Langstone Harbour where fauna in muddy gravel were seen to either be completely removed or considerably reduced by the dredging activity using a modified oyster dredge (EMU, 1992). In the same study, species richness was also found to decrease with a mean number of 6.5 species in the control site compared with 4.4 in the dredge site (EMU, 1992).

The recovery of faunal communities which experience high levels of natural disturbance are generally characterised by species able to withstand and recover from disturbance (Collie et al., 2000; Roberts et al., 2010). The longer recovery periods for soft sediments are related to the fact these habitats are mediated by physical, chemical and biological processes, as opposed to the dominance of physical processes that occur within sandy habitats (Roberts et al., 2010). The recovery of faunal communities which experience high levels of natural disturbance are generally characterised by species able to withstand and recover from disturbance (Collie et al., 2000; Roberts et al., 2010). The longer recovery periods for soft sediments are related to the fact these habitats are mediated by physical, chemical and biological processes, as opposed to the dominance of physical processes that occur within sandy habitats (Roberts et al., 2010).

The main species of concern are therefore Bar-tailed Godwit, Black-tailed Godwit, Curlew, Dunlin, Grey Plover, Pintail, Ringed Plover, Redshank, Shelduck, Shoveler and Turnstone. SSSI condition assessments regard these areas as in unfavourable but recovering or no change condition, the reason for which is not related to fishing activity.

Dunlin, Ringed Plover, Grey Plover and Shelduck, have been set to a restore abundance target in Chichester and Langstone Harbours. In Portsmouth Harbour Dunlin is set to a restore target. However, declines of dunlin in both harbours, and grey plover in Chichester and Langstone Harbours are not thought to be site specific. There is no evidence which seeds and this makes them less sensitive to changes in food availability as clam dredging is known to cause changes to infaunal invertebrates. The Dark-bellied Brent goose foods upon feed upon eel grass (Zostera spp.) which is protected under the Prohibition of Gathering (Sea Fisheries Resources) in Seagrass Beds byelaw and Bottom Towed Fishing gear byelaw.

Prey preferences exhibited by Sanderling (Mytilus spat., sandhoppers, wrack flies) and Red-Breasted Merganser (<1cm fish) and this makes them less sensitive to changes in food availability caused by clam and oyster dredges as clam dredging is known to cause changes to infaunal invertebrates. Clam dredging mostly targets intertidal mud and does not capture small fish species.

Vessel Used in Fishing byelaw prohibits commercial fishing vessels over 12 metres from the Southern IFCA district. The reduction in vessel size also restricts the type of gear that can be used, with vessels often using lighter towed gear.

The Solent European Marine Site (Prohibition of Method of Dredging) Order 2004 prevents pump scooping as a means of taking shellfish. Fishing for Oysters, Mussels and Clam byelaw regulates methods can be used to fish for these species. These are 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.

Temporary Closure of Shellfish Beds byelaw allows the authority to
suggests the declines of Ringed Plover and Shelduck are due to changes in prey food availability.

Since the introduction of Bottom Towed Fishing Gear Byelaws first introduced in 2014 and the Solent Dredge Fishing Gear Byelaw shellfish dredging throughout the Solent has been noted to decline (Solent Forum, 2018). Most likely this is due to a combination of the reduction in available fishing area and increases in compliance actions.

Both oyster dredging and clam dredging are now subject to a four-month open season, operating from November to February. During this season, an average 3 to 4 vessels will clam dredge across all three shellfish dredge management areas (Portsmouth Harbour, Southampton Water and Langstone Harbour) on fishable days when weather and tide permit. Due to tidal restrictions associated with the nature of this fishery, vessels were not able to operate over the entire 07:00-17:00 period open to fishing. The Dredge Permit Byelaw will enable bivalve fishing for an additional 2 hours each day the season is open, with the allowable fishing period between 06:00 and 18:00 daily. However, due to the physical restrictions of tides and water depth, this will not lead to a direct increase in fishing effort of 2 hours each day. Dredge fishing for bivalves in the intertidal in limited by the tidal height. Engagement with fishermen confirms that fishing is only possible around a window either side of HW, quoted as 2 hours either side by multiple fishermen. This is further restricted by vessel size and draft, water depth of the are fished, as well temporarily close any bed or part of a bed of shellfish where it is the opinion of the Committee that it is severely depleted and as such required temporary closure in order to ensure recovery, or any bed or part of bed containing mainly immature or undersized shellfish which is in the interest of protection and development of the fishery, or any bed of transplanted shellfish that ought to not be fished until it becomes established.

The Cockles byelaw states that no person shall fish for or take from a fishery any cockle between 1st day of February and 30th of April and when the cockle bed is covered by water only a dredge less than 460 mm in width can be used. This largely eliminates the use of a clam dredge for harvesting cockles.

The Prohibition of Gathering (Sea Fisheries Resources) in Seagrass Beds byelaw prohibits any person from digging for, fishing for or taking any sea fisheries resource in or from the prohibited areas. No person shall carry a rake, spade, fork or any similar tool in prohibited areas.

Bottom Towed Fishing Gear 2016 byelaw prohibits bottom towed fishing gear over sensitive habitats. These habitats include reef, seagrass, as well as intertidal and subtidal sediments and saltmarsh within the Solent EMS. The network of permanent bottom towed closure areas helps to maintain site integrity and offer long-term stability against the effects of fishing displacement. The network of closure areas within the Solent EMS equates to approximately 33.9% of the Solent Maritime SAC.
as weather conditions, all of which further restrict the available fishing period within the 12-hour window and over a period of days and weeks. Furthermore, fishers often do not work over two tidal cycles in one day, as the time restrictions regularly do not allow for this, and depending on catch success in the first tidal window it is often not necessary. Therefore, it is not possible for fishing effort to increase every day for an additional 2 hours. Finally, fishermen often take days off from fishing during each working week as well as over holiday periods further reducing the total effort. Therefore, this change should not significantly increase the impacts to the stock. Through the requirement to submit catch returns, including time spent fishing, Southern IFCA will have a greater ability to monitor this and quantify changes in fishing effort between seasons, also understanding better the relationship between fishing location, tidal restrictions and stock levels/prey availability. For the last five seasons, oyster dredging has only been permitted in the eastern harbours (Portsmouth and Langstone Harbour), with the wider Solent and Southampton Water closed.

In the last three seasons (2016/17; 2017/18), the eastern harbours have been open for the four-month season (as per the Oyster Close Season byelaw). This period will remain the same under the Dredge Permit Byelaw.
In the 2018/19 season, from the 1st November 2018 two further areas will no longer be closed; Ryde Middle and Portsmouth Harbour.

Typically, an average of 1 to 2 vessels operate over the season on any one day, weather and conditions permitting.

Feature data provided by Natural England, combined with sightings data, reveals that clam dredging occurs over this supporting habitat. This means the activity has the potential to cause a potential adverse effect on the benthic communities on which designated bird species rely.

Since 2013, the wider Solent and Southampton Water has been closed to oyster dredging. As a result, there has been no interaction between the activity and designated bird species.

The lack of activity therefore means that the activity does not interact with benthic communities and has no potential to cause adverse effect on the communities upon which designated bird species rely on at the current status of the fishery.

If Southampton Water and the wider Solent were not subject to closure and the activity were to take place in these areas (in the 2018/19 season Ryde Middle oyster bed will be open), the activity is focused subtidally and occasionally fringes on the intertidal. This means it is likely to have a much-reduced impact in areas utilised by birds and limited interaction with prey species of designated bird species. In incidences where limited interaction occurs, a period of eight
months is considered sufficient to allow for recovery. Additional protection is afforded by virtue through permanent closures to bottom towed fishing gear designed to protect good examples of SAC habitat.

In incidences where limited interaction occurs, a period of eight months is considered sufficient to allow for recovery. Additional protection is afforded by virtue through permanent closures to bottom towed fishing gear designed to protect good examples of SAC habitat.

Intertidal habitats are likely to experience a high rate of natural disturbance than subtidal habitats and therefore the severity of clam dredging impacts may be less.

Many small benthic organisms such as crustaceans, polychaetes and molluscs (characteristic of mud communities), have short generation times and high fecundities, both of which enhance their capacity for rapid recolonization (Coen, 1995). In such instances, the effect of dredging on food availability may only be short term.

Annelids in general however are known to be vulnerable to impacts of bottom towed gear. 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 recovery times of 1210 days in muddy sand habitats (Kaiser et al., 2006). EMU (1992) also reported that annelids were seen to be most badly
Selective extraction of species and competition for prey were identified as potential pressures through direct impacts of clam dredging. Changes in prey availability and competition for prey were identified as potential pressures through indirect impacts of clam dredging.

The selective extraction of species and competition for prey were screened out at TLSE level as Manila clam, American hard-shell clam a Native oyster do not represent the prey species of designated bird species.

The indirect change in prey availability is caused through physical disturbance or damage to supporting habitats which can result in changes to community structure, the removal and mortality of non-target organisms through interaction with fishing gear and smothering of prey species through increased sedimentation.

Bottom towed gear has been shown to reduce biomass, production and species richness and diversity (Veale et al., 2010; Hiddink et al., 2003). In a meta-analysis of 39 studies, those investigating the effect of intertidal dredging commonly reported 100% removal of biogenic fauna and were reported to have the most severe initial impact (Collie et al., 2000). Intertidal dredging may refer to other types of dredge including suction dredging.

The relative impact of shellfish dredging on benthic organisms, which form potential prey items, is species-affected by the action of a mechanical modified oyster dredge.

Since the introduction of Bottom Towed Fishing Gear Byelaws first introduced in 2014 and the Solent Dredge Fishing Gear Byelaw shellfish dredging throughout the Solent has been noted to decline (Solent Forum, 2018). Most likely this is due to a combination of the reduction in available fishing area and increases in compliance actions.

Feature data provided by Natural England, combined with sightings data, reveals that clam dredging does not regularly occur this supporting habitat. This means the activity is highly unlikely to cause a potential adverse effect on the benthic communities on which designated bird species rely. Since 2013, the wider Solent and Southampton Water has been closed to oyster dredging. As a result, there has been no interaction between the activity and designated bird species.

The lack of activity therefore means that the activity does not interact with benthic communities and has no potential to cause adverse effect on the communities upon which designated bird species rely on at the current status of the fishery.

Feature data provided by Natural England, combined with sightings data, reveals that clam dredging does not occur over intertidal coarse sediment habitat and occurs only very occasionally over intertidal mixed sediments. This means the activity is very unlikely to have the potential to cause adverse effect on the benthic

The Solent Dredge Permit Byelaw will apply to all areas of Langstone Harbour, Portsmouth Harbour, Southampton Water and the wider Solent. Under this new byelaw, shellfish dredging will be prohibited for 35 weeks of the year during spring, summer and autumn months (1st March to 31st October inclusive). This closed season enables the recovery of sedimentary habitats, including infaunal communities which supports food availability and helps to maintain the structure of intertidal and subtidal habitats. Additionally, it supports breeding shellfish populations.

The timings of the recovery period were designed to allow for the quickest period of recovery over the summer months, which represents the period of highest biological activity for invertebrate fauna of sedimentary habitats. The permit byelaw will only allow shellfish dredging to take place between 06:00 and 18:00 in order to further manage fishing effort and aid compliance. Conditions which govern the bar spacing and strength will also form a part of the permit. These will reduce the number of undersized shellfish being brought up for sorting and therefore reduce the likelihood of damage and mortality to these individuals so increasing the prey species availability. All catches will be required to be reported further enabling Southern IFCA to monitor fishing effort levels throughout the shellfish fishery, with the potential to limit the number of permits issued in the future. For oysters only, the Solent Dredge Permit Byelaw will set out ‘Harvest Areas’ giving Southern IFCA the ability to open and close specific oyster beds. The

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specific and largely related to their biological characteristics and physical habitat (Mercaldo-Allen & Goldberg, 2011). Population recovery rates are species specific (Roberts et al., 2010). Long-lived bivalves will undoubtedly take longer to recovery from disturbance than other species such as short-lived and small benthic organisms on the other hand have rapid generation times, high fecundities and therefore excellent recolonization capacities (Coen, 1995; Roberts et al., 2010).

communities in these habitats on which designated bird species rely.

If Southampton Water and the wider Solent were not subject to closure and the activity were to take place in these areas (in the 2018/19 season Ryde Middle oyster bed will be open), the activity is focused subtidally and occasionally fringes on the intertidal. This means it is likely to have a much-reduced impact in areas utilised by birds and limited interaction with prey species of designated bird species. In incidences where limited interaction occurs, a period of eight months is considered sufficient to allow for recovery. Additional protection is afforded by virtue through permanent closures to bottom towed fishing gear designed to protect good examples of SAC habitat.

In incidences where limited interaction occurs, a period of eight months is considered sufficient to allow for recovery. Additional protection is afforded by virtue through permanent closures to bottom towed fishing gear designed to protect good examples of SAC habitat.

determination of the status of oyster beds is based upon annual stock assessments.

This will allow greater flexibility to monitor and control the oyster fishery fishing effort through more specific opening or closing of these areas. Areas can be closed to allow for the recovery of populations or to provide a rest period for habitat structure to remain undisturbed.

Vessels Used in Fishing byelaw prohibits commercial fishing vessels over 12 metres from the Southern IFCA district. The reduction in vessel size also restricts the type of gear that can be used, with vessels often using lighter towed gear.

The Solent European Marine Site (Prohibition of Method of Dredging) Order 2004 prevents pump scooping as a means of taking shellfish.

Fishing for Oysters, Mussels and Clam byelaw regulates methods can be used to fish for these species. These are 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.

Temporary Closure of Shellfish Beds byelaw allows the authority to temporarily close any bed or part of a bed of shellfish where it is the opinion of the Committee that it is severely depleted and as such required temporary closure in order to ensure recovery, or any bed or part of bed containing mainly immature or undersized shellfish which is in the interest of protection and development of the fishery, or any bed of transplanted shellfish.
shellfish that ought to not be fished until it becomes established.

The Cockles byelaw states that no person shall fish for or take from a fishery any cockle between 1st day of February and 30th of April and when the cockle bed is covered by water only a dredge less than 460 mm in width can be used. This largely eliminates the use of a clam dredge for harvesting cockles.

The Prohibition of Gathering (Sea Fisheries Resources) in Seagrass Beds byelaw prohibits any person from digging for, fishing for or taking any sea fisheries resource in or from the prohibited areas. No person shall carry a rake, spade, fork or any similar tool in prohibited areas.

Bottom Towed Fishing Gear 2016 byelaw prohibits bottom towed fishing gear over sensitive habitats. These habitats include reef, seagrass, as well as intertidal and subtidal sediments and saltmarsh within the Solent EMS. The network of permanent bottom towed fear closure areas helps to maintain site integrity and offer long-term stability against the effects of fishing displacement. The network of closure areas equates to approximately 33.9% of the Solent Maritime SAC.

Using available information on the diet of designated bird species and WeBS low tide count data distribution maps, designated bird species sensitive to changes in food availability within intertidal mudflats and sandflats subject to shellfish dredging include Bar-tailed godwit, Black-tailed Godwit, Curlew, Dark Bellied Brent goose, Dunlin, Grey plover, Pintail, Ringed

| Waterbird assemblage and non-breeding qualifying features internationally important regularly occurring | Intertidal mud, sand and muddy sand | Food availability | Selective extraction of species and competition for prey were identified as potential pressures through direct impacts of clam dredging. Changes in prey availability and competition for prey were identified as potential pressures through indirect impacts of clam dredging. | The Solent Dredge Permit Byelaw will apply to all areas of Langstone Harbour, Portsmouth Harbour, Southampton Water and the wider Solent. Under this new byelaw, shellfish dredging will be prohibited for 35 weeks of the year during spring, summer and autumn months (1st March to 31st October inclusive). This closed season enables the recovery of sedimentary habitats, |
The selective extraction of species and competition for prey were screened out at TLSE level as Manila clam, American hard-shell clam and Native oyster do not represent the prey species of designated bird species. The indirect change in prey availability is caused through physical disturbance or damage to supporting habitats which can result in changes to community structure, the removal and mortality of non-target organisms through interaction with fishing gear and smothering of prey species through increased sedimentation. Bottom towed gear has been shown to reduce biomass, production, species richness and diversity (Veale et al., 2000; Hiddink et al., 2003) and increase variation in community structure (Clarke et al., 2018b). Alterations in the size structure and dynamics of populations and communities are also known to occur (Robert et al., 2010). A monitoring study by Clarke et al., (2018b) reported, a higher abundance of small annelid worms in the dredged site, whilst the abundance of molluscs was greater in the control site.

In a meta-analysis of 39 studies, those investigating the effect of intertidal dredging commonly reported 100% removal of biogenic fauna and were reported to have the most severe initial impact (Collie et al., 2000). Intertidal dredging may refer to other types of dredge including suction dredging. This was also observed in an experimental study conducted in Langstone Harbour where fauna in muddy gravel were seen to either be completed removed or considerably plover, Redshank, Teal, Turnstone, Sanderling, Shelduck, Shoveler and Wigeon. The sites used by these species, which occur in close proximity to shellfish dredging, are concentrated within the north eastern quarter of Langstone harbour and include west of the Oyster beds, and the mid Langstone Channel. In Portsmouth Harbour they include Bombketch and Portlighthouse lake, whilst in Southampton water the activity is focused along the west shore from Hythe to Calshot and to a lesser extent due to the more mixed/sandi substrates either side of the Hamble Estuary mouth.

Prey preferences exhibited by the dark-bellied Brent goose, teal and wigeon include plants, grasses and seeds and this makes them less sensitive to changes in food availability, as clam dredging is known to cause changes to infaunal invertebrates. The Dark-bellied Brent goose foods upon feed upon eel grass (Zostera spp.) which is protected under the Prohibition of Gathering Zeas Beds bylaw and Bottom Towed Fishing gear byelaw. Prey preferences exhibited by the Sanderling (Mytilus spat, sandhoppers and wrack flies) and Red-Breasted Merganser (<1cm fish) and this makes them less sensitive to changes in food availability caused by clam and oyster dredging as clam dredging is known to cause changes to infaunal invertebrates. Clam dredging mostly targets intertidal mud and does not capture small fish species. including infaunal communities which supports food availability and helps to maintain the structure of intertidal and subtidal habitats. Additionally, it supports breeding shellfish populations. The timings of the recovery period were designed to allow for the quickest period of recovery over the summer months, which represents the period of highest biological activity for invertebrate fauna of sedimentary habitats. The permit byelaw will only allow shellfish dredging to take place between 06:00 and 18:00 in order to further manage fishing effort and aid compliance. Conditions which govern the bar spacing and strength will also form a part of the permit. These will reduce the number of undersized shellfish, being brought up for sorting and therefore reduce the likelihood of damage and mortality to these individuals so increasing the prey species availability. All catches will be required to be reported further enabling Southern IFCA to monitor fishing effort levels throughout the shellfish fishery, with the potential to limit the number of permits issued in the future. For oysters only, the Solent Dredge Permit Byelaw will set out ‘Harvest Areas’ giving Southern IFCA the ability to open and close specific oyster beds. The determination of the status of oyster beds is based upon annual stock assessments.

This will allow greater flexibility to monitor and control the oyster fishery fishing effort through more specific opening or closing of these areas. Areas can be closed to allow for the recovery of populations or to provide a rest period for habitat structure to remain undisturbed. Vessels Used in Fishing byelaw prohibits commercial fishing vessels.
reduced by the dredging activity using a modified oyster dredge (EMU, 1992).

In the same study, species richness was also found to decrease with a mean number of 6.5 species in the control site compared with 4.4 in the dredge site (EMU, 1992).

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). Population recovery rates are species specific (Roberts et al., 2010). Long-lived bivalves will undoubtedly take longer to recover from disturbance than other species such as short-lived and small benthic organisms on the other hand have rapid generation times, high fecundities and therefore excellent recolonization capacities (Coen, 1995; Roberts et al., 2010).

The recovery of faunal communities which experience high levels of natural disturbance are generally characterised by species able to withstand and recover from disturbance (Collie et al., 2000; Roberts et al., 2010). The longer recovery periods for soft sediments are related to the fact these habitats are mediated by physical, chemical and biological processes, as opposed to the dominance of physical processes that occur within sandy habitats (Roberts et al., 2010).

The main species of concern are therefore Bar-tailed godwit, Black-tailed godwit, Curlew, Dunlin, Grey plover, Pintail, Ringed plover, Redshank, Shelduck, Shoveler and Turnstone. SSSI condition assessments regard these areas as in unfavourable but recovering or no change condition, the reason for which is not related to fishing activity.

Dunlin, Ringed Plover, Grey Plover and Shelduck have been set to a restore abundance target in Chichester and Langstone Harbours. In Portsmouth Harbour Dunlin is set to a restore target. However, declines of dunlin in both harbours, and grey plover in Chichester and Langstone Harbours are not thought to be site specific. There is no evidence which suggests the declines of Ringed Plover and Shelduck are due to changes in prey food availability.

Since the introduction of Bottom Towed Fishing Gear Byelaws first introduced in 2014 and the Solent Dredge Fishing Gear Byelaw shellfish dredging throughout the Solent has been noted to decline (Solent Forum, 2018). Most likely this is due to a combination of the reduction in available fishing area and increases in compliance actions.

Feature data provided by Natural England, combined with sightings data, reveals that shellfish dredging occurs over this supporting habitat. This means the activity is likely to cause a potential adverse effect on the benthic communities on which designated bird species rely.

Both oyster dredging and clam dredging are now subject to a four-over 12 metres from the Southern IFCA district. The reduction in vessel size also restricts the type of gear that can be used, with vessels often using lighter towed gear.

The Solent European Marine Site (Prohibition of Method of Dredging) Order 2004 prevents pump scooping as a means of taking shellfish.

Fishing for Oysters, Mussels and Clam byelaw regulates methods can be used to fish for these species. These are a) hand picking and b) dredging using a dredge with a rigid framed south designed to take shellfish only when towed along the sea bed. Temporary Closure of Shellfish Beds byelaw allows the authority to temporarily close any bed or part of a bed of shellfish where it is the opinion of the Committee that it is severely depleted and as such required temporary closure in order to ensure recovery, or any bed or part of bed containing mainly immature or undersized shellfish which is in the interest of protection and development of the fishery, or any bed of transplanted shellfish that ought to not be fished until it becomes established.

The Cockles byelaw states that no person shall fish for or take from a fishery any cockle between 1st day of February and 30th of April and when the cockle bed is covered by water only a dredge less than 460 mm in width can be used. This largely eliminates the use of a clam dredge for harvesting cockles.

The Prohibition of Gathering (Sea Fisheries Resources) in Seagrass Beds byelaw prohibits any person from...
month open season, operating from November to February. During this season, an average 3 to 4 vessels will clam dredge across all three shellfish dredge management areas (Portsmouth Harbour, Southampton Water and Langstone Harbour) on fischable days when weather and tide permit. Due to tidal restrictions associated with the nature of this fishery, vessels were not able to operate over the entire 07:00-17:00 period open to fishing. The Dredge Permit Byelaw will enable bivalve fishing for an additional 2 hours each day the season is open, with the allowable fishing period between 06:00 and 18:00 daily. However, due to the physical restrictions of tides and water depth, this will not lead to a direct increase in fishing effort of 2 hours each day. Dredge fishing for bivalves in the intertidal in limited by the tidal height. Engagement with fishermen confirms that fishing is only possible around a window either side of HW, quoted as 2 hours either side by multiple fishermen. This is further restricted by vessel size and draft, water depth of the area fished, as well as weather conditions, all of which further restrict the available fishing period within the 12-hour window and over a period of days and weeks. Furthermore, fishers often do not work over two tidal cycles in one day, as the tide restrictions regularly do not allow for this, and depending on catch success in the first tidal window it is often not necessary. Therefore, it is not possible for fishing effort to increase every day for an additional 2 hours. Finally, fishermen often take days off from fishing during each working week as well as over holiday periods further reducing the total effort.

digging for, fishing for or taking any sea fisheries resource in or from the prohibited areas. No person shall carry a rake, spade, fork or any similar tool in prohibited areas.

The Bottom Towed Fishing Gear byelaw prohibits bottom towed fishing gear over sensitive features including reef features and seagrass within the Solent and Chichester and Langstone Harbours SPA, closing most of the site to these activities. Southern IFCA is currently amending this byelaw to introduce additional network of permanent bottom towed fishing gear closure areas. The network is designed to protect good examples of low-energy SAC habitats, maintaining the integrity of the site, whilst also offering long-term stability to guard against the effects of fishing effort displacement which may result from other additional measures also being introduced. These additional measures include spatial and temporal restrictions on shellfish dredging within the site, via a network of dredge fishing management areas and daily closures from 17:00 to 07:00 (further details in section 7). Within each dredge fishing management area, shellfish dredging will be prohibited for 35 weeks of the year during the spring, summer and autumn months in order to enable the recovery of infaunal communities and to maintain the structure of intertidal and subtidal habitats, as well as supporting breeding shellfish populations.
This change in management is to provide fishermen greater flexibility upon when they can fish, and is not intended to increase overall total effort. Therefore, this change should not significantly increase the impacts to the food availability in the designated site. Through the requirement to submit catch returns, including time spent fishing, Southern IFCA will have a greater ability to monitor this and quantify changes in fishing effort between seasons, also understanding better the relationship between fishing location, tidal restrictions and stock levels/prey availability.

For the last five seasons, oyster dredging has only been permitted in the eastern harbours (Portsmouth and Langstone Harbour), with the wider Solent and Southampton Water closed. In the last two seasons (2016/17, 2017/18), the eastern harbours have been open for the four-month season (as per the Oyster Close Season byelaw). This period will remain the same under the Dredge Permit Byelaw. In the 2018/19 season, from the 1st November 2018 two further areas will no longer be closed: Ryde Middle and Portsmouth Harbour. Typically, an average of 1 to 2 vessels operate over the season on any one day, weather and conditions permitting.

Since 2013, the wider Solent and Southampton Water has been closed to oyster dredging. As a result, there has been no interaction between the activity and designated bird species.

The lack of activity therefore means that the activity does not interact with benthic communities and has no...
potential to cause adverse effect on the communities upon which designated bird species rely on at the current status of the fishery.

If Southampton Water and the wider Solent were not subject to closure and the activity were to take place in these areas (in the 2018/19 season Ryde Middle oyster bed will be open), the activity is focused subtidally and occasionally fringes on the intertidal. This means it is likely to have a much reduced impact in areas utilised by birds and limited interaction with prey species of designated bird species. In incidences where limited interaction occurs, a period of eight months is considered sufficient to allow for recovery. Additional protection is afforded by virtue through permanent closures to bottom towed fishing gear designed to protect good examples of SAC habitat.

In incidences where limited interaction occurs, a period of eight months is considered sufficient to allow for recovery. Additional protection is afforded by virtue through permanent closures to bottom towed fishing gear designed to protect good examples of SAC habitat.

Intertidal habitats are likely to experience a high rate of natural disturbance than subtidal habitats and therefore the severity of clam dredging impacts may be less.

Many small benthic organisms such as crustaceans, polychaetes and molluscs (characteristic of mud communities), have short generation times and high fecundities, both of which enhance their capacity for rapid recolonization
(Coen, 1995). In such instances, the effect of dredging on food availability may only be short term.

Annelids in general however are known to be vulnerable to impacts of bottom towed gear. 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 recovery times of 1210 days in muddy sand habitats (Kaiser et al., 2006). EMU (1992) also reported that annelids were seen to be most badly affected by the action of a mechanical modified oyster dredge.

Recovery rates of key prey species taken by birds of concern are presented in Annex 10. These rates of recovery where taken by Fern et al. (2000) who investigated the impacts of a tractor-towed cockle harvester in muddy sand and clean sand.

Waterbird assemblage and non-breeding qualifying features:

| Waterbird assemblage and non-breeding qualifying features: | Intertidal mixed and coarse sediment | Food | Maintain the distribution, abundance and availability of key food and prey items. | Selective extraction of species and competition for prey were screened out at TLSE level as Manila clam, American hard-shell clam, Native oyster do not represent the prey species of designated bird species. The indirect change in prey availability is caused through physical disturbance or damage to supporting habitats. | Since the introduction of Bottom Towed Fishing Gear Byelaws first introduced in 2014 and the Solent Dredge Fishing Gear Byelaw shellfish dredging throughout the Solent has been noted to decline (Solent Forum, 2018). Most likely this is due to a combination of the reduction in available fishing area and increases in compliance actions. Intertidal mixed and coarse sediment provide an important feeding habitat for ringed plover who feed on small invertebrates and the Dark-bellied brent goose who feed on algae (Enteromorpha spp.), a food item also preferred by Teal, Wigeon and Shelduck. | The Solent Dredge Permit Byelaw will apply to all areas of Langstone Harbour, Portsmouth Harbour, Southampton Water and the wider Solent. Under this new byelaw, shellfish dredging will be prohibited for 35 weeks of the year during spring, summer and autumn months (1st March to 31st October inclusive). This closed season enables the recovery of sedimentary habitats, including infaunal communities which supports food availability and helps to maintain the structure of intertidal and subtidal habitats. Additionally, it supports breeding shellfish populations. The timings of the recovery period were designed to allow for the quickest period of recovery over the summer months, which represents the period of highest |

SIFCA Reference: SIFCA/HRA/_PPSDPByelaw2018
which can result in changes to community structure, the removal and mortality of non-target organisms through interaction with fishing gear and smothering of prey species through increased sedimentation.

Bottom towed gear has been shown to reduce biomass, production, species richness and diversity (Vasee et al., 2000; Hiddink et al., 2003) and increase variation in community structure (Clarke et al., 2018b). Alterations in the size structure and dynamics of populations and communities are also known to occur (Robert et al., 2010). A monitoring study by Clarke et al., (2018b) reported a higher abundance of small annelid worms in the dredged site, whilst the abundance of molluscs was greater in the control site.

In a meta-analysis of 39 studies, those investigating the effect of intertidal dredging commonly reported 100% removal of biogenic fauna and were reported to have the most severe initial impact (Collie et al., 2000). Intertidal dredging may refer to other types of dredge including suction dredging. This was also observed in an experimental study conducted in Langstone Harbour where fauna in muddy gravel were seen to either be completed removed or considerably reduced by the dredging activity using a modified oyster dredge (EMU, 1992). In the same study, species richness was also found to decrease with a mean number of 6.5 species in the control site compared with 4.4 in the dredged site (EMU, 1992).

Feature data provided by Natural England, combined with sightings data, reveals that clam dredging does not occur over intertidal coarse sediment and only rarely occurs over intertidal mixed sediment supporting habitat. This means the activity is highly unlikely to cause a potential adverse effect on the benthic communities on which designated bird species rely.

Since 2013, the wider Solent and Southampton Water has been closed to oyster dredging. As a result, there has been no interaction between the activity and designated bird species.

The lack of activity therefore means that the activity does not interact with benthic communities and has no potential to cause adverse effect on the communities upon which designated bird species rely on at the current status of the fishery.

Feature data provided by Natural England, combined with sightings data, reveals that clam dredging does not occur over intertidal coarse sediment habitat and occurs only very occasionally over intertidal mixed sediments. This means the activity is very unlikely to have the potential to cause adverse effect on the benthic communities in these habitats on which designated bird species rely.

If Southampton Water and the wider Solent were not subject to closure and the activity were to take place in these areas (in the 2018/19 season Ryde Middle oyster bed will be open), the activity is focused subtidally and occasionally fringes on the intertidal. This means it is likely to have a much biological activity for invertebrate fauna of sedimentary habitats. The permit byelaw will only allow shellfish dredging to take place between 06:00 and 18:00 in order to further manage fishing effort and aid compliance. Conditions which govern the bar spacing and strength will also form a part of the permit. These will reduce the number of undersized shellfishes being brought up for sorting and therefore reduce the likelihood of damage and mortality to these individuals so increasing the prey species availability. All catches will be required to be reported further enabling Southern IFCA to monitor fishing effort levels throughout the shellfish fishery, with the potential to limit the number of permits issued in the future. For oysters only, the Solent Dredge Permit Byelaw will set out ‘Harvest Areas’ giving Southern IFCA the ability to open and close specific oyster beds. The determination of the status of oyster beds is based upon annual stock assessments.

This will allow greater flexibility to monitor and control the oyster fishery fishing effort through more specific opening or closing of these areas. Areas can be closed to allow for the recovery of populations or to provide a rest period for habitat structure to remain undisturbed. Vessels Used in Fishing byelaw prohibits commercial fishing vessels over 12 metres from the Southern IFCA district. The reduction in vessel size also restricts the type of gear that can be used, with vessels often using lighter towed gear.

The Solent European Marine Site (Prohibition of Method of Dredging)
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). Population recovery rates are species-specific (Roberts et al., 2010). Long-lived bivalves will undoubtedly take longer to recover from disturbance than other species such as short-lived and small benthic organisms on the other hand have rapid generation times, high fecundities and therefore excellent recolonization capacities (Coen, 1995; Roberts et al., 2010).

The recovery of faunal communities which experience high levels of natural disturbance are generally characterised by species able to withstand and recover from disturbance (Collie et al., 2000; Roberts et al., 2010). The longer recovery periods for soft sediments are related to the fact these habitats are mediated by physical, chemical and biological processes, as opposed to the dominance of physical processes that occur within sandy habitats (Roberts et al., 2010). The selective extraction of species and competition for prey were screened out at TLSE level as Manila clam and American hard-shell clam do not represent the prey species of designated bird species.

Order 2004 prevents pump scooping as a means of taking shellfish. Fishing for Oysters, Mussels and Clam byelaw regulates methods can be used to fish for these species. These are a) hand picking and b) dredging using a dredge with a rigid framed south designed to take shellfish only when towed along the sea bed.

Temporary Closure of Shellfish Beds byelaw allows the authority to temporarily close any bed or part of a bed of shellfish where it is the opinion of the Committee that it is severely depleted and as such required temporary closure in order to ensure recovery, or any bed or part of bed containing mainly immature or undersized shellfish which is in the interest of protection and development of the fishery, or any bed of transplanted shellfish that ought not to be fished until it becomes established.

The Cockles byelaw states that no person shall fish for or take from a fishery any cockle between 1st day of February and 30th of April and when the cockle bed is covered by water only a dredge less than 460 mm in width can be used. This largely eliminates the use of a clam dredge for harvesting cockles.

The Prohibition of Gathering (Sea Fisheries Resources) in Seagrass Beds byelaw prohibits any person from digging for, fishing for or taking any sea fisheries resource in or from the prohibited areas. No person shall carry a rake, spade, fork or any similar tool in prohibited areas.

The Bottom Towed Fishing Gear byelaw prohibits bottom towed fishing gear over
sensitive features including reef features and seagrass within the Solent and Chichester and Langstone Harbours SPA. IFCA is currently amending this byelaw to introduce additional network of permanent bottom towed fishing gear closure areas. The network is designed to protect good examples of low-energy SAC habitats, maintaining the integrity of the site, whilst also offering long-term stability to guard against the effects of fishing effort displacement which may result from other additional measures also being introduced. These additional measures include spatial and temporal restrictions on shellfish dredging within the site, via a network of dredge fishing management areas and daily closures from 17:00 to 07:00 (further details in section 7). Within each dredge fishing management area, shellfish dredging will be prohibited for 35 weeks of the year during the spring, summer and autumn months in order to enable the recovery of infaunal communities and to maintain the structure of intertidal and subtidal habitats, as well as supporting breeding shellfish populations.

Waterfowl all disturbance reduce the disturbance and displacement through:

Since the introduction of Bottom Towed Fishing Gear Byelaws first introduced in 2014 and the Solent Dredge Fishing Gear Byelaw shellfish dredging throughout the Solent has been noted to decline (Solent Forum, 2018). Most likely this is due to a combination of the reduction in available fishing area and increases in compliance actions. Both oyster dredging and clam dredging are now subject to a four-month open season, operating from November to February. During this season, an average 3 to 4 vessels will clam dredge across all three shellfish permit areas of Langstone Harbour, Portsmouth Harbour, Southampton Water and the wider Solent. Under this new byelaw, shellfish dredging will be prohibited for 35 weeks of the year during the spring, summer and autumn months (1st March to 31st October inclusive). This closed season enables the recovery of sedimentary habitats, including infaunal communities which supports food availability and helps to maintain the structure of intertidal and subtidal habitats. Additionally, it supports breeding shellfish populations. The timings of the recovery period were

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significantly disturbed. 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.

dredge management areas (Portsmouth Harbour, Southampton Water and Langstone Harbour) on fishable days when weather and tide permit. Due to tidal restrictions associated with the nature of this fishery, vessels are not able to operate over the entire 07:00-17:00 period open to fishing. The Dredge Permit Byelaw will enable bivalve fishing for an additional 2 hours each day the season is open, with the allowable fishing period between 06:00 and 18:00 daily. However, due to the physical restrictions of tides and water depth, this will not lead to a direct increase in fishing effort of 2 hours each day. Dredge fishing for bivalves in the intertidal in limited by the tidal height. Engagement with fishermen confirms that fishing is only possible around a window either side of HW, quoted as 2 hours either side by multiple fishermen. This is further restricted by vessel size and draft, water depth of the area fished, as well as weather conditions, all of which further restrict the available fishing period within the 12-hour window and over a period of days and weeks. Furthermore, fishers often do not work over two tidal cycles in one day, as the time restrictions regularly do not allow for this, and depending on catch success in the first tidal window it is often not necessary. Therefore, it is not possible for fishing effort to increase every day for an additional 2 hours. Finally, fishermen often take days of from fishing during each working week as well as over holiday periods further reducing the total effort. This change in management is to provide fishermen greater flexibility upon when they can fish, and is not intended to increase overall total
designed to allow for the quickest period of recovery over the summer months, which represents the period of highest biological activity for invertebrate fauna of sedimentary habitats. The permit byelaw will only allow shellfish dredging to take place between 06:00 and 18:00 in order to further manage fishing effort and aid compliance. Conditions which govern the bar spacing and strength will also form a part of the permit. These will reduce the number of undersized shellfish being brought up for sorting and therefore reduce the likelihood of damage and mortality to these individuals. All catches will be required to be reported further enabling Southern IFCA to monitor fishing effort levels throughout the shellfish fishery, with the potential to limit the number of permits issued in the future. For oysters only, the Solent Dredge Permit Byelaw will set out ‘Harvest Areas’ giving Southern IFCA the ability to open and close specific oyster beds. The determination of the status of oyster beds is based upon annual stock assessments. This will allow greater flexibility to monitor and control the oyster fishery fishing effort through more specific opening or closing of these areas. Areas can be closed to allow for the recovery of populations or to provide a rest period for habitat structure to remain undisturbed.

Vessels Used in Fishing byelaw prohibits commercial fishing vessels over 12 metres from the Southern IFCA district. The reduction in vessel size also restricts the type of gear that can be used, with vessels often using lighter towed gear.
effort. Therefore, this change should not significantly increase the impacts to the habitats, fauna and features of the designated site. Through the requirement to submit catch returns, including time spent fishing, Southern IFCA will have a greater ability to monitor this and quantify changes in fishing effort between seasons, also understanding better the relationship between fishing location and tidal restrictions.

Since 2013, the wider Solent and Southampton Water has been closed to oyster dredging. As a result, there has been no interaction between the activity and designated bird species. In the 2018/19 season Ryde middle bed will be open however this bed is not located close to any SPA.

The lack of activity therefore means that oyster dredging does not interact with the protected birds features and therefore cannot cause disturbance.

If Southampton Water and the wider Solent were not subject to closure, and the activity were to take place in these areas (Ryde Middle oyster bed will be open for the 2018/19 season), the activity is focused subtidally and occasionally fringes on the intertidal. It is thought that oyster dredging has very little direct impact on disturbance of waders since the activity occurs subtidally and when it does occur on the fringes of the intertidal zone (which is infrequently) it does so at high tide and feeding takes place at low tide, thus eliminating the possibility of any adverse significant effect.

Additional protection is afforded by virtue through permanent closures to

The Solent European Marine Site (Prohibition of Method of Dredging) Order 2004 prevents pump scooping as a means of taking shellfish.

Bottom Towed Fishing Gear 2016 byelaw prohibits bottom towed fishing gear over sensitive habitats. These habitats include reef, seagrass, as well as intertidal and subtidal sediments and saltmarsh within the Solent EMS. The network of permanent bottom towed fish closure areas helps to maintain site integrity and offer long-term stability against the effects of fishing displacement. The network of closure areas within the Solent MS, equates to approximately 33.9% of the Solent Maritime SAC.

Fishing for Oysters, Mussels and Clam byelaw regulates methods that can be used to fish for these species. These are 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.

Temporary Closure of Shellfish Beds byelaw allows the authority to temporarily close any bed or part of a bed of shellfish where it is the opinion of the Committee that it is severely depleted and as such required temporary closure in order to ensure recovery, or any bed or part of bed containing mainly immature or undersized shellfish which is in the interest of protection and development of the fishery, or any bed of transplanted shellfish that ought to not be fished until it becomes established. For the last three seasons (2013/14, 2014/15 and 2015/16) this byelaw has been used to close the oyster fishery in Southampton Water and the wider Solent, as well as...
bottom towed fishing gear designed to protect good examples of SAC habitat.

It is thought that shellfish dredging has very little direct impact on disturbance of waders since it occurs at high tide and feeding takes place at low tide, thus eliminating the possibly of any adverse significant effect.

Langstone Harbour is an area subject to moderate levels of vessel traffic and Solent and Southampton Water experiences high levels of vessel traffic and some bird species can become habituated to particular disturbance events or types of disturbance. In the context of the vessel levels that occur within these SPAs, it is therefore highly unlikely that shellfish dredging will lead to a significant adverse effect on the feature. In addition, the Harbours and Southampton Water are subject to periodic maintenance dredging that is likely to lead to greater disturbance than that caused by shellfish dredging.

Both oyster dredging and clam dredging are now subject to a four-month open season, operating from November to February. During this season, an average 3 to 4 vessels will clam dredge across all three shellfish dredge management areas (Portsmouth Harbour, Southampton Water and Langstone Harbour) on fishable days when weather and tide permit. Due to tidal restrictions associated with the nature of this fishery, vessels are not able to operate over the entire 07:00-17:00 period open to fishing. The Dredge Permit Byelaw will enable bivalve fishing for an additional 2 hours each day the season is open, with the allowable shortening the open season in the eastern harbours. For the 2016/17 season, Southampton Water and the wider Solent will remain closed and the eastern harbours will open as per the Oyster Close Season byelaw. The Oyster Close Season byelaw prohibits any person from dredging or fishing for in or taking any fishery oysters during the period from the 1st day of March to the 31st of October in any year.

Oyster dredge byelaw prohibits the use of any dredge which exceeds 1.5 m in length when using a single dredge or totalling 3.0 m in length when using two dredges at the same time.

Oysters, Clams, Mussels – Prohibition on Night Fishing byelaw prohibits any person from dredging or fishing or taking any oysters before 8.00 am or after 4.00 pm during the open season.

The Prohibition of Gathering (Sea Fisheries Resources) in Seagrass Beds byelaw prohibits any person from digging for, fishing for or taking any sea fisheries resource in or from the prohibited areas. No person shall carry a rake, spade, fork or any similar tool in prohibited areas.
fishing period between 06:00 and 18:00 daily. However, due to the physical restrictions of tides and water depth, this will not lead to a direct increase in fishing effort of 2 hours each day. Dredge fishing for bivalves in the intertidal in limited by the tidal height. Engagement with fishermen confirms that fishing is only possible around a window either side of HW, quoted as 2 hours either side by multiple fishermen. This is further restricted by vessel size and draft, water depth of the area fished, as well as weather conditions, all of which further restrict the available fishing period within the 12-hour window and over a period of days and weeks. Furthermore, fishers often do not work over two tidal cycles in one day, as the time restrictions regularly do not allow for this, and depending on catch success in the first tidal window it is often not necessary. Therefore, it is not possible for fishing effort to increase every day for an additional 2 hours. Finally, fishers often take days off from fishing during each working week as well as over holiday periods further reducing the total effort. This change in management is to provide fishermen greater flexibility upon when they can fish, and is not intended to increase overall total effort. Therefore, this change should not significantly increase the impacts to the habitats, fauna and features of the designated site. Through the requirement to submit catch returns, including time spent fishing, Southern IFCA will have a greater ability to monitor this and quantify changes in fishing effort between seasons, also understanding better the relationship between fishing location and tidal restrictions.
| Black-tailed godwit | 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. | Disturbance and displacement through visual presence and noise were identified as potential pressures of clam dredging. Disturbance can result in displacement when birds are unable to use an area, due to the magnitude of the 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 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. Since the introduction of Bottom Towed Fishing Gear Byelaws first introduced in 2014 and the Solent Dredge Fishing Gear Byelaw shellfish dredging throughout the Solent has been noted to decline (Solent Forum, 2018). Most likely this is due to a combination of the reduction in available fishing area and increases in compliance actions. There is no colocation information available for Black tailed Godwit in Solent and Southampton water. In Portsmouth black tailed godwits are known to feed in at least one area where co-location of the feature exists with clam dredging activity. It is thought that shellfish dredging has very little direct impact on disturbance of waders since it occurs at high tide and feeding takes place at low tide. Black-tailed godwits are present in significant numbers from July to April. The wind-farm sensitivity index indicates the Black-tailed godwit has low sensitivity to wind farm developments. Furthermore, Gill et al. (2001) reported no significant relationship between numbers of black-tailed godwits and human activity at a range of spatial scales (Gill et al., 2001). 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., 2001). Another study looking at the disturbance of bird species in the Solent reported low vulnerability to disturbance as a result of short disturbance distances and ability to feed effectively at night, when disturbance levels are much lower (Stillman et al., 2012). The Solent Dredge Permit Byelaw will apply to all areas of Langstone Harbour, Portsmouth Harbour, Southampton Water and the wider Solent. Under this new byelaw, shellfish dredging will be prohibited for 35 weeks of the year during spring, summer and autumn months (1st March to 31st October inclusive). This closed season enables the recovery of sedimentary habitats, including infaunal communities which supports food availability and helps to maintain the structure of intertidal and subtidal habitats. Additionally, it supports breeding shellfish populations. The timings of the recovery period were designed to allow for the quickest period of recovery over the summer months, which represents the period of highest biological activity for invertebrate fauna of sedimentary habitats. The permit byelaw will only allow shellfish dredging to take place between 06:00 and 18:00 in order to further manage fishing effort and aid compliance. Conditions which govern the bar spacing and strength will also form a part of the permit. These will reduce the number of undersized shellfish being brought up for sorting and therefore reduce the likelihood of damage and mortality to these individuals. All catches will be required to be reported further enabling Southern IFCA to monitor fishing effort levels throughout the shellfish fishery, with the potential to limit the number of permits issued in the future. For oysters only, the Solent Dredge Permit Byelaw will set out ‘Harvest Areas’ giving Southern IFCA the ability to open and close specific oyster beds. The determination of the status of oyster beds is based upon annual stock assessments. |
Since 2013, the wider Solent and Southampton Water has been closed to oyster dredging. As a result, there has been no interaction between the activity and designated bird species. In the 2018/19 season Ryde middle bed will be open however this bed is not located close to any SPA. The lack of activity therefore means that oyster dredging does not interact with the protected birds features and therefore cannot cause disturbance.

If Southampton Water and the wider Solent were not subject to closure, and the activity were to take place in these areas (Ryde Middle oyster bed will be open for the 2018/19 season), the activity is focused subtidally and occasionally fringes on the intertidal. It is thought that oyster dredging has very little direct impact on disturbance of waders since the activity occurs subtidally and when it does occur on the fringes of the intertidal zone (which is infrequently) it does so at high tide and feeding takes place at low tide, thus eliminating the possibility of any adverse significant effect.

Additional protection is afforded by virtue through permanent closures to bottom towed fishing gear designed to protect good examples of SAC habitat. Portsmouth Harbour and Solent and Southampton Water are areas subject to high levels of vessel traffic and some bird species can become habituated to particular disturbance events or types of disturbance. In the context of the high vessel levels that occur within these sites, it is therefore highly unlikely that shellfish dredging will not lead to a significant adverse impact.

This will allow greater flexibility to monitor and control the oyster fishery fishing effort through more specific opening or closing of these areas. Areas can be closed to allow for the recovery of populations or to provide a rest period for habitat structure to remain undisturbed.

Vessels Used in Fishing bylaw prohibits commercial fishing vessels over 12 metres from the Southern IFCA district. The reduction in vessel size also restricts the type of gear that can be used, with vessels often using lighter towed gear.

The Solent European Marine Site (Prohibition of Method of Dredging) Order 2004 prevents pump scooping as a means of taking shellfish.

Bottom Towed Fishing Gear 2016 bylaw prohibits bottom towed fishing gear over sensitive habitats. These habitats include reef, seagrass, as well as intertidal and subtidal sediments and saltmarsh within the Solent EMS. The network of permanent bottom towed closure areas helps to maintain site integrity and offer long-term stability against the effects of fishing displacement. The network of closure areas within the Solent MS, equates to approximately 33.9% of the Solent Maritime SAC.

Fishing for Oysters, Mussels and Clam bylaw regulates methods can be used to fish for these species. These are 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.
effect on the feature. In addition, Portsmouth Harbour and Solent and Southampton Water are subject to regular maintenance dredging that is likely to lead to greater disturbance than that caused by shellfish dredging. Both oyster dredging and clam dredging are now subject to a four-month open season, operating from November to February. During this season, an average 3 to 4 vessels will clam dredge across all three shellfish dredge management areas (Portsmouth Harbour, Southampton Water and Langstone Harbour) on fishable days when weather and tide permit. Due to tidal restrictions associated with the nature of this fishery, vessels are not able to operate over the entire 07:00-17:00 period open to fishing. The Dredge Permit Byelaw will enable bivalve fishing for an additional 2 hours each day the season is open, with the allowable fishing period between 06:00 and 18:00 daily. However, due to the physical restrictions of tides and water depth, this will not lead to a direct increase in fishing effort of 2 hours each day. Dredge fishing for bivalves in the intertidal is limited by the tidal height. Engagement with fishermen confirms that fishing is only possible around a window either side of HW, quoted as 2 hours either side by multiple fishermen. This is further restricted by vessel size and draft, water depth of the area fished, as well as weather conditions, all of which further restrict the available fishing period within the 12-hour window and over a period of days and weeks. Furthermore, fishermen often do not work over two tidal cycles in one day, as the time restrictions regularly do not allow Temporary Closure of Shellfish Beds byelaw allows the authority to temporarily close any bed or part of a bed of shellfish where it is the opinion of the Committee that it is severely depleted and as such required temporary closure in order to ensure recovery, or any bed or part of bed containing mainly immature or undersized shellfish which is in the interest of protection and development of the fishery, or any bed of transplanted shellfish that ought to not be fished until it becomes established. For the last three seasons (2013/14, 2014/15 and 2015/16) this byelaw has been used to close the oyster fishery in Southampton Water and the wider Solent, as well as shortening the open season in the eastern harbours. For the 2016/17 season, Southampton Water and the wider Solent will remain closed and the eastern harbours will open as per the Oyster Close Season byelaw. The Oyster Close Season byelaw prohibits any person from dredging or fishing for or taking any fishery oysters during the period from the 1st day of March to the 31st of October in any year. Oyster dredge byelaw prohibits the use of any dredge which exceeds 1.5 m in length when using a single dredge or totalling 3.0 m in length when using two dredges at the same time. Oysters, Clams, Mussels – Prohibition on Night Fishing byelaw prohibits any person from dredging or fishing or taking any oysters before 8.00 am or after 4.00 pm during the open season. The Prohibition of Gathering (Sea Fisheries Resources) in Seagrass Beds byelaw prohibits any person from digging for, fishing for or taking any sea fisheries resource in or from the
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| Grey plover | All | 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. | Disturbance and displacement through visual presence and noise were identified as potential pressures of clam dredging. Disturbance can result in displacement when birds are unable to use an area due to the magnitude of the 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 take flight which increase energy demands and reduce food intake with potential consequences for survival and reproduction. | Since the introduction of Bottom towed Fishing Gear Byelaws first introduced in 2014 and the Solent Dredge Fishing Gear Byelaw shellfish dredging throughout the Solent has been noted to decline (Solent Forum, 2018). Most likely this is due to a combination of the reduction in available fishing area and increases in compliance actions. Grey plovers are known to feed at low tide in the vicinity of at least one site where clam dredging also takes place. It is however thought that shellfish dredging has very little direct impact on disturbance of waders since it occurs at high tide and feeding takes place at low tide, thus eliminating the possibly of any adverse significant effect. | The Solent Dredge Permit Byelaw will apply to all areas of Langstone Harbour, Portsmouth Harbour, Southampton Water and the wider Solent. Under this new byelaw, shellfish dredging will be prohibited for 35 weeks of the year during spring, summer and autumn months (1st March to 31st October inclusive). This closed season enables the recovery of sedimentary habitats, including infaunal communities which supports food availability and helps to maintain the structure of intertidal and subtidal habitats. Additionally, it supports breeding shellfish populations. The timings of the recovery period were designed to allow for the quickest period of recovery over the summer months, which represents the period of highest biological activity for invertebrate fauna of sedimentary habitats. The permit prohibited areas. No person shall carry a rake, spade, fork or any similar tool in prohibited areas. |
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.

Grey plovers are present from August to March. The wind-farm sensitivity index indicates that Grey plover have very low sensitivity to wind farm developments. The escape flight distance exhibited by the species has been reported at 124 m in response to disturbance of people. In the Solent, the median response distance to disturbance was 75 m. Studies of bird disturbance in the Solent revealed that Grey plover typically had the shortest disturbance distances and were able to feed relatively effectively at night, meaning that these species were less affected by visitors. It is worth noting however that the study looked at disturbance in response to land-based and water-based recreational activities, with half of all incidences where major flight was observed involving activities on the intertidal.

Oyster dredging is however known to predominantly occur subtidally and infrequently occurs on the fringes on the intertidal. It is thought that oyster dredging has very little direct impact on disturbance of waders since the activity occurs subtidally and when it does occur on the fringes of the intertidal zone (which is infrequently) it does so at high tide and feeding takes place at low tide, thus eliminating the possibility of any adverse significant effect.

Langstone Harbour is an area subject to moderate levels of vessel traffic, and some bird species can become habituated to particular disturbance events or types of disturbance. In the context of the vessel levels that occur within the Langstone Harbour it is byelaw will only allow shellfish dredging to take place between 06:00 and 18:00 in order to further manage fishing effort and aid compliance. Conditions which govern the bar spacing and strength will also form a part of the permit. These will reduce the number of undersized shellfishes being brought up for sorting and therefore reduce the likelihood of damage and mortality to these individuals. All catches will be required to be reported further enabling Southern IFCA to monitor fishing effort levels throughout the shellfish fishery, with the potential to limit the number of permits issued in the future. For oysters only, the Solent Dredge Permit Byelaw will set out ‘Harvest Areas’ giving Southern IFCA the ability to open and close specific oyster beds. The determination of the status of oyster beds is based upon annual stock assessments.

This will allow greater flexibility to monitor and control the oyster fishery fishing effort through more specific opening or closing of these areas. Areas can be closed to allow for the recovery of populations or to provide a rest period for habitat structure to remain undisturbed.

Vessels Used in Fishing byelaw prohibits commercial fishing vessels over 12 metres from the Southern IFCA district. The reduction in vessel size also restricts the type of gear that can be used, with vessels often using lighter towed gear.

The Solent European Marine Site (Prohibition of Method of Dredging) Order 2004 prevents pump scooping as a means of taking shellfish.
therefore highly unlikely that clam dredging will lead to a significant adverse effect on the feature. In addition, the Harbours and Southampton Water are subject to periodic maintenance dredging that is likely to lead to greater disturbance than that caused by shellfish dredging.

Both oyster dredging and clam dredging are now subject to a four-month open season, operating from November to February. During this season, an average 3 to 4 vessels will clam dredge across all three shellfish dredge management areas (Portsmouth Harbour, Southampton Water and Langstone Harbour) on fishable days when weather and tide permit. Due to tidal restrictions associated with the nature of this fishery, vessels are not able to operate over the entire 07:00-17:00 period open to fishing. The Dredge Permit Byelaw will enable bivalve fishing for an additional 2 hours each day the season is open, with the allowable fishing period between 06:00 and 18:00 daily. However, due to the physical restrictions of tides and water depth, this will not lead to a direct increase in fishing effort of 2 hours each day. Dredge fishing for bivalves in the intertidal is limited by the tidal height. Engagement with fishermen confirms that fishing is only possible around a window either side of HW, quoted as 2 hours either side by multiple fishermen. This is further restricted by vessel size and draft, water depth of the area fished, as well as weather conditions, all of which further restrict the available fishing period within the 12-hour window and over a period of days and weeks. Furthermore, fishers often do not work Bottom Towed Fishing Gear 2016 bylaw prohibits bottom towed fishing gear over sensitive habitats. These habitats include reef, seagrass, as well as intertidal and subtidal sediments and saltmarsh within the Solent EMS. The network of permanent bottom towed gear closure areas helps to maintain site integrity and offer long-term stability against the effects of fishing displacement. The network of closure areas within the Solent MS, equates to approximately 33.9% of the Solent Maritime SAC.

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over two tidal cycles in one day, as the time restrictions regularly do not allow for this, and depending on catch success in the first tidal window it is often not necessary. Therefore, it is not possible for fishing effort to increase every day for an additional 2 hours. Finally, fishermen often take days of from fishing during each working week as well as over holiday periods further reducing the total effort. This change in management is to provide fishermen greater flexibility upon when they can fish, and is not intended to increase overall total effort. Therefore, this change should not significantly increase the impacts to the habitats, fauna and features of the designated site. Through the requirement to submit catch returns, including time spent fishing, Southern IFCA will have a greater ability to monitor this and quantify changes in fishing effort between seasons, also understanding better the relationship between fishing location and tidal restrictions.

Oyster Close Season byelaw. The Oyster Close Season byelaw prohibits any person from dredging or fishing for or taking any fishery oysters during the period from the 1st day of March to the 31st of October in any year. Oyster dredge byelaw prohibits the use of any dredge which exceeds 1.5 m in length when using a single dredge or totalling 3.0 m in length when using two dredges at the same time.

Oysters, Clams, Mussels – Prohibition on Night Fishing byelaw prohibits any person from dredging or fishing or taking any oysters before 8.00 am or after 4.00 pm during the open season.

The Prohibition of Gathering (Sea Fisheries Resources) in Seagrass Beds byelaw prohibits any person from digging for, fishing for or taking any sea fisheries resource in or from the prohibited areas. No person shall carry a rake, spade, fork or any similar tool in prohibited areas.

The Solent Dredge Permit Byelaw will apply to all areas of Langstone Harbour, Portsmouth Harbour, Southampton Water and the wider Solent. Under this new byelaw, shellfish dredging will be prohibited for 35 weeks of the year during spring, summer and autumn months (1st March to 31st October inclusive). This closed season enables the recovery of sedimentary habitats, including faunal communities which supports food availability and helps to maintain the structure of intertidal and subtidal habitats. Additionally, it supports breeding shellfish populations. The timings of the recovery period were designed to allow for the quickest period of recovery over the summer months, which represents the period of highest disturbance caused by human activity.

Disturbance and displacement through visual presence and noise were identified as potential pressures of clam dredging. Disturbance can result in displacement when birds are unable to use an area due to the magnitude of the 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 take flight which increase energy demands and reduce food intake with potential

Since the introduction of Bottom Towed Fishing Gear Byelaws first introduced in 2014 and the Solent Dredge Fishing Gear Byelaw shellfish dredging throughout the Solent has been noted to decline (Solent Forum, 2018). Most likely this is due to a combination of the reduction in available fishing area and increases in compliance actions.

The distribution of Sanderling is largely determined by sediment type and the population is confined to areas with sandy sediments. Co-location of sanderling with shellfish activity is not available. It is thought that shellfish dredging has very little direct impact on disturbance of waders since it

The Solent Dredge Permit Byelaw will apply to all areas of Langstone Harbour, Portsmouth Harbour, Southampton Water and the wider Solent. Under this new byelaw, shellfish dredging will be prohibited for 35 weeks of the year during spring, summer and autumn months (1st March to 31st October inclusive). This closed season enables the recovery of sedimentary habitats, including faunal communities which supports food availability and helps to maintain the structure of intertidal and subtidal habitats. Additionally, it supports breeding shellfish populations. The timings of the recovery period were designed to allow for the quickest period of recovery over the summer months, which represents the period of highest disturbance caused by human activity.
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.

occurs at high tide and feeding takes place at low tide.

Sanderling are present in significant numbers from October to May, and in August.

The wind-farm sensitivity index indicates that Sanderling have a very low sensitivity to wind farm developments.

Oyster dredging is however known to predominantly occur subtidally and infrequently occurs on the fringes of the intertidal. It is thought that oyster dredging has very little direct impact on disturbance of waders since the activity occurs subtidally and when it does occur on the fringes of the intertidal zone (which is infrequently) it does so at high tide and feeding takes place at low tide, eliminating the possibly of any adverse significant effect.

Langstone Harbour is an area subject to moderate levels of vessel traffic and some bird species can become habituated to particular disturbance events or types of disturbance. In the context of the moderate vessel levels that occur within Langstone Harbour, it is therefore highly unlikely that clam dredging will lead to a significant adverse effect on the feature. In addition, Langstone Harbour is subject to periodic maintenance dredging that is likely to lead to greater disturbance than that caused by shellfish dredging.

Both oyster dredging and clam dredging are now subject to a four-month open season, operating from November to February. During this season, an average 3 to 4 vessels will biological activity for invertebrate fauna of sedimentary habitats. The permit byelaw will only allow shellfish dredging to take place between 06:00 and 18:00 in order to further manage fishing effort and aid compliance. Conditions which govern the bar spacing and strength will also form a part of the permit. These will reduce the number of undersized shellfishes being brought up for sorting and therefore reduce the likelihood of damage and mortality to these individuals. All catches will be required to be reported further enabling Southern IFCA to monitor fishing effort levels throughout the shellfish fishery, with the potential to limit the number of permits issued in the future. For oysters only, the Solent Dredge Permit Byelaw will set out ‘Harvest Areas’ giving Southern IFCA the ability to open and close specific oyster beds. The determination of the status of oyster beds is based upon annual stock assessments.

This will allow greater flexibility to monitor and control the oyster fishery fishing effort through more specific opening or closing of these areas. Areas can be closed to allow for the recovery of populations or to provide a rest period for habitat structure to remain undisturbed.

Vessels Used in Fishing byelaw prohibits commercial fishing vessels over 12 metres from the Southern IFCA district. The reduction in vessel size also restricts the type of gear that can be used, with vessels often using lighter towed gear.

The Solent European Marine Site (Prohibition of Method of Dredging)
clam dredge across all three shellfish dredge management areas (Portsmouth Harbour, Southampton Water and Langstone Harbour) on fishable days when weather and tide permit. Due to tidal restrictions associated with the nature of this fishery, vessels are not able to operate over the entire 07:00-17:00 period open to fishing. The Dredge Permit Byelaw will enable bivalve fishing for an additional 2 hours each day the season is open, with the allowable fishing period between 06:00 and 18:00 daily. However, due to the physical restrictions of tides and water depth, this will not lead to a direct increase in fishing effort of 2 hours each day. Dredge fishing for bivalves in the intertidal is limited by the tidal height. Engagement with fishermen confirms that fishing is only possible around a window either side of HW, quoted as 2 hours either side by multiple fishermen. This is further restricted by vessel size and draft, water depth of the area fished, as well as weather conditions, all of which further restrict the available fishing period within the 12-hour window and over a period of days and weeks. Furthermore, fishers often do not work over two tidal cycles in one day, as the time restrictions regularly do not allow for this, and depending on catch success in the first tidal window it is often not necessary. Therefore, it is not possible for fishing effort to increase every day for an additional 2 hours. Finally, fishers often take days of from fishing during each working week as well as over holiday periods further reducing the total effort. This change in management is to provide fishermen greater flexibility upon when they can fish, and is not

Order 2004 prevents pump scooping as a means of taking shellfish.

Bottom Towed Fishing Gear 2016 byelaw prohibits bottom towed fishing gear over sensitive habitats. These habitats include reef, seagrass, as well as intertidal and subtidal sediments and saltmarsh within the Solent EMS. The network of permanent bottom towed features closure areas helps to maintain site integrity and offer long-term stability against the effects of fishing displacement. The network of closure areas within the Solent MS, equates to approximately 33.9% of the Solent Maritime SAC.

Fishing for Oysters, Mussels and Clam byelaw regulates methods can be used to fish for these species. These are 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.

Temporary Closure of Shellfish Beds byelaw allows the authority to temporarily close any bed or part of a bed of shellfish where it is the opinion of the Committee that it is severely depleted and as such required temporary closure in order to ensure recovery, or any bed or part of bed containing mainly immature or undersized shellfish which is in the interest of protection and development of the fishery, or any bed of transplanted shellfish that ought not to be fished until it becomes established. For the last three seasons (2013/14, 2014/15 and 2015/16) this byelaw has been used to close the oyster fishery in Southampton Water and the wider Solent, as well as shortening the open season in the eastern harbours. For the 2016/17
intended to increase overall total effort. Therefore, this change should not significantly increase the impacts to the habitats, fauna and features of the designated site. Through the requirement to submit catch returns, including time spent fishing, Southern IFCA will have a greater ability to monitor this and quantify changes in fishing effort between seasons, also understanding better the relationship between fishing location and tidal restrictions.

The Solent Dredge Permit Byelaw will apply to all areas of Langstone Harbour, Portsmouth Harbour, Southampton Water and the wider Solent. Under this new byelaw, shellfish dredging will be prohibited for 35 weeks of the year during spring, summer and autumn months (1st March to 31st October inclusive). This closed season enables the recovery of sedimentary habitats, including infaunal communities which supports food availability and helps to maintain the structure of intertidal and subtidal habitats. Additionally, it supports breeding shellfish populations. The timings of the recovery period were

| Dunlin | All | Disturbance | Reduce the | Disturbance and displacement through | Since the introduction of Bottom Towed Fishing Gear Byelaws first introduced in 2014 and the Solent Dredge Fishing Gear Byelaw shellfish dredging throughout the Solent has been noted to decline (Solent Forum, 2018). Most likely this is due to a combination of the reduction in available fishing area and increases in compliance actions. Dunlin are known to feed at low tide in areas where shellfish dredging activity also occurs. It is however thought that clam dredging has very little direct impact on disturbance of waders since it occurs at high tide and feeding takes place during the period from the 1st day of March to the 31st of October in any year. Oyster dredge byelaw prohibits the use of any dredge which exceeds 1.5 m in length when using a single dredge or totalling 3.0 m in length when using two dredges at the same time. Oysters, Clams, Mussels – Prohibition on Night Fishing byelaw prohibits any person from dredging or fishing or taking any oysters before 8.00 am or after 4.00 pm during the open season. The Prohibition of Gathering (Sea Fisheries Resources) in Seagrass Beds byelaw prohibits any person from digging for, fishing for or taking any sea fisheries resource in or from the prohibited areas. No person shall carry a rake, spade, fork or any similar tool in prohibited areas. |
significantly disturbed. 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.

place at low tide, thus eliminating the possibly of any adverse significant effect.

Dunlin are present in significant numbers from September to April. The wind farm sensitivity index indicates that Dunlin have low sensitivity to wind farm developments. The escape flight distance exhibited by the species ranges, in one study the distance from the disturbance stimulus was 30 m when stimuli was a researcher, to 71 to 163 m when people caused the disturbance. The median distance at which a response occurred was reported at 75 metres in the Solent. Studies in the Solent revealed that Dunlin were predicted to be one of the most vulnerable species to disturbance and disturbance was predicted to increase time spent feeding intertidally (Stillman et al., 2012). It is worth noting however that the study looked at disturbance in response to land-based and water-based recreational activities, with half of all incidences where major flight was observed involving activities on the intertidal.

Oyster dredging is however known to predominantly occur subtidally and infrequently occurs on the fringes on the intertidal zone (which is infrequently) it does so at high tide and feeding takes place at low tide, thus eliminating the possibly of any adverse significant effect. Vessels Used in Fishing byelaw prohibits commercial fishing vessels over 12 metres from the Southern IFCA district. The reduction in vessel size also restricts the type of gear that can be used, with vessels often using lighter towed gear.
Langstone Harbour is an area subject to moderate levels of vessel traffic, whilst Portsmouth harbour is subject to high levels of vessel activity and some bird species can become habituated to particular disturbance events or types of disturbance. In the context of the moderate vessel levels that occur within the Harbours, it is therefore highly unlikely that clam dredging will lead to a significant adverse effect on the feature. In addition, the Harbours are subject to periodic maintenance dredging that is likely to lead to greater disturbance than that caused by shellfish dredging.

Both oyster dredging and clam dredging are now subject to a four-month open season, operating from November to February. During this season, an average 3 to 4 vessels will clam/dredge across all three shellfish dredge management areas (Portsmouth Harbour, Southampton Water and Langstone Harbour) on fishable days when weather and tide permit. Due to tidal restrictions associated with the nature of this fishery, vessels are not able to operate over the entire 07:00-17:00 period open to fishing. The Dredge Permit Byelaw will enable bivalve fishing for an additional 2 hours each day the season is open, with the allowable fishing period between 06:00 and 18:00 daily. However, due to the physical restrictions of tides and water depth, this will not lead to a direct increase in fishing effort of 2 hours each day. Dredge fishing for bivalves in the intertidal is limited by the tidal height. Engagement with fishermen confirms that fishing is only possible around a window either side of HW, quoted as 2 hours either side by The Solent European Marine Site (Prohibition of Method of Dredging) Order 2004 prevents pump scooping as a means of taking shellfish.

Bottom Towed Fishing Gear 2016 byelaw prohibits bottom towed fishing gear over sensitive habitats. These habitats include reef, seagrass, as well as intertidal and subtidal sediments and saltmarsh within the Solent EMS. The network of permanent bottom towed fish closure areas helps to maintain site integrity and offer long-term stability against the effects of fishing displacement. The network of closure areas within the Solent MS, equates to approximately 33.9% of the Solent Maritime SAC.

Fishing for Oysters, Mussels and Clam byelaw regulates methods can be used to fish for these species. These are 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.

Temporary Closure of Shellfish Beds byelaw allows the authority to temporarily close any bed or part of a bed of shellfish where it is the opinion of the Committee that it is severely depleted and as such required temporary closure in order to ensure recovery, or any bed or part of bed containing mainly immature or undersized shellfish which is in the interest of protection and development of the fishery, or any bed of transplanted shellfish that ought to not be fished until it becomes established. For the last three seasons (2013/14, 2014/15 and 2015/16) this byelaw has been used to close the oyster fishery in Southampton Water and the wider Solent, as well as...
multiple fishermen. This is further restricted by vessel size and draft, water depth of the area fished, as well as weather conditions, all of which further restrict the available fishing period within the 12-hour window and over a period of days and weeks. Furthermore, fishers often do not work over two tidal cycles in one day, as the time restrictions regularly do not allow for this, and depending on catch success in the first tidal window it is often not necessary. Therefore, it is not possible for fishing effort to increase every day for an additional 2 hours. Finally, fishermen often take days off from fishing during each working week as well as over holiday periods further reducing the total effort. This change in management is to provide fishermen greater flexibility upon when they can fish, and is not intended to increase overall total effort. Therefore, this change should not significantly increase the impacts to the habitats, fauna and features of the designated site. Through the requirement to submit catch returns, including time spent fishing, Southern IFCA will have a greater ability to monitor this and quantify changes in fishing effort between seasons, also understanding better the relationship between fishing location and tidal restrictions.

Redshank

| Disturbance caused by human activity | Disturbance and displacement through visual presence and noise were identified as potential pressures of clam dredging. Disturbance can result in displacement when birds are unable to use an area due to the magnitude of the disturbance. The effects of disturbance can include a reduction in the survival of displaced individuals and effects on multiple fishermen. This is further restricted by vessel size and draft, water depth of the area fished, as well as weather conditions, all of which further restrict the available fishing period within the 12-hour window and over a period of days and weeks. Furthermore, fishers often do not work over two tidal cycles in one day, as the time restrictions regularly do not allow for this, and depending on catch success in the first tidal window it is often not necessary. Therefore, it is not possible for fishing effort to increase every day for an additional 2 hours. Finally, fishermen often take days off from fishing during each working week as well as over holiday periods further reducing the total effort. This change in management is to provide fishermen greater flexibility upon when they can fish, and is not intended to increase overall total effort. Therefore, this change should not significantly increase the impacts to the habitats, fauna and features of the designated site. Through the requirement to submit catch returns, including time spent fishing, Southern IFCA will have a greater ability to monitor this and quantify changes in fishing effort between seasons, also understanding better the relationship between fishing location and tidal restrictions. | Reduce the frequency, duration and / or intensity of disturbance affecting roosting, foraging, feeding, moulting | Since the introduction of Bottom Towed Fishing Gear Byelaws first introduced in 2014 and the Solent Dredge Fishing Gear Byelaw shellfish dredging throughout the Solent has been noted to decline (Solent Forum, 2018). Most likely this is due to a combination of the reduction in available fishing area and increases in compliance actions. | The Solent Dredge Permit Byelaw will apply to all areas of Langstone Harbour, Portsmouth Harbour, Southampton Water and the wider Solent. Under this new byelaw, shellfish dredging will be prohibited for 35 weeks of the year during spring, summer and autumn months (1st March to 31st October inclusive). This closed season enables the recovery of sedimentary habitats, including infaunal communities which shortening the open season in the eastern harbours. For the 2016/17 season, Southampton Water and the wider Solent will remain closed and the eastern harbours will open as per the Oyster Close Season byelaw. The Oyster Close Season byelaw prohibits any person from dredging or fishing for in or taking any fishery oysters during the period from the 1st day of March to the 31st of October in any year. Oyster dredge byelaw prohibits the use of any dredge which exceeds 1.5 m in length when using a single dredge or totalling 3.0 m in length when using two dredges at the same time. Oysters, Clams, Mussels – Prohibition on Night Fishing byelaw prohibits any person from dredging or fishing or taking any oysters before 8.00 am or after 4.00 pm during the open season. The Prohibition of Gathering (Sea Fisheries Resources) in Seagrass Beds byelaw prohibits any person from digging for, fishing for or taking any sea fisheries resource in or from the prohibited areas. No person shall carry a rake, spade, fork or any similar tool in prohibited areas.

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and/or loafing birds so that they are not significantly disturbed. The movement of birds to less suitable feeding areas can lead to increased densities and interspecific competition. Disturbance can cause birds to 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.

Redshank are known to feed at low tide in the vicinity of at least one site where shellfish dredging also takes place. It is however thought that shellfish dredging has very little direct impact on disturbance of waders since it occurs at high tide and feeding takes place at low tide, thus eliminating the possibly of any adverse significant effect.

Redshank are present in significant numbers between July and April. The wind-farm sensitivity index indicates that Redshank have low sensitivity to wind farm developments. The escape flight distance exhibited by the species has been reported at 92 m in response to researchers, 95 m in response to people 175 m in response to kayaks and 260 m in response to surfers. In another study, the median distance at which a response occurred was reported at ranged between 75-150 metres in the Solent. Studies of bird disturbance in the Solent revealed that Redshank had the shortest disturbance distances and were able to feed relatively affected at night, meaning that this species is less affected by disturbance from visitors (Stillman et al., 2012). It is worth noting however that the study looked at disturbance in response to land-based and water-based recreational activities, with half of all incidences where major flight was observed involving activities on the intertidal.

Oyster dredging is however known to predominantly occur subtidally and infrequently occurs on the fringes on the intertidal. It is thought that oyster dredging has very little direct impact on disturbance of waders since the supports food availability and helps to maintain the structure of intertidal and subtidal habitats. Additionally, it supports breeding shellfish populations. The timings of the recovery period were designed to allow for the quickest period of recovery over the summer months, which represents the period of highest biological activity for invertebrate fauna of sedimentary habitats. The permit byelaw will only allow shellfish dredging to take place between 06:00 and 18:00 in order to further manage fishing effort and aid compliance. Conditions which govern the bar spacing and strength will also form a part of the permit. These will reduce the number of undersized shellfishes being brought up for sorting and therefore reduce the likelihood of damage and mortality to these individuals. All catches will be required to be reported further enabling Southern IFCA the ability to open and close specific oyster beds. The determination of the status of oyster beds is based upon annual stock assessments.

This will allow greater flexibility to monitor and control the oyster fishery fishing effort through more specific opening or closing of these areas. Areas can be closed to allow for the recovery of populations or to provide a rest period for habitat structure to remain undisturbed.

Vessels Used in Fishing byelaw prohibits commercial fishing vessels over 12 metres from the Southern IFCA
activity occurs subtidally and when it does occur on the fringes of the intertidal zone (which is infrequently) it does so at high tide and feeding takes place at low tide, thus eliminating the possibility of any adverse significant effect.

Langstone Harbour is an area subject to moderate levels of vessel traffic and some bird species can become habituated to particular disturbance events or types of disturbance. In the context of the moderate vessel levels that occur within Langstone Harbour, it is therefore highly unlikely that shellfish dredging will lead to a significant adverse effect on the feature. In addition, Langstone Harbour is subject to periodic maintenance dredging that is likely to lead to greater disturbance than that caused by shellfish dredging.

Both oyster dredging and clam dredging are now subject to a four-month open season, operating from November to February. During this season, an average 3 to 4 vessels will clam dredge across all three shellfish dredge management areas (Portsmouth Harbour, Southampton Water and Langstone Harbour) on fishable days when weather and tide permit. Due to tidal restrictions associated with the nature of this fishery, vessels are not able to operate over the entire 07:00-17:00 period open to fishing. The Dredge Permit Byelaw will enable bivalve fishing for an additional 2 hours each day the season is open, with the allowable fishing period between 06:00 and 18:00 daily. However, due to the physical restrictions of tides and water depth, this will not lead to a direct district. The reduction in vessel size also restricts the type of gear that can be used, with vessels often using lighter towed gear.

The Solent European Marine Site (Prohibition of Method of Dredging) Order 2004 prevents pump scooping as a means of taking shellfish.

Bottom Towed Fishing Gear 2016 byelaw prohibits bottom towed fishing gear over sensitive habitats. These habitats include reef, seagrass, as well as intertidal and subtidal sediments and saltmarsh within the Solent EMS. The network of permanent bottom towed fear closure areas helps to maintain site integrity and offer long-term stability against the effects of fishing displacement. The network of closure areas within the Solent MS, equates to approximately 33.9% of the Solent Maritime SAC.

Fishing for Oysters, Mussels and Clam byelaw regulates methods can be used to fish for these species. These are 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.

Temporary Closure of Shellfish Beds byelaw allows the authority to temporarily close any bed or part of a bed of shellfish where it is the opinion of the Committee that it is severely depleted and as such required temporary closure in order to ensure recovery, or any bed or part of bed containing mainly immature or undersized shellfish which is in the interest of protection and development of the fishery, or any bed of transplanted shellfish that ought to not be fished until
increase in fishing effort of 2 hours each day. Dredge fishing for bivalves in the intertidal is limited by the tidal height. Engagement with fishermen confirms that fishing is only possible around a window either side of HW, quoted as 2 hours either side by multiple fishermen. This is further restricted by vessel size and draft, water depth of the area fished, as well as weather conditions, all of which further restrict the available fishing period within the 12-hour window and over a period of days and weeks. Furthermore, fishers often do not work over two tidal cycles in one day, as the time restrictions regularly do not allow for this, and depending on catch success in the first tidal window it is often not necessary. Therefore, it is not possible for fishing effort to increase every day for an additional 2 hours. Finally, fishers often take days off from fishing during each working week as well as over holiday periods further reducing the total effort. This change in management is to provide fishermen greater flexibility upon when they can fish, and is not intended to increase overall total effort. Therefore, this change should not significantly increase the impacts to the habitats, fauna and features of the designated site. Through the requirement to submit catch returns, including time spent fishing, Southern IFCA will have a greater ability to monitor this and quantify changes in fishing effort between seasons, also understanding better the relationship between fishing location and tidal restrictions.

| Dark-bellied brent goose | All | Disturbance caused by human activity | Reduce the intensity, frequency and duration of disturbance and displacement through visual presence and noise | Disturbance and displacement through visual presence and noise were identified as potential pressures of clam dredging. | Since the introduction of Bottom Towed Fishing Gear Byelaws first introduced in 2014 and the Solent Dredge Fishing Gear Byelaw shellfish it becomes established. For the last three seasons (2013/14, 2014/15 and 2015/16) this byelaw has been used to close the oyster fishery in Southampton Water and the wider Solent, as well as shortening the open season in the eastern harbours. For the 2016/17 season, Southampton Water and the wider Solent will remain closed and the eastern harbours will open as per the Oyster Close Season byelaw. The Oyster Close Season byelaw prohibits any person from dredging or fishing for in or taking any fishery oysters during the period from the 1st day of March to the 31st of October in any year. Oyster dredge byelaw prohibits the use of any dredge which exceeds 1.5 m in length when using a single dredge or totalling 3.0 m in length when using two dredges at the same time. Oysters, Clams, Mussels – Prohibition on Night Fishing byelaw prohibits any person from dredging or fishing or taking any oysters before 8.00 am or after 4.00 pm during the open season. The Prohibition of Gathering (Sea Fisheries Resources) in Seagrass Beds byelaw prohibits any person from digging for, fishing for or taking any sea fisheries resource in or from the prohibited areas. No person shall carry a rake, spade, fork or any similar tool in prohibited areas. | The Solent Dredge Permit Byelaw will apply to all areas of Langstone Harbour, Portsmouth Harbour, Southampton Water and the wider Solent. Under this |
of disturbance affecting roosting, foraging, feeding, moulting and/or loafing birds so that they are not significantly disturbed.

Disturbance can result in displacement when birds are unable to use an area due to the magnitude of the 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 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.

Dredging throughout the Solent has been noted to decline (Solent Forum, 2018). Most likely this is due to a combination of the reduction in available fishing area and increases in compliance actions. Dark-bellied Brent geese are known to feed on intertidal mudflats and sandflats and on mixed sediment shores during low tide. It is however thought that shellfish dredging has very little direct impact on disturbance of waders since it occurs at high tide and feeding takes place at low tide, thus eliminating the possibility of any adverse significant effect.

Dark-bellied brent geese occur from October to April.

The wind-farm sensitivity index indicates that Dark-bellied brent geese have moderate sensitivity to wind farm developments. The escape flight distance exhibited by the species ranges. The median distance at which a response occurred was reported at 51.5 metres in the Solent.

Since 2013, the wider Solent and Southampton Water has been closed to oyster dredging. As a result, there has been no interaction between the activity and designated bird species. In the 2018/19 season Ryde middle bed will be open however this bed is not located close to any SPA.

The lack of activity therefore means that oyster dredging does not interact with the protected birds features and therefore cannot cause disturbance.

If Southampton Water and the wider Solent were not subject to closure, and new byelaw, shellfish dredging will be prohibited for 35 weeks of the year during spring, summer and autumn months (1st March to 31st October inclusive). This closed season enables the recovery of sedimentary habitats, including infaunal communities which supports food availability and helps to maintain the structure of intertidal and subtidal habitats. Additionally, it supports breeding shellfish populations. The timings of the recovery period were designed to allow for the quickest period of recovery over the summer months, which represents the period of highest biological activity for invertebrate fauna of sedimentary habitats. The permit byelaw will only allow shellfish dredging to take place between 06:00 and 18:00 in order to further manage fishing effort and aid compliance. Conditions which govern the bar spacing and strength will also form a part of the permit. These will reduce the number of undersized shellfishes being brought up for sorting and therefore reduce the likelihood of damage and mortality to these individuals. All catches will be required to be reported further enabling Southern IFCA to monitor fishing effort levels throughout the shellfish fishery, with the potential to limit the number of permits issued in the future. For oysters only, the Solent Dredge Permit Byelaw will set out ‘Harvest Areas’ giving Southern IFCA the ability to open and close specific oyster beds. The determination of the status of oyster beds is based upon annual stock assessments. This will allow greater flexibility to monitor and control the oyster fishery fishing effort through more specific opening or closing of these areas. Areas can be closed to allow for the recovery.
the activity were to take place in these areas (Ryde Middle oyster bed will be open for the 2018/19 season), the activity is focused subtidally and occasionally fringes on the intertidal. It is thought that oyster dredging has very little direct impact on disturbance of waders since the activity occurs subtidally and when it does occur on the fringes of the intertidal zone (which is infrequently) it does so at high tide and feeding takes place at low tide, thus eliminating the possibility of any adverse significant effect.

Additional protection is afforded by virtue through permanent closures to bottom towed fishing gear designed to protect good examples of SAC habitat.

Langstone Harbour is an area subject to moderate levels of vessel traffic. Portsmouth, Solent and Southampton water are subject to high levels of vessel traffic and some bird species can become habituated to particular disturbance events or types of disturbance. In the context of the moderate vessel levels that occur within Langstone Harbour, it is therefore highly unlikely that shellfish dredging will lead to a significant adverse effect on the feature. In addition, Langstone Harbour is subject to periodic maintenance dredging that is likely to lead to greater disturbance than that caused by shellfish dredging.

Both oyster dredging and clam dredging are now subject to a four-month open season, operating from November to February. During this season, an average 3 to 4 vessels will clam dredge across all three shellfish dredge management areas (Portsmouth Harbour, Southampton Water and Langstone Harbour) on of populations or to provide a rest period for habitat structure to remain undisturbed.

Vessels Used in Fishing byelaw prohibits commercial fishing vessels over 12 metres from the Southern IFCA district. The reduction in vessel size also restricts the type of gear that can be used, with vessels often using lighter towed gear.

The Solent European Marine Site (Prohibition of Method of Dredging) Order 2004 prevents pump scooping as a means of taking shellfish.

Bottom Towed Fishing Gear 2016 byelaw prohibits bottom towed fishing gear over sensitive habitats. These habitats include reef, seagrass, as well as intertidal and subtidal sediments and saltmarsh within the Solent EMS. The network of permanent bottom towed fear closure areas helps to maintain site integrity and offer long-term stability against the effects of fishing displacement. The network of closure areas within the Solent MS, equates to approximately 33.9% of the Solent Maritime SAC.

Fishing for Oysters, Mussels and Clam byelaw regulates methods can be used to fish for these species. These are 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.

Temporary Closure of Shellfish Beds byelaw allows the authority to temporarily close any bed or part of a bed of shellfish where it is the opinion of the Committee that it is severely depleted and as such required
fishable days when weather and tide permit. Due to tidal restrictions associated with the nature of this fishery, vessels are not able to operate over the entire 07:00-17:00 period open to fishing. The Dredge Permit Byelaw will enable bivalve fishing for an additional 2 hours each day the season is open, with the allowable fishing period between 06:00 and 18:00 daily. However, due to the physical restrictions of tides and water depth, this will not lead to a direct increase in fishing effort of 2 hours each day. Dredge fishing for bivalves in the intertidal is limited by the tidal height. Engagement with fishermen confirms that fishing is only possible around a window either side of HW, quoted as 2 hours either side by multiple fishermen. This is further restricted by vessel size and draft, water depth of the area fished, as well as weather conditions, all of which further restrict the available fishing period within the 12-hour window and over a period of days and weeks. Furthermore, fishers often do not work over two tidal cycles in one day, as the time restrictions regularly do not allow for this, and depending on catch success in the first tidal window it is often not necessary. Therefore, it is not possible for fishing effort to increase every day for an additional 2 hours. Finally, fishermen often take days of from fishing during each working week as well as over holiday periods further reducing the total effort. This change in management is to provide fishermen greater flexibility upon when they can fish, and is not intended to increase overall total effort. Therefore, this change should not significantly increase the impacts to the habitats, fauna and features of the temporary closure in order to ensure recovery, or any bed or part of bed containing mainly immature or undersized shellfish which is in the interest of protection and development of the fishery, or any bed of transplanted shellfish that ought to not be fished until it becomes established. For the last three seasons (2013/14, 2014/15 and 2015/16) this byelaw has been used to close the oyster fishery in Southampton Water and the wider Solent, as well as shortening the open season in the eastern harbours. For the 2016/17 season, Southampton Water and the wider Solent will remain closed and the eastern harbours will open as per the Oyster Close Season byelaw. The Oyster Close Season byelaw prohibits any person from dredging or fishing for in or taking any fishery oysters during the period from the 1st day of March to the 31st of October in any year. Oyster dredge byelaw prohibits the use of any dredge which exceeds 1.5 m in length when using a single dredge or totalling 3.0 m in length when using two dredges at the same time.

Oysters, Clams, Mussels – Prohibition on Night Fishing byelaw prohibits any person from dredging or fishing or taking any oysters before 8.00 am or after 4.00 pm during the open season. The Prohibition of Gathering (Sea Fisheries Resources) in Seagrass Beds byelaw prohibits any person from digging for, fishing for or taking any sea fisheries resource in or from the prohibited areas. No person shall carry a rake, spade, fork or any similar tool in prohibited areas.
<table>
<thead>
<tr>
<th>Shelduck</th>
<th>All</th>
<th>Disturbance</th>
<th>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.</th>
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| | | Disturbance and displacement through visual presence and noise were identified as potential pressures of clam dredging. Disturbance can result in displacement when birds are unable to use an area due to the magnitude of the 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 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. | Since the introduction of Bottom Towed Fishing Gear Byelaws first introduced in 2014 and the Solent Dredge Fishing Gear Byelaw shellfish dredging throughout the Solent has been noted to decline (Solent Forum, 2018). Most likely this is due to a combination of the reduction in available fishing area and increases in compliance actions. Shelduck are known to feed at low tide in the vicinity of at least one site where clam dredging also takes place. It is however thought that shellfish dredging has very little direct impact on disturbance of waders since it occurs at high tide and feeding takes place at low tide, thus eliminating the possibly of any adverse significant effect. Shelduck are present in significant numbers between November and June. The wind-farm sensitivity index indicates the Shelduck have very low sensitivity to wind farm developments. The escape flight distance exhibited by the species has been reported at 148-250 m in response to disturbance of people. In another study, the median distance at which a response occurred was reported at 77.5 metres in the Solent. The Solent Dredge Permit Byelaw will apply to all areas of Langstone Harbour, Portsmouth Harbour, Southampton Water and the wider Solent. Under this new byelaw, shellfish dredging will be prohibited for 35 weeks of the year during spring, summer and autumn months (1st March to 31st October inclusive). This closed season enables the recovery of sedimentary habitats, including infaunal communities which supports food availability and helps to maintain the structure of intertidal and subtidal habitats. Additionally, it supports breeding shellfish populations. The timings of the recovery period were designed to allow for the quickest period of recovery over the summer months, which represents the period of highest biological activity for invertebrate fauna of sedimentary habitats. The permit byelaw will only allow shellfish dredging to take place between 06:00 and 18:00 in order to further manage fishing effort and aid compliance. Conditions which govern the bar spacing and strength will also form a part of the permit. These will reduce the number of undersized shellfishes being brought up for sorting and therefore reduce the likelihood of damage and mortality to these individuals. All catches will be required to be reported further enabling Southern IFCA to monitor fishing effort levels throughout the shellfish fishery, with the potential to limit the number of permits issued in the future. For oysters.
Oyster dredging is however known to predominantly occur subtidally and infrequently occurs on the fringes of the intertidal. It is thought that oyster dredging has very little direct impact on disturbance of waders since the activity occurs subtidally and when it does occur on the fringes of the intertidal zone (which is infrequently) it does so at high tide and feeding takes place at low tide, thus eliminating the possibility of any adverse significant effect.

Langstone Harbour is an area subject to moderate levels of vessel traffic and some bird species can become habituated to particular disturbance events or types of disturbance. In the context of the moderate vessel levels that occur within Langstone Harbour, it is therefore highly unlikely that shellfish dredging will lead to a significant adverse effect on the feature. In addition, Langstone Harbour is subject to periodic maintenance dredging that is likely to lead to greater disturbance than that caused by shellfish dredging. Both oyster dredging and clam dredging are now subject to a four-month open season, operating from November to February. During this season, an average 3 to 4 vessels will clam dredge across all three shellfish dredge management areas (Portsmouth Harbour, Southampton Water and Langstone Harbour) on fishable days when weather and tide permit. Due to tidal restrictions associated with the nature of this fishery, vessels are not able to operate over the entire 07:00-17:00 period open to fishing. The Dredge Permit Byelaw will enable bivalve fishing for only, the Solent Dredge Permit Byelaw will set out ‘Harvest Areas’ giving Southern IFCA the ability to open and close specific oyster beds. The determination of the status of oyster beds is based upon annual stock assessments.

This will allow greater flexibility to monitor and control the oyster fishery fishing effort through more specific opening or closing of these areas. Areas can be closed to allow for the recovery of populations or to provide a rest period for habitat structure to remain undisturbed.

Vessels Used in Fishing byelaw prohibits commercial fishing vessels over 12 metres from the Southern IFCA district. The reduction in vessel size also restricts the type of gear that can be used, with vessels often using lighter towed gear.

The Solent European Marine Site (Prohibition of Method of Dredging) Order 2004 prevents pump scooping as a means of taking shellfish.

Bottom Towed Fishing Gear 2016 byelaw prohibits bottom towed fishing gear over sensitive habitats. These habitats include reef, seagrass, as well as intertidal and subtidal sediments and saltmarsh within the Solent EMS. The network of permanent bottom towed closure areas helps to maintain site integrity and offer long-term stability against the effects of fishing displacement. The network of closure areas equates to approximately 33.9% of the Solent Maritime SAC.

Fishing for Oysters, Mussels and Clam byelaw regulates methods can be used.
an additional 2 hours each day the season is open, with the allowable fishing period between 06:00 and 18:00 daily. However, due to the physical restrictions of tides and water depth, this will not lead to a direct increase in fishing effort of 2 hours each day. Dredge fishing for bivalves in the intertidal in limited by the tidal height. Engagement with fishermen confirms that fishing is only possible around a window either side of HW, quoted as 2 hours either side by multiple fishermen. This is further restricted by vessel size and draft, water depth of the area fished, as well as weather conditions, all of which further restrict the available fishing period within the 12-hour window and over a period of days and weeks. Furthermore, fishers often do not work over two tidal cycles in one day, as the time restrictions regularly do not allow for this, and depending on catch success in the first tidal window it is often not necessary. Therefore, it is not possible for fishing effort to increase every day for an additional 2 hours. Finally, fishers often take days of from fishing during each working week as well as over holiday periods further reducing the total effort. This change in management is to provide fishermen greater flexibility upon when they can fish, and is not intended to increase overall total effort. Therefore, this change should not significantly increase the impacts to the habitats, fauna and features of the designated site. Through the requirement to submit catch returns, including time spent fishing, Southern IFCA will have a greater ability to monitor this and quantify changes in fishing effort between seasons, also understanding better the relationship to fish for these species. These are a) hand picking and b) dredging using a dredge with a rigid framed south designed to take shellfish only when towed along the sea bed.

Temporary Closure of Shellfish Beds byelaw allows the authority to temporarily close any bed or part of a bed of shellfish where it is the opinion of the Committee that it is severely depleted and as such required temporary closure in order to ensure recovery, or any bed or part of bed containing mainly immature or undersized shellfish which is in the interest of protection and development of the fishery, or any bed of transplanted shellfish that ought to not be fished until it becomes established. For the last three seasons (2013/14, 2014/15 and 2015/16) this byelaw has been used to close the oyster fishery in Southampton Water and the wider Solent, as well as shortening the open season in the eastern harbours. For the 2016/17 season, Southampton Water and the wider Solent will remain closed and the eastern harbours will open as per the Oyster Close Season byelaw. The Oyster Close Season byelaw prohibits any person from dredging or fishing for in or taking any fishery oysters during the period from the 1st day of March to the 31st of October in any year. Oyster dredge byelaw prohibits the use of any dredge which exceeds 1.5 m in length when using a single dredge or totalling 3.0 m in length when using two dredges at the same time.

Oysters, Clams, Mussels – Prohibition on Night Fishing byelaw prohibits any person from dredging or fishing or taking any oysters before 8.00 am or after 4.00 pm during the open season.
Disturbance and displacement through visual presence and noise were identified as potential pressures of clam dredging. Disturbance can result in displacement when birds are unable to use an area due to the magnitude of the 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 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. Since the introduction of Bottom Towed Fishing Gear Byelaws first introduced in 2014 and the Solent Dredge Fishing Gear Byelaw shellfish dredging throughout the Solent has been noted to decline (Solent Forum, 2018). Most likely this is due to a combination of the reduction in available fishing area and increases in compliance actions. Teals are known to feed at low tide in the vicinity of at least one site where shellfish dredging also takes place. It is however thought that shellfish dredging has very little direct impact on disturbance of waders since it occurs at high tide and feeding takes place at low tide, thus eliminating the possibility of any adverse significant effect. Teals are present from September to March. The wind-farm sensitivity index indicates that Teal have very low sensitivity to wind farm developments. The escape flight distance exhibited by the species widely ranges. In response to boats, the distance from the disturbance stimuli was 400 m, however in response to researchers was 86 m. In another study, the median distance at which a response between fishing location and tidal restrictions.

The Prohibition of Gathering (Sea Fisheries Resources) in Seagrass Beds byelaw prohibits any person from digging for, fishing for or taking any sea fisheries resource in or from the prohibited areas. No person shall carry a rake, spade, fork or any similar tool in prohibited areas.

The Solent Dredge Permit Byelaw will apply to all areas of Langstone Harbour, Portsmouth Harbour, Southampton Water and the wider Solent. Under this new byelaw, shellfish dredging will be prohibited for 35 weeks of the year during spring, summer and autumn months (1st March to 31st October inclusive). This closed season enables the recovery of sedimentary habitats, including infaunal communities which supports food availability and helps to maintain the structure of intertidal and subtidal habitats. Additionally, it supports breeding shellfish populations. The timings of the recovery period were designed to allow for the quickest period of recovery over the summer months, which represents the period of highest biological activity for invertebrate fauna of sedimentary habitats. The permit byelaw will only allow shellfish dredging to take place between 06:00 and 18:00 in order to further manage fishing effort and aid compliance. Conditions which govern the bar spacing and strength will also form a part of the permit. These will reduce the number of undersized shellfishes being brought up for sorting and therefore reduce the likelihood of damage and mortality to these individuals. All catches will be required to be reported further enabling Southern IFCA to monitor fishing effort levels throughout the shellfish fishery.
occurred was reported at 60 metres in the Solent.

Since 2013, the wider Solent and Southampton Water has been closed to oyster dredging. As a result, there has been no interaction between the activity and designated bird species. In the 2018/19 season Ryde middle bed will be open however this bed is not located close to any SPA.

The lack of activity therefore means that oyster dredging does not interact with the protected birds features and therefore cannot cause disturbance. If Southampton Water and the wider Solent were not subject to closure, and the activity were to take place in these areas (Ryde Middle oyster bed will be open for the 2018/19 season), the activity is focused subtidally and occasionally fringes on the intertidal. It is thought that oyster dredging has very little direct impact on disturbance of waders since the activity occurs subtidally and when it does occur on the fringes of the intertidal zone (which is infrequently) it does so at high tide and feeding takes place at low tide, thus eliminating the possibility of any adverse significant effect.

Additional protection is afforded by virtue through permanent closures to bottom towed fishing gear designed to protect good examples of SAC habitat. Langstone Harbour is an area subject to moderate levels of vessel traffic whilst Solent and Southampton water experience high levels of vessel traffic and some bird species can become habituated to particular disturbance events or types of disturbance. In the context of the moderate vessel levels that occur within Langstone Harbour, with the potential to limit the number of permits issued in the future. For oysters only, the Solent Dredge Permit Byelaw will set out ‘Harvest Areas’ giving Southern IFCA the ability to open and close specific oyster beds. The determination of the status of oyster beds is based upon annual stock assessments.

This will allow greater flexibility to monitor and control the oyster fishery. Fishing effort through more specific opening or closing of these areas. Areas can be closed to allow for the recovery of populations or to provide a rest period for habitat structure to remain undisturbed.

Vessels Used in Fishing byelaw prohibits commercial fishing vessels over 12 metres from the Southern IFCA district. The reduction in vessel size also restricts the type of gear that can be used, with vessels often using lighter towed gear.

The Solent European Marine Site (Prohibition of Method of Dredging) Order 2004 prevents pump scooping as a means of taking shellfish.

Bottom Towed Fishing Gear 2016 byelaw prohibits bottom towed fishing gear over sensitive habitats. These habitats include reef, seagrass, as well as intertidal and subtidal sediments and saltmarsh within the Solent EMS. The network of permanent bottom towed gear closure areas helps to maintain site integrity and offer long-term stability against the effects of fishing displacement. The network of closure areas within the Solent Maritime SAC equates to approximately 33.9% of the Solent Maritime SAC.
and high levels in the Solent and Southampton water it is therefore highly unlikely that shellfish dredging will lead to a significant adverse effect on the feature. In addition, Langstone Harbour is subject to periodic maintenance dredging that is likely to lead to greater disturbance than that caused by shellfish dredging.

Both oyster dredging and clam dredging are now subject to a four-month open season, operating from November to February. During this season, an average 3 to 4 vessels will clam dredge across all three shellfish dredge management areas (Portsmouth Harbour, Southampton Water and Langstone Harbour) on fishable days when weather and tide permit. Due to tidal restrictions associated with the nature of this fishery, vessels are not able to operate over the entire 07:00-17:00 period open to fishing. The Dredge Permit Byelaw will enable bivalve fishing for an additional 2 hours each day the season is open, with the allowable fishing period between 06:00 and 18:00 daily. However, due to the physical restrictions of tides and water depth, this will not lead to a direct increase in fishing effort of 2 hours each day. Dredge fishing for bivalves in the intertidal is limited by the tidal height. Engagement with fishermen confirms that fishing is only possible around a window either side of HW, quoted as 2 hours either side by multiple fishermen. This is further restricted by vessel size and draft, water depth of the are fished, as well as weather conditions, all of which further restrict the available fishing period within the 12-hour window and over a period of days and weeks.

Fishing for Oysters, Mussels and Clam byelaw regulates methods that can be used to fish for these species. These are 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.

Temporary Closure of Shellfish Beds byelaw allows the authority to temporarily close any bed or part of a bed of shellfish where it is the opinion of the Committee that it is severely depleted and as such required temporary closure in order to ensure recovery, or any bed or part of bed containing mainly immature or undersized shellfish which is in the interest of protection and development of the fishery, or any bed of transplanted shellfish that ought to not be fished until it becomes established. For the last three seasons (2013/14, 2014/15 and 2015/16) this byelaw has been used to close the oyster fishery in Southampton Water and the wider Solent, as well as shortening the open season in the eastern harbours. For the 2016/17 season, Southampton Water and the wider Solent will remain closed and the eastern harbours will open as per the Oyster Close Season byelaw. The Oyster Close Season byelaw prohibits any person from dredging or fishing for in or taking any fishery oysters during the period from the 1st day of March to the 31st of October in any year.

Oyster dredge byelaw prohibits the use of any dredge which exceeds 1.5 m in length when using a single dredge or totalling 3.0 m in length when using two dredges at the same time.

Oysters, Clams, Mussels – Prohibition on Night Fishing byelaw prohibits any
Furthermore, fishers often do not work over two tidal cycles in one day, as the time restrictions regularly do not allow for this, and depending on catch success in the first tidal window it is often not necessary. Therefore, it is not possible for fishing effort to increase every day for an additional 2 hours. Finally, fishermen often take days of from fishing during each working week as well as over holiday periods further reducing the total effort. This change in management is to provide fishermen greater flexibility upon when they can fish, and is not intended to increase overall total effort. Therefore, this change should not significantly increase the impacts to the habitats, fauna and features of the designated site.  Through the requirement to submit catch returns, including time spent fishing, Southern IFCA will have a greater ability to monitor this and quantify changes in fishing effort between seasons, also understanding better the relationship between fishing location and tidal restrictions.

<table>
<thead>
<tr>
<th>Ringed plover</th>
<th>All</th>
<th>Disturbance</th>
<th>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.</th>
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Ringed plovers are present from August to May. The wind-farm sensitivity index indicates that Ringed plover have very low sensitivity to wind farm developments. The escape flight distance exhibited by the species has been reported at 121 m in response to disturbance of people. Studies of bird disturbance in the Solent revealed that ringed plover was one of the most vulnerable to disturbance and it was reported that disturbance increased the level of time spent feeding (Stillman et al., 2012). It is worth noting however that the study looked at disturbance in response to land-based and water-based recreational activities, with half of all incidences where major flight was observed involving activities on the intertidal.

Since 2013, the wider Solent and Southampton Water has been closed to oyster dredging. As a result, there has been no interaction between the activity and designated bird species. In the 2018/19 season Ryde middle bed will be open however this bed is not located close to any SPA.

The lack of activity therefore means that oyster dredging does not interact with the protected birds features and therefore cannot cause disturbance. If Southampton Water and the wider Solent were not subject to closure, and the activity were to take place in these areas (Ryde Middle oyster bed will be open for the 2018/19 season), the activity is focused subtidally and occasionally fringes on the intertidal. It which represents the period of highest biological activity for invertebrate fauna of sedimentary habitats. The permit byelaw will only allow shellfish dredging to take place between 06:00 and 18:00 in order to further manage fishing effort and aid compliance. Conditions which govern the bar spacing and strength will also form a part of the permit. These will reduce the number of undersized shellfish being brought up for sorting and therefore reduce the likelihood of damage and mortality to these individuals. All catches will be required to be reported further enabling Southern IFCA to monitor fishing effort levels throughout the shellfish fishery, with the potential to limit the number of permits issued in the future. For oysters only, the Solent Dredge Permit Byelaw will set out ‘Harvest Areas’ giving Southern IFCA the ability to open and close specific oyster beds. The determination of the status of oyster beds is based upon annual stock assessments. This will allow greater flexibility to monitor and control the oyster fishery fishing effort through more specific opening or closing of these areas. Areas can be closed to allow for the recovery of populations or to provide a res period for habitat structure to remain undisturbed.

Vessels Used in Fishing byelaw prohibits commercial fishing vessels over 12 metres from the Southern IFCA district. The reduction in vessel size also restricts the type of gear that can be used, with vessels often using lighter towed gear.

The Solent European Marine Site (Prohibition of Method of Dredging)
is thought that oyster dredging has very little direct impact on disturbance of waders since the activity occurs subtidally and when it does occur on the fringes of the intertidal zone (which is infrequently) it does so at high tide and feeding takes place at low tide, thus eliminating the possibility of any adverse significant effect.

Additional protection is afforded by virtue through permanent closures to bottom towed fishing gear designed to protect good examples of SAC habitat.

Langstone Harbour is an area subject to moderate levels of vessel traffic and Solent and Southampton Water experiences high levels of vessel traffic and some bird species can become habituated to particular disturbance events or types of disturbance. In the context of the moderate and high vessel levels that occur within Langstone Harbour and Solent and Southampton Water it is therefore highly unlikely that shellfish dredging will lead to a significant adverse effect on the feature. In addition, Langstone Harbour is subject to periodic maintenance dredging that is likely to lead to greater disturbance than that caused by shellfish dredging.

Both oyster dredging and clam dredging are now subject to a four-month open season, operating from November to February. During this season, an average 3 to 4 vessels will clam dredge across all three shellfish dredge management areas (Portsmouth Harbour, Southampton Water and Langstone Harbour) on fishable days when weather and tide permit. Due to tidal restrictions associated with the nature of this fishery, vessels are not able to operate Order 2004 prevents pump scooping as a means of taking shellfish.

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The Prohibition of Gathering (Sea Fisheries Resources) in Seagrass Beds byelaw prohibits any person from digging for, fishing for or taking any sea fisheries resource in or from the prohibited areas. No person shall carry a rake, spade, fork or any similar tool in prohibited areas.
monitor this and quantify changes in fishing effort between seasons, also understanding better the relationship between fishing location and tidal restrictions.

Since the introduction of Bottom Towed Fishing Gear Byelaws first introduced in 2014 and the Solent Dredge Fishing Gear Byelaw shellfish dredging throughout the Solent has been noted to decline (Solent Forum, 2018). Most likely this is due to a combination of the reduction in available fishing area and increases in compliance actions.

Curlew are known to feed at low tide in the vicinity of at least one site where shellfish dredging also takes place. It is however thought that shellfish dredging has very little direct impact on disturbance of waders since it occurs at high tide and feeding takes place at low tide.\textsuperscript{2} \textsuperscript{3}\textsuperscript{4} \textsuperscript{5} Eliminating the possibly of any adverse effect. Curlew are present in significant numbers between June and April. The wind farm sensitivity index indicates that Curlew have low sensitivity to wind farm developments. The escape flight distance exhibited by the species has been reported at 95 m to 339 m in response to people, 220 m in response to kayaks and 400 m \textsuperscript{2} in response to surfers. In another study the median distance at which a response occurred was reported at 75 metres in the Solent. Studies of bird disturbance in the Solent revealed that curlew were the most vulnerable to disturbance and it was reported that disturbance decreased the level of time spent feeding (Stillman et al., 2012). It is worth noting however that disturbance and displacement through visual presence and noise were identified as potential pressures of clam dredging.

Disturbance can result in displacement when birds are unable to use an area due to the magnitude of the 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 take flight which increase energy demands and reduce food intake with potential consequences for survival and reproduction.

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Oyster dredging is however known to predominantly occur subtidally and infrequently occurs on the fringes on the intertidal. It is thought that oyster dredging has very little direct impact on disturbance of waders since the activity occurs subtidally and when it does occur on the fringes of the intertidal zone (which is infrequently) it does so at high tide and feeding takes place at low tide, thus eliminating the possibility of any adverse significant effect.

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Both oyster dredging and clam dredging are now subject to a four-month open season, operating from November to February. During this season, an average 3 to 4 vessels will clam dredge across all three shellfish dredge management areas (Portsmouth Harbour, Southampton Water and Langstone Harbour) on determination of the status of oyster beds is based upon annual stock assessments.

This will allow greater flexibility to monitor and control the oyster fishery fishing effort through more specific opening or closing of these areas. Areas can be closed to allow for the recovery of populations or to provide a rest period for habitat structure to remain undisturbed.

Vessels Used in Fishing byelaw prohibits commercial fishing vessels over 12 metres from the Southern IFCA district. The reduction in vessel size also restricts the type of gear that can be used, with vessels often using lighter towed gear.

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Temporary Closure of Shellfish Beds byelaw allows the authority to temporarily close any bed or part of a bed of shellfish where it is the opinion of the Committee that it is severely depleted and as such required temporary closure in order to ensure recovery, or any bed or part of bed containing mainly immature or undersized shellfish which is in the interest of protection and development of the fishery, or any bed of transplanted shellfish that ought to not be fished until it becomes established. For the last three seasons (2013/14, 2014/15 and 2015/16) this byelaw has been used to close the oyster fishery in Southampton Water and the wider Solent, as well as shortening the open season in the eastern harbours. For the 2016/17 season, Southampton Water and the wider Solent will remain closed and the eastern harbours will open as per the Oyster Close Season byelaw. The Oyster Close Season byelaw prohibits any person from dredging or fishing for or taking any oyster fishery oysters during the period from the 1st day of March to the 31st of October in any year. Oyster dredge byelaw prohibits the use of any dredge which exceeds 1.5 m in length when using a single dredge or totalling 3.0 m in length when using two dredges at the same time. Oysters, Clams, Mussels – Prohibition on Night Fishing byelaw prohibits any person from dredging or fishing or taking any oyster fish before 8.00 am or after 4.00 pm during the open season. The Prohibition of Gathering (Sea Fisheries Resources) in Seagrass Beds
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Bar-tailed godwits

Disturbance and displacement through visual presence and noise were identified as potential pressures of clam dredging. Disturbance can result in displacement when birds are unable to use an area due to the magnitude of the 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 take flight which increase energy demands and reduce food intake with potential consequences for survival and reproduction.

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The Solent Dredge Permit Byelaw will apply to all areas of Langstone Harbour, Portsmouth Harbour, Southampton Water and the wider Solent. Under this new byelaw, shellfish dredging will be prohibited for 35 weeks of the year during spring, summer and autumn months (1st March to 31st October inclusive). This closed season enables the recovery of sedimentary habitats, including infaunal communities which supports food availability and helps to maintain the structure of intertidal and subtidal habitats. Additionally, it supports breeding shellfish populations.

The timings of the recovery period were designed to allow for the quickest period of recovery over the summer months, which represents the period of highest biological activity for invertebrate fauna of sedimentary habitats. The permit byelaw will only allow shellfish dredging to take place between 06:00 and 18:00 in order to further manage fishing effort and aid compliance. Conditions which govern the bar spacing and strength will also form a part of the permit. These will reduce the number of undersized shellfishes being brought up for sorting and therefore reduce the likelihood of damage and mortality to these individuals. All catches will be required to be reported further enabling Southern IFCA to monitor fishing effort levels throughout the shellfish fishery, with the potential to limit the number of
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<table>
<thead>
<tr>
<th>Turnstone</th>
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<th>Disturbance</th>
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Wigeon

### Disturbance

**All**

- Reduce the frequency, duration and/or intensity of disturbance caused by human activity.

Disturbance and displacement through visual presence and noise were identified as potential pressures of clam dredging. Disturbance can result in displacement when birds are unable to use an area due to the magnitude of the 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 take flight which increase energy demands and reduce food intake with potential consequences for survival and reproduction.

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Since the introduction of Bottom Towed Fishing Gear Byelaws first introduced in 2014 and the Solent Dredge Fishing Gear Byelaw shellfish dredging throughout the Solent has been noted to decline (Solent Forum, 2018). Most likely this is due to a combination of the reduction in available fishing area and increases in compliance actions.

Wigeon are known to feed at low tide in the vicinity of at least one site where shellfish dredging also takes place. It is however thought that shellfish dredging has very little direct impact on disturbance of waders since it occurs at high tide and feeding takes place at low tide, thus eliminating the possibility of any adverse significant effect.

Wigeon are present in significant numbers between September and March. The wind-farm sensitivity index indicates that Wigeon have extremely low sensitivity to wind farm developments. The escape flight distance exhibited by the species has been reported at 115-230 m in

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The Solent European Marine Site (Prohibition of Method of Dredging) Order 2004 prevents pump scooping as a means of taking shellfish. Bottom Towed Fishing Gear 2016 byelaw prohibits bottom towed fishing gear over sensitive habitats. These habitats include reef, seagrass, as well as intertidal and subtidal sediments and saltmarsh within the Solent EMS. The network of permanent bottom towed fishery closure areas helps to maintain site integrity and offer long-term stability against the effects of fishing.
lead to greater disturbance than that caused by shellfish dredging. Both oyster dredging and clam dredging are now subject to a four-month open season, operating from November to February. During this season, an average 3 to 4 vessels will clam dredge across all three shellfish dredge management areas (Portsmouth Harbour, Southampton Water and Langstone Harbour) on fishable days when weather and tide permit. Due to tidal restrictions associated with the nature of this fishery, vessels are not able to operate over the entire 07:00-17:00 period open to fishing. The Dredge Permit Byelaw will enable bivalve fishing for an additional 2 hours each day the season is open, with the allowable fishing period between 06:00 and 18:00 daily. However, due to the physical restrictions of tides and water depth, this will not lead to a direct increase in fishing effort of 2 hours each day. Dredge fishing for bivalves in the intertidal in limited by the tidal height. Engagement with fishermen confirms that fishing is only possible around a window either side of HW, quoted as 2 hours either side by multiple fishermen. This is further restricted by vessel size and draft, water depth of the area fished, as well as weather conditions, all of which further restrict the available fishing period within the 12-hour window and over a period of days and weeks. Furthermore, fishermen often do not work over two tidal cycles in one day, as the time restrictions regularly do not allow for this, and depending on catch success in the first tidal window it is often not necessary. Therefore, it is not possible for fishing effort to increase every day for an additional 2.

Displacement. The network of closure zones within the Solent Maritime SAC, equates to approximately 33.9% of the Solent Maritime SAC.

Fishing for Oysters, Mussels and Clam byelaw regulates methods can be used to fish for these species. These are a) hand picking and b) dredging using a dredge with a rigid framed south designed to take shellfish only when towed along the sea bed.

Temporary Closure of Shellfish Beds byelaw allows the authority to temporarily close any bed or part of a bed of shellfish where it is the opinion of the Committee that it is severely depleted and as such required temporary closure in order to ensure recovery, or any bed or part of bed containing mainly immature or undersized shellfish which is in the interest of protection and development of the fishery, or any bed of transplanted shellfish that ought to not be fished until it becomes established. For the last three seasons (2013/14, 2014/15 and 2015/16) this byelaw has been used to close the oyster fishery in Southampton Water and the wider Solent, as well as shortening the open season in the eastern harbours. For the 2016/17 season, Southampton Water and the wider Solent will remain closed and the eastern harbours will open as per the Oyster Close Season byelaw. The Oyster Close Season byelaw prohibits any person from dredging or fishing for in or taking any fishery oysters during the period from the 1st day of March to the 31st of October in any year.

Oyster dredge byelaw prohibits the use of any dredge which exceeds 1.5 in length when using a single dredge or
Finally, fishermen often take days of from fishing during each working week as well as over holiday periods further reducing the total effort. This change in management is to provide fishermen greater flexibility upon when they can fish, and is not intended to increase overall total effort. Therefore, this change should not significantly increase the impacts to the habitats, fauna and features of the designated site. Through the requirement to submit catch returns, including time spent fishing, Southern IFCA will have a greater ability to monitor this and quantify changes in fishing effort between seasons, also understanding better the relationship between fishing location and tidal restrictions.

<table>
<thead>
<tr>
<th>Pintail</th>
<th>All</th>
<th>Disturbance</th>
<th>Reduce the frequency, duration and / or intensity of disturbance affecting roosting, foraging, feeding, moulting and/or loaing birds so that they are not significantly disturbed.</th>
</tr>
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</table>

Disturbance and displacement through visual presence and noise were identified as potential pressures of clam dredging. Disturbance can result in displacement when birds are unable to use an area due to the magnitude of the 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 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 occurs. Since the introduction of Bottom Towed Fishing Gear Byelaws first introduced in 2014 and the Solent Dredge Fishing Gear Byelaw shellfish dredging throughout the Solent has been noted to decline (Solent Forum, 2018). Most likely this is due to a combination of the reduction in available fishing area and increases in compliance actions.

Pintails are known to feed in at least one location where clam dredging is known to take place. However, it is thought that shellfish dredging has very little direct impact on disturbance of waders since it occurs at high tide and feeding takes place at low tide. Pintails are present in significant numbers between September and March. The wind-farm sensitivity index indicates that Pintail have low sensitivity to wind farm developments, totalling 3.0 m in length when using two dredges at the same time.

Oysters, Clams, Mussels – Prohibition on Night Fishing byelaw prohibits any person from dredging or fishing or taking any oysters before 8.00 am or after 4.00 pm during the open season.

The Prohibition of Gathering (Sea Fisheries Resources) in Seagrass Beds byelaw prohibits any person from digging for, fishing for or taking any sea fisheries resource in or from the prohibited areas. No person shall carry a rake, spade, fork or any similar tool in prohibited areas.

The Solent Dredge Permit Byelaw will apply to all areas of Langstone Harbour, Portsmouth Harbour, Southampton Water and the wider Solent. Under this new byelaw, shellfish dredging will be prohibited for 35 weeks of the year during spring, summer and autumn months (1st March to 31st October inclusive). This closed season enables the recovery of sedimentary habitats, including infaunal communities which supports food availability and helps to maintain the structure of intertidal and subtidal habitats. Additionally, it supports breeding shellfish populations. The timings of the recovery period were designed to allow for the quickest period of recovery over the summer months, which represents the period of highest biological activity for invertebrate fauna of sedimentary habitats. The permit byelaw will only allow shellfish dredging to take place between 06:00 and 18:00 in order to further manage fishing effort and aid compliance. Conditions which govern the bar spacing and strength will...
takes place. Responsiveness to disturbance is largely thought to be a species-specific trait.

Oyster dredging is however known to predominantly occur subtidally and infrequently occurs on the fringes on the intertidal. It is thought that oyster dredging has very little direct impact on disturbance of waders since the activity occurs subtidally and when it does occur on the fringes of the intertidal zone (which is infrequently) it does so at high tide and feeding takes place at low tide, thus eliminating the possibly of any adverse significant effect.

Langstone Harbour is an area subject to moderate levels of vessel traffic and some bird species can become habituated to particular disturbance events or types of disturbance. In the context of the moderate vessel levels that occur within Langstone Harbour, it is therefore highly unlikely that shellfish dredging will lead to a significant adverse effect on the feature. In addition, Langstone Harbour is subject to periodic maintenance dredging that is likely to lead to greater disturbance than that caused by shellfish dredging.

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This will allow greater flexibility to monitor and control the oyster fishery fishing effort through more specific opening or closing of these areas. Areas can be closed to allow for the recovery of populations or to provide a rest period for habitat structure to remain undisturbed.

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Byelaw will enable bivalve fishing for an additional 2 hours each day the season is open, with the allowable fishing period between 06:00 and 18:00 daily. However, due to the physical restrictions of tides and water depth, this will not lead to a direct increase in fishing effort of 2 hours each day. Dredge fishing for bivalves in the intertidal is limited by the tidal height. Engagement with fishermen confirms that fishing is only possible around a window either side of HW, quoted as 2 hours either side by multiple fishermen. This is further restricted by vessel size and draft, water depth of the area fished, as well as weather conditions, all of which further restrict the available fishing period within the 12-hour window and over a period of days and weeks. Furthermore, fishers often do not work over two tidal cycles in one day, as the time restrictions regularly do not allow for this, and depending on catch success in the first tidal window it is often not necessary. Therefore, it is not possible for fishing effort to increase every day for an additional 2 hours. Finally, fishermen often take days of from fishing during each working week as well as over holiday periods further reducing the total effort. This change in management is to provide fishermen greater flexibility upon when they can fish, and is not intended to increase overall total effort. Therefore, this change should not significantly increase the impacts to the habitats, fauna and features of the designated site. Through the requirement to submit catch returns, including time spent fishing, Southern IFCA will have a greater ability to monitor this and quantify changes in fishing effort between seasons, also saltmarsh within the Solent EMS. The network of permanent bottom towed fear closure areas helps to maintain site integrity and offer long-term stability against the effects of fishing displacement. The network of closure areas within the Solent MS, equates to approximately 33.9% of the Solent Maritime SAC.

Fishing for Oysters, Mussels and Clam byelaw regulates methods can be used to fish for these species. These are 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.

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understanding better the relationship between fishing location and tidal restrictions.

the period from the 1st day of March to the 31st of October in any year.

Oyster dredge byelaw prohibits the use of any dredge which exceeds 1.5 m in length when using a single dredge or totalling 3.0 m in length when using two dredges at the same time.

Oysters, Clams, Mussels – Prohibition on Night Fishing byelaw prohibits any person from digging for, fishing for or taking any oysters before 8.00 am or after 4.00 pm during the open season.

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<table>
<thead>
<tr>
<th>Shoveler</th>
<th>All</th>
<th>Disturbance</th>
<th>Reduce the</th>
</tr>
</thead>
</table>

Disruption and displacement through visual presence and noise were identified as potential pressures of clam dredging.

Disturbance can result in displacement when birds are unable to use an area due to the magnitude of the 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 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

Since the introduction of Bottom Towed Fishing Gear Byelaws first introduced in 2014 and the Solent Dredge Fishing Gear Byelaw shellfish dredging throughout the Solent has been noted to decrease (Solent Forum, 2018). Most likely this is due to a combination of the reduction in available fishing area and increases in compliance actions. Shoveler are known to feed in at least one location where clam dredging is known to take place. However, it is thought that shellfish dredging has very little direct impact on disturbance of waders since it occurs at high tide and feeding takes place at low tide. Shoveler are present in significant numbers between September and March.

The Solent Dredge Permit Byelaw will apply to all areas of Langstone Harbour, Portsmouth Harbour, Southampton Water and the wider Solent. Under this new byelaw, shellfish dredging will be prohibited for 35 weeks of the year during spring, summer and autumn months (1st March to 31st October inclusive). This closed season enables the recovery of sedimentary habitats, including infaunal communities which support food availability and helps to maintain the structure of intertidal and subtidal habitats. Additionally, it supports breeding shellfish populations. The timings of the recovery period were designed to allow for the quickest period of recovery over the summer months, which represents the period of highest biological activity for invertebrate fauna of sedimentary habitats. The permit byelaw will only allow shellfish dredging to take place between 06:00 and 18:00.
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.

The wind-farm sensitivity index indicates that Shoveler have low sensitivity to wind farm developments. The escape flight distance exhibited by the species has been reported at 200 m in response to boats and 126 m in response to researchers.

Oyster dredging is however known to predominantly occur subtidally and infrequently occurs on the fringes on the intertidal. It is thought that oyster dredging has very little direct impact on disturbance of waders since the activity occurs subtidally and when it does occur on the fringes of the intertidal zone (which is infrequently) it does so at high tide and feeding takes place at low tide, thus eliminating the possibly of any adverse significant effect.

Langstone Harbour is an area subject to moderate levels of vessel traffic and some bird species can become habituated to particular disturbance events or types of disturbance. In the context of the moderate vessel levels that occur within Langstone Harbour, it is therefore highly unlikely that shellfish dredging will lead to a significant adverse effect on the feature. In addition, Langstone Harbour is subject to periodic maintenance dredging that is likely to lead to greater disturbance than that caused by shellfish dredging.

Both oyster dredging and clam dredging are now subject to a four-month open season, operating from November to February. During this season, an average 3 to 4 vessels will clam dredge across all three shellfish dredge management areas in order to further manage fishing effort and aid compliance. Conditions which govern the bar spacing and strength will also form a part of the permit. These will reduce the number of undersized shellfishes being brought up for sorting and therefore reduce the likelihood of damage and mortality to these individuals. All catches will be reported further enabling Southern IFCA to monitor fishing effort levels throughout the shellfish fishery, with the potential to limit the number of permits issued in the future. For oysters only, the Solent Dredge Permit Byelaw will set out ‘Harvest Areas’ giving Southern IFCA the ability to open and close specific oyster beds. The determination of the status of oyster beds is based upon annual stock assessments.

This will allow greater flexibility to monitor and control the oyster fishery fishing effort through more specific opening or closing of these areas. Areas can be closed to allow for the recovery of populations or to provide a rest period for habitat structure to remain undisturbed.

Vessels Used in Fishing byelaw prohibits commercial fishing vessels over 12 metres from the Southern IFCA district. The reduction in vessel size also restricts the type of gear that can be used, with vessels often using lighter towed gear.

The Solent European Marine Site (Prohibition of Method of Dredging) Order 2004 prevents pump scooping as a means of taking shellfish.

Bottom Towed Fishing Gear 2016 byelaw prohibits bottom towed fishing gear over sensitive habitats. These
due to the physical restrictions of tides and water depth, this will not lead to a direct increase in fishing effort of 2 hours each day. Dredge fishing for bivalves in the intertidal is limited by the tidal height. Engagement with fishermen confirms that fishing is only possible around a window either side of HW, quoted as 2 hours either side by multiple fishermen. This is further restricted by vessel size and draft, water depth of the area fished, as well as weather conditions, all of which further restrict the available fishing period within the 12-hour window and over a period of days and weeks. Furthermore, fishers often do not work over two tidal cycles in one day, as the time restrictions regularly do not allow for this, and depending on catch success, or the Committee’s decision to close the fishery, or any bed or part of bed containing mainly immature or undersized shellfish which is in the interest of protection and development of the fishery, or any bed of transplanted shellfish that ought to not be fished until it becomes established. For the last three seasons (2013/14, 2014/15 and 2015/16) this byelaw has been used to close the oyster fishery in Southampton Water and the wider Solent, as well as shortening the open season in the eastern harbours. For the 2016/17 season, Southampton Water and the wider Solent will remain closed and the eastern harbours will open as per the Oyster Close Season byelaw. The Oyster Close Season byelaw prohibits any person from dredging or fishing for in or taking any fishery oysters during the 12-hour window.
significantly increase the impacts to the habitats, fauna and features of the designated site. Through the requirement to submit catch returns, including time spent fishing, Southern IFCA will have a greater ability to monitor this and quantify changes in fishing effort between seasons, also understanding better the relationship between fishing location and tidal restrictions.

the period from the 1st day of March to the 31st of October in any year.

Oyster dredge byelaw prohibits the use of any dredge which exceeds 1.5 m in length when using a single dredge or totalling 3.0 m in length when using two dredges at the same time.

Oysters, Clams, Mussels – Prohibition on Night Fishing byelaw prohibits any person from digging for, fishing for or taking any oysters before 8.00 am or after 4.00 pm during the open season.

The Prohibition of Gathering (Sea Fisheries Resources) in Seagrass Beds byelaw prohibits any person from digging for, fishing for or taking any sea fisheries resource in or from the prohibited areas. No person shall carry a rake, spade, fork or any similar tool in prohibited areas.

Red-breasted merganser
All Disturbance Reduce the frequency, duration and / or intensity of disturbance affecting roosting, foraging, feeding, moulting and/or rafting birds so that they are not significantly disturbed.

Disturbance and displacement through visual presence and noise were identified as potential pressures of clam dredging.

Disturbance can result in displacement when birds are unable to use an area due to the magnitude of the 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 take flight which increase energy demands and reduce food intake with potential consequences for survival and reproduction.

Since the introduction of Bottom Towed Fishing Gear Byelaws first introduced in 2014 and the Solent Dredge Fishing Gear Byelaw shellfish dredging throughout the Solent has been noted to decline (Solent Forum, 2018). Most likely this is due to a combination of the reduction in available fishing area and increases in compliance actions.

Red-breasted mergansers are a type of diving duck known to feed on small fish. Shellfish dredging therefore may cause disturbance to the species when feeding. Red-breasted Merganser are known to feed in the vicinity of at least one site where shellfish dredging also takes place.

Red-breasted mergansers occur in significant numbers from November to April.

The Solent Dredge Permit Byelaw will apply to all areas of Langstone Harbour, Portsmouth Harbour, Southampton Water and the wider Solent. Under this new byelaw, shellfish dredging will be prohibited for 35 weeks of the year during spring, summer and autumn months (1st March to 31st October inclusive). This closed season enables the recovery of sedimentary habitats, including infaunal communities which supports food availability and helps to maintain the structure of intertidal and subtidal habitats. Additionally, it supports breeding shellfish populations.

The timings of the recovery period were designed to allow for the quickest period of recovery over the summer months, which represents the period of highest biological activity for invertebrate fauna of sedimentary habitats. The permit byelaw will only allow shellfish dredging
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. The wind-farm sensitivity index indicates that Red-breasted merganser have moderate sensitivity to wind farm developments.

Oyster dredging is known to predominantly occur subtidally and infrequently occurs on the fringes on the intertidal. Therefore, oyster dredging has the potential to cause disturbance to red-breasted merganser feeding in subtidal areas.

Langstone Harbour is an area subject to moderate levels of vessel traffic whilst Portsmouth harbour is subject to high levels of vessel traffic and some bird species can become habituated to particular disturbance events or types of disturbance. In the context of the moderate and high vessel levels that occur within the Harbours, it is therefore highly unlikely that shellfish dredging will lead to a significant adverse effect on the feature. In addition, the Harbours are subject to periodic maintenance dredging that is likely to lead to greater disturbance than that caused by shellfish dredging.

Both oyster dredging and clam dredging are now subject to a four-month open season, operating from November to February. During this season, an average 3 to 4 vessels will clam dredge across all three shellfish dredge management areas (Portsmouth Harbour, Southampton Water and Langstone Harbour) on fishable days when weather and tide permit. Due to tidal restrictions associated with the nature of this fishery, vessels are not able to operate over the entire 07:00-17:00 period open to fishing. The Dredge Permit to take place between 06:00 and 18:00 in order to further manage fishing effort and aid compliance. Conditions which govern the bar spacing and strength will also form a part of the permit. These will reduce the number of undersized shellfish being brought up for sorting and therefore reduce the likelihood of damage and mortality to these individuals. All catches will be required to be reported further enabling Southern IFCA to monitor fishing effort levels throughout the shellfish fishery, with the potential to limit the number of permits issued in the future. For oysters only, the Solent Dredge Permit Byelaw will set out ‘Harvest Areas’ giving Southern IFCA the ability to open and close specific oyster beds. The determination of the status of oyster beds is based upon annual stock assessments.

This will allow greater flexibility to monitor and control the oyster fishery fishing effort through more specific opening or closing of these areas. Areas can be closed to allow for the recovery of populations or to provide a rest period for habitat structure to remain undisturbed.

Vessels Used in Fishing byelaw prohibits commercial fishing vessels over 12 metres from the Southern IFCA district. The reduction in vessel size also restricts the type of gear that can be used, with vessels often using lighter towed gear.

The Solent European Marine Site (Prohibition of Method of Dredging) Order 2004 prevents pump scooping as a means of taking shellfish.

Bottom Towed Fishing Gear 2016 byelaw prohibits bottom towed fishing
Byelaw will enable bivalve fishing for an additional 2 hours each day the season is open, with the allowable fishing period between 06:00 and 18:00 daily. However, due to the physical restrictions of tides and water depth, this will not lead to a direct increase in fishing effort of 2 hours each day. Dredge fishing for bivalves in the intertidal is limited by the tidal height. Engagement with fishermen confirms that fishing is only possible around a window either side of HW, quoted as 2 hours either side by multiple fishermen. This is further restricted by vessel size and draft, water depth of the area fished, as well as weather conditions, all of which further restrict the available fishing period within the 12-hour window and over a period of days and weeks. Furthermore, fishers often do not work over two tidal cycles in one day, as the time restrictions regularly do not allow for this, and depending on catch success in the first tidal window, it is often not necessary. Therefore, it is not possible for fishing effort to increase every day for an additional 2 hours. Finally, fishermen often take days of from fishing during each working week as well as over holiday periods further reducing the total effort.

This change in management is to provide fishermen greater flexibility upon when they can fish, and is not intended to increase total effort. Therefore, this change should not significantly increase the impacts to the habitats, fauna and features of the designated site. Through the requirement to submit catch returns, including time spent fishing, Southern IFCA will have a greater ability to monitor this and quantify changes in fishing effort between seasons, also gear over sensitive habitats. These habitats include reef, seagrass, as well as intertidal and subtidal sediments and saltmarsh within the Solent EMS. The network of permanent bottom towed closure areas helps to maintain site integrity and offer long-term stability against the effects of fishing displacement. The network of closure areas within the Solent MS, equates to approximately 33.9% of the Solent Maritime SAC. Fishing for Oysters, Mussels and Clam byelaw regulates methods can be used to fish for these species. These are a) hand picking and b) dredging using a dredge with a rigid framed south designed to take shellfish only when towed along the sea bed.

Temporary Closure of Shellfish Beds byelaw allows the authority to temporarily close any bed or part of a bed of shellfish where it is the opinion of the Committee that it is severely depleted and as such required temporary closure in order to ensure recovery, or any bed or part of bed containing mainly immature or undersized shellfish which is in the interest of protection and development of the fishery, or any bed of transplanted shellfish that ought to not be fished until it becomes established. For the last three seasons (2013/14, 2014/15 and 2015/16) this byelaw has been used to close the oyster fishery in Southampton Water and the wider Solent, as well as shortening the open season in the eastern harbours. For the 2016/17 season, Southampton Water and the wider Solent will remain closed and the eastern harbours will open as per the Oyster Close Season byelaw. The Oyster Close Season byelaw prohibits any person from dredging or fishing for...
understanding better the relationship between fishing location and tidal restrictions.

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| Little egret | All                  | Disturbance caused by human activity | Disturbance and displacement through visual presence and noise were identified as potential pressures of clam dredging. Disturbance can result in displacement when birds are unable to use an area due to the magnitude of the 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 take flight which increase energy demands and reduce food intake with potential consequences for survival and reproduction. |

Since the introduction of Bottom Towed Fishing Gear Byelaws first introduced in 2014 and the Solent Dredge Fishing Gear Byelaw shellfish dredging throughout the Solent has been noted to decline (Solent Forum, 2018). Most likely this is due to a combination of the reduction in available fishing area and increases in compliance actions.

Little egret are known to feed on small fish, amphibians and insects. Shellfish dredging therefore may cause disturbance to the species when feeding. WeBS low tide count data indicates that very low densities of little egret feed in areas close to areas of shellfish dredging.

The Solent Dredge Permit Byelaw will apply to all areas of Langstone Harbour, Portsmouth Harbour, Southampton Water and the wider Solent. Under this new byelaw, shellfish dredging will be prohibited for 35 weeks of the year during spring, summer and autumn months (1st March to 31st October inclusive). This closed season enables the recovery of sedimentary habitats, including infaunal communities which supports food availability and helps to maintain the structure of intertidal and subtidal habitats. Additionally, it supports breeding shellfish populations. The timings of the recovery period were designed to allow for the quickest period of recovery over the summer months, which represents the period of highest biological activity for invertebrate fauna of sedimentary habitats. The permit
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.

The median escape flight distance exhibited by this species has been reported at 75 m in the Solent.

Oyster dredging is however known to predominantly occur subtidally and infrequently occurs on the fringes of the intertidal. It is thought that oyster dredging has very little direct impact on disturbance of waders since the activity occurs subtidally and when it does occur on the fringes of the intertidal zone (which is infrequently) it does so at high tide and feeding takes place at low tide, thus eliminating the possibility of any adverse significant effect.

Langstone Harbour is an area subject to moderate levels of vessel traffic, whilst Portsmouth and Solent and Southampton water experience high levels of vessel traffic and some bird species can become habituated to particular disturbance events or types of disturbance. In the context of the vessel levels that occur throughout the Solent, it is therefore highly unlikely that Shellfish dredging will lead to a significant adverse effect on the feature. In addition, throughout the Solent there is periodic maintenance dredging that is likely to lead to greater disturbance than that caused by shellfish dredging.

Both oyster dredging and clam dredging are now subject to a four-month open season, operating from November to February. During this season, an average 3 to 4 vessels will clam dredge across all three shellfish dredge management areas (Portsmouth Harbour, Southampton Water and Langstone Harbour) on fishable days when weather and tide byelaw will only allow shellfish dredging to take place between 06:00 and 18:00 in order to further manage fishing effort and aid compliance. Conditions which govern the bar spacing and strength will also form a part of the permit. These will reduce the number of undersized shellfish being brought up for sorting and therefore reduce the likelihood of damage and mortality to these individuals. All catches will be required to be reported further enabling Southern IFCA to monitor fishing effort levels throughout the shellfish fishery, with the potential to limit the number of permits issued in the future. For oysters only, the Solent Dredge Permit Byelaw will set out ‘Harvest Areas’ giving Southern IFCA the ability to open and close specific oyster beds. The determination of the status of oyster beds is based upon annual stock assessments.

This will allow greater flexibility to monitor and control the oyster fishery fishing effort through more specific opening or closing of these areas. Areas can be closed to allow for the recovery of populations or to provide a rest period for habitat structure to remain undisturbed.

Vessels Used in Fishing byelaw prohibits commercial fishing vessels over 12 metres from the Southern IFCA district. The reduction in vessel size also restricts the type of gear that can be used, with vessels often using lighter towed gear.

The Solent European Marine Site (Prohibition of Method of Dredging) Order 2004 prevents pump scooping as a means of taking shellfish.
permit. Due to tidal restrictions associated with the nature of this fishery, vessels are not able to operate over the entire 07:00-17:00 period open to fishing. The Dredge Permit Byelaw will enable bivalve fishing for an additional 2 hours each day the season is open, with the allowable fishing period between 06:00 and 18:00 daily. However, due to the physical restrictions of tides and water depth, this will not lead to a direct increase in fishing effort of 2 hours each day. Dredge fishing for bivalves in the intertidal is limited by the tidal height. Engagement with fishermen confirms that fishing is only possible around a window either side of HW, quoted as 2 hours either side by multiple fishermen. This is further restricted by vessel size and draft, water depth of the area and weather conditions, all of which restrict the available fishing period within the 12-hour window and over a period of days and weeks. Furthermore, fishers often do not work over two tidal cycles in one day, as the time restrictions regularly do not allow for this, and depending on catch success in the first tidal window it is often not necessary. Therefore, it is not possible for fishing effort to increase every day for an additional 2 hours. Finally, fishers often take days of from fishing during each working week as well as over holiday periods further reducing the total effort. This change in management is to provide fishers greater flexibility upon when they can fish, and is not intended to increase overall total effort. Therefore, this change should not significantly increase the impacts to the habitats, fauna and features of the designated site. Through the
requirement to submit catch returns, including time spent fishing. Southern IFCA will have a greater ability to monitor this and quantify changes in fishing effort between seasons, also understanding better the relationship between fishing location and tidal restrictions.

Oyster Close Season byelaw prohibits any person from dredging or fishing for or taking any fishery oysters during the period from the 1st day of March to the 31st of October in any year.

Oyster dredge byelaw prohibits the use of any dredge which exceeds 1.5 m in length when using a single dredge or totalling 3.0 m in length when using two dredges at the same time.

Oysters, Clams, Mussels – Prohibition on Night Fishing byelaw prohibits any person from dredging or fishing or taking any oysters before 8.00 am or after 4.00 pm during the open season.

The Prohibition of Gathering (Sea Fisheries Resources) in Seagrass Beds byelaw prohibits any person from digging for, fishing for or taking any sea fisheries resource in or from the prohibited areas. No person shall carry a rake, spade, fork or any similar tool in prohibited areas.

Waterbird assemblage and non-breeding qualifying features

Inter nationally important regularly occurring migratory species

Nationally important populations of regularly occurring migratory species

Intertidal mixed and coarse sediment, Intertidal Mud, Intertidal sand and muddy sand

Supporting habitat: quality of supporting non-breeding habitat

Abrasion, penetration and disturbance of the surface of the seabed and below the surface of the seabed, as well as smothering and changes in sedimentation were identified as potential pressures.

Shellfish dredging has been shown to alter the sedimentary characteristics of the affected substrate. The use of a modified oyster dredge to fish for clams led to the removal of the coarse fraction of sediment (EMU, 1992) and suction dredging has been shown to increase median grains through the loss of fine silts (Piersma, 2001). Similarly, Clarke et al., (2018b) reported increases in finer sediments in control treatments compared by impact treatments (subject to shellfish dredging). Since the introduction of Bottom Towed Fishing Gear Byelaws first introduced in 2014 and the Solent Dredge Fishing Gear Byelaw shellfish dredging throughout the Solent has been noted to decline (Solent Forum, 2018). Most likely this is due to a combination of the reduction in available fishing area and increases in compliance actions.

Both oyster dredging and clam dredging are now subject to a four-month open season, operating from November to February. During this season, an average of 3 to 4 vessels will clam dredge across all three shellfish dredge management areas (Portsmouth Harbour, Southampton Water and Langstone Harbour) on Bottom Towed Fishing Gear 2016 byelaw prohibits bottom towed fishing gear over sensitive habitats. These habitats include reef, seagrass, as well as intertidal and subtidal sediments and saltmarsh within the Solent EMS. The network of permanent bottom towed fear closure areas helps to maintain site integrity and offer long-term stability against the effects of fishing displacement. The network of closure areas within the Solent MS, equates to approximately 33.9% of the Solent Maritime SAC.

The Solent Dredge Permit Byelaw will apply to all areas of Langstone Harbour, Portsmouth Harbour, Southampton Water and the wider Solent. Under this new byelaw, shellfish dredging will be...
sediment composition between dredged and undredged areas after hydraulic escalator harvesting were no longer detectable after 1 year (Godcharles, 1971).

Shellfish dredging has been reported to disturb the top 15 to 20 cm of sediment (EMU, 1992). Dredging is known to cause changes in topography (Natural England, 2014). Typically, impacts include the creation of depressions and trenches and the smoothing of ripples or creation of ridges within sand environments (Wheeler et al., 2014). The physical recovery of sediments to such impacts largely depends on the sediment type (Mercaldo-Allen & Goldberg, 2011). In high energy environments physical recovery can take longer detectable after 1 year (Godcharles, 1971). Shellfish dredging has been reported to disturb the top 15 to 20 cm of sediment (EMU, 1992). Dredging is known to cause changes in topography (Natural England, 2014). Typically, impacts include the creation of depressions and trenches and the smoothing of ripples or creation of ridges within sand environments (Wheeler et al., 2014). The physical recovery of sediments to such impacts largely depends on the sediment type (Mercaldo-Allen & Goldberg, 2011). In high energy environments physical recovery can take longer detectable after 1 year.
take days, whereas recovery in low energy areas can take months (Northeast Region EFHSC, 2002; Wallace & Hoff, 2005). Trawl marks in silty clay sediment have been shown to persist throughout the year within the study area (Smith et al., 2007).

designated site. Through the requirement to submit catch returns, including time spent fishing, Southern IFCA will have a greater ability to monitor this and quantify changes in fishing effort between seasons, also understanding better the relationship between fishing location and tidal restrictions.

For the last five seasons, oyster dredging has only been permitted in the eastern harbours (Portsmouth and Langstone Harbour), with the wider Solent and Southampton Water closed.

In the last two seasons (2016/17; 2017/18), the eastern harbours have been open for the four-month season (as per the Oyster Close Season byelaw). This period will remain the same under the Dredge Permit byelaw.

In the 2018/19 season, from the 1st November 2018 two further areas will no longer be closed; Ryde Middle and Portsmouth Harbour.

Typically, an average of 1 to 2 vessels operate over the season on any one day, weather and conditions permitting. The distribution of fishing effort for each activity differs. Clam dredging takes places intertidally and on the fringes of the subtidal and is largely concentrated on the eastern side of Southampton Water, in areas known as Ashlett Creek and Bird Pile. Activity also takes place in Langstone Harbour, although to a lesser extent, in the north eastern quarter of the harbour. Using feature data, clam dredging is shown to occur predominantly over intertidal mud, as well as intertidal mixed sediments, intertidal sand and muddy sand and for habitat structure to remain undisturbed.

Oyster Close Season byelaw prohibits any person from dredging or fishing for or taking from the fishery any oysters during the period 1st day of May to 31st October in any year.

The Cockles byelaw states that no person shall fish for or take from a fishery any cockle between 1st day of February and 30th of April and when the cockle bed is covered by water only a dredge less than 460 mm in width can be used. This largely the use of a clam dredge for harvesting cockles. Vessels Used in Fishing byelaw prohibits commercial fishing vessels over 12 metres from the Southern IFCA district. The reduction in vessel size also restricts the type of gear that can be used, with vessels often using lighter towed gear.

The Solent European Marine Site (Prohibition of Method of Dredging) Order 2004 prevents pump scooping as a means of taking shellfish.

Fishing for Oysters, Mussels and Clam byelaw regulates methods can be used to fish for these species. These are a) hand picking and b) dredging using a dredge with a rigid framed mouth so designed to take shellfish only when towed along the sea bed.

Temporary Closure of Shellfish Beds byelaw allows the authority to temporarily close any bed or part of a bed of shellfish where it is the opinion of the Committee that it is severely depleted and as such required temporary closure in order to ensure
subtidal mixed sediments (to a lesser extent due to the nature of the fishery). The concentration of fishing effort within intertidal areas means the activity has the potential to cause changes to sediment composition. The level of fishing effort (3 to 4 vessels on fishable days) spread over the three shellfish dredge management areas (one of which falls outside of the SAC) limits potential for such impacts and closure of the fishery for 8 months of the year allows sufficient time for restoration of sediment composition.

Oyster dredging takes place subtidally and on the fringes of the intertidal in the north eastern quarter of Langstone Harbour. Using feature data, oyster dredging is shown to occur predominantly over subtidal mixed sediment within the main channels in Langstone Harbour and over intertidal mud and intertidal sand and muddy sand (to a lesser extent). Fishing effort within intertidal habitats is known to be relatively low due to the subtidal nature of the fishery and as such will limit any changes in sediment character/topography.

The distribution of fishing effort for each activity differs. Clam dredging takes places intertidally and on the fringes of the subtidal and is largely concentrated on the eastern side of Southampton Water, in areas known as Ashlett Creek and Bird Pile. Activity also takes place in Langstone Harbour, although to a lesser extent, in the north eastern quarter of the harbour. Using feature data, clam dredging is shown to occur predominantly over intertidal mud, as well as intertidal mixed sediments, intertidal sand and muddy sand and recovery, or any bed or part of bed containing mainly immature or undersized shellfish which is in the interest of protection and development of the fishery, or any bed of transplanted shellfish that ought to not be fished until it becomes established. This byelaw has been used to close certain areas in the Solent to oyster dredging (see Table 3).
subtidal mixed sediments (to a lesser extent due to the nature of the fishery). The concentration of fishing effort within intertidal areas means the activity has the potential to cause changes to topography. The level of fishing effort (3 to 4 vessels on fishable days) spread over the three shellfish dredge management areas (one of which falls outside of the SAC) limits potential for changes to topography and closure of the fishery for 8 months of the year allows sufficient time for restoration of such changes.

There is an inverse relationship between wave action and depth and so the natural mobility of bottom sediments tends to decrease with depth (Wheeler et al., 2014). The impact of shellfish dredging might therefore be more substantial and long term in deeper subtidal habitats (Wheeler et al., 2014).

Resultant sediment plumes and areas of elevated turbidity can extend up to 30 metres beyond the dredge zone (Manning, 1957; Haven, 1979; Manzi et al., 1985; Maier et al., 1998). The amount of suspended sediment rapidly returns to low levels with distance from the dredge activity (Kyte et al., 1976; Maier et al., 1998), with 98% resettling within 15 m (Mercaldo-Allen & Goldberg, 2011).

Physical recovery of high energy environments can take days, whilst low energy areas can take months (Northeast Region EFHSC, 2002; Wallace & Hoff, 2005). Higher energy environments, such as those in the wider Solent, are therefore unlikely to suffer long-term changes in sediment
composition as a result of shellfish dredging. Intertidal habitats within the eastern harbours on the other hand are likely to be lower energy environments. The Bottom Towed Fishing Gear byelaw 2016 protects a number of very low energy intertidal areas.

Potential adverse effects on habitat types highlighted above which overlap with areas of clam dredging (as this activity predominantly occur over intertidal habitats) are mitigated through the Bottom Towed Fishing Gear byelaw and 2016 and Solent Dredge Fishing byelaw (see mitigation measures column).
8 Conclusion

In order to conclude whether the introduction of the Solent Dredge Permit byelaw, which will permit vessels to undertake shellfish dredging within the Solent European Marine Site, has an effect on the integrity of the three SPAs (Chichester and Langstone Harbours, Portsmouth Harbour and Solent and Southampton Water), it is necessary to assess whether the impacts of the to-be permitted activity (clam dredging and oyster dredging) will hinder the sites 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 Favourable Conservation Status of its Qualifying Features, by maintaining or restoring:
  - The extent and distribution of qualifying natural habitats and habitats of qualifying species
  - The structure and function (including typical species) of qualifying natural habitats
  - The structure and function of the habitats of qualifying species
  - The supporting processes on which qualifying natural habitats and the habitats of qualifying species rely
  - The populations of qualifying species, and,
  - The distribution of qualifying species within the site.

The review of research into the impacts of shellfish dredging (detailed in section 5.2) identifies that this activity has the potential to lead to the abrasion, penetration or disturbance of the seabed, removal of target and non-target species, smothering and changes in suspended solids and visual disturbance. Physical disturbance can lead to changes in topography and sediment composition, whilst biological disturbance can lead to reductions in biomass, production, species richness and diversity, as well as alterations in size structure and population dynamics. Disturbance can occur visually or through noise. Changes in prey availability relate to the indirect effects of clam dredging which include interactions with fishing gear through crushing, burial or exposure; and smothering of prey species through enhanced sedimentation. It is therefore recognised that this activity has the potential to lead to an adverse effect upon the following SPA attributes:

- Water quality – turbidity
- Disturbance caused by human activity
- Supporting Habitat: Food availability
- Maintain the structure, function and availability of the following habitats which support the assemblage feature for all stages (moulting, roosting, loafing, feeding) of the non-breeding period.
- Supporting habitat: quality of supporting non-breeding habitat

These potential impacts and risks to the integrity of the site are mitigated through a number of conditions under the permit, previously applied through the Solent Dredge Fishing byelaw and Oyster Close Season byelaw, in-combination with permanent closures to shellfish dredging under the Bottom Towed Fishing Gear 2016 byelaw. Mitigation measures include the following:

- An 8-month close season for shellfish dredging throughout the Solent, covering the designated features/sub-features of the Solent Maritime SAC. The close season prohibits shellfish dredging during the spring, summer and autumn months, 1st March to 31st October inclusive. This closed season enables the recovery of infaunal communities and maintains the structure of intertidal and subtidal habitats, as well as supporting breeding shellfish populations, particularly during the summer months which represent the period of highest
biological activity for invertebrate infauna of mudflats. The timing of the recovery period was designed to allow for the quickest recovery possible, this is because the restoration of a community in temperate zones is likely to be more rapid if the cessation of sediment disturbance occurs prior to the spring-summer influx of recruits (Borja et al., 2010). This supports the timing of the reproductive season for key species within the site which generally occurs between spring and autumn (see Annex 13 for reproductive season of key species). Restricting shellfish dredging during winter is likely to aid restoration of infaunal communities if the main recolonisation mechanism is by those who undergo recolonization via larval settlement. This supports the recolonization strategies used by a number of individual species, with a number of species employing both larval settlement and active or passive migration (i.e. *Macoma balthica*, *Hediste diversicolor*) (see Annex 13 for recolonization strategies of key species).

- A diurnal closure (18:00-06:00) further manages fishing effort and aids compliance and is extended to the wider Solent to afford this area more protection.

- A network of permanent bottom towed fishing gear closure areas protects good examples of SAC habitat, maintains the integrity of the site and also safeguards against the effects of any fishing displacement. The network of closure areas covers approximately 95.4 km² and equates to approximately 33.9% of the Solent Maritime SAC. A number of low-energy areas were identified as being most suitable for the permanent closures. Good examples of estuarine habitat including intertidal mud, subtidal mud and saltmarsh form the permanent closure areas to all types of bottom towed fishing gear. This network of areas, shown in Annex 4, includes the River Hamble, Sina Lake, Broom Channel, Russell’s Lake, the River Medina, King’s Quay, Newtown Creek, the Yar (Yarmouth), and parts of Langstone Harbour, Ashlett Creek, Hythe foreshore, the Test, Lymington and Keyhaven, Areas.

- A requirement to submit catch return information, including quantities fished, areas fished and fishing periods, provides the Authority with greater evidence to understand and quantify fishing pressure within spatial areas of the site. The flexible design of the byelaws will enable the Authority to adapt management more rapidly, through varying permit conditions, should the need arise.

Considering all the evidence presented in this Appropriate Assessment, including scientific literature, habitat feature data and sightings data, it is concluded that the introduction of the Solent Dredge Permit byelaw, to permit shellfish dredging within the Solent, will not hinder the site from achieving its conservation objectives and as such will not have an adverse effect upon the integrity of the three SPAs. As outlined above, the permit conditions (8-month close season, diurnal closure, catch reporting) and network of bottom towed fishing gear closures, will continue to mitigate against any potential impacts of shellfish dredging on the subtidal and intertidal subfeatures of this site, in addition to required catch reporting that will allow catch rates and fishing effort to be monitored. Furthermore, the permit will be flexible and as such will allow Southern IFCA to review the suitability of the permit conditions, attach conditions to the permit and revoke any conditions attached to the permit at any time after the permits have been issued, following a set process. As such, any changes with regard to the Authority’s duties and obligation under sections 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 Habitat Regulations Assessment. This flexibility allows proportionate management of the dredge fishery in Solent whilst achieving the conservation objectives of the three SPAs.
9 In-combination assessment

Based on the mitigation measures, in the form of permit conditions, it is concluded that the introduction of the Solent Dredge Permit bylaw, to permit shellfish dredging within the Solent, alone will not have an adverse effect on the features and sub-features of the Chichester and Langstone harbours, Portsmouth Harbour and Solent and Southampton Water SPAs.

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

Commercial plans and projects that occur within or that may affect the three SPAs are considered in section 9.1.

9.1 Other plans and projects

<table>
<thead>
<tr>
<th>Project details</th>
<th>Status</th>
<th>Potential for in-combination effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kendalls Wharf extension</td>
<td>In planning</td>
<td>Relevant pathways identified in relation to this project include:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Loss of intertidal habitat, increase in suspended sediment and bird disturbance (construction and operation).</td>
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<tr>
<td></td>
<td></td>
<td>Loss of intertidal habitat – As part of this project, the total area subject to capital dredging is expected to be 0.33 ha. Following dredging, 0.073 ha of intertidal mudflat would be removed. The total intertidal area lost or altered is 0.146 ha which equates to 0.01% of the total intertidal habitat in Langstone Harbour. The combined total loss and change to intertidal mudflat to result in a maximum loss of 0.120 ha of potential foraging ground to waders and wildfowl. Despite a relatively small area of habitat loss, when compared to the total available habitat within the Chichester and Langstone Harbours SPA, the proposed works could not be concluded to not have a likely significant effect on waterfowl and waders (except for dark-bellied Brent geese). The impact significance of intertidal habitat loss was concluded to be minor(^{21}) with regards to potential reduction in functional habitat and moderate(^{22}) for potential loss of feeding habitat for waders and wildfowl.</td>
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</table>
|                          |             | Increase in suspended sediment concentrations – It is estimated that during capital dredge operations suspended sediment concentrations could reach a maximum of 196 mg/l. Naturally occurring suspended sediment concentrations reach up to 200 mg/l within Langstone Harbour. The temporary and spatially limited sediment plumes were not anticipated to have a significant effect on the feeding success of terns within the harbour as a whole and any such effect will be limited to the Broom Channel for a short duration. The impact significance of increases in suspended sediment concentration was...

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\(^{21}\) When an effect will be experienced but the effect magnitude is sufficiently small and well within accepted standards and/or receptor is of low sensitivity.

\(^{22}\) Moderate significance impacts may cover a broad range, although the emphasis remains on demonstrating that the impact has been reduced to a level that is as low as reasonably practical. This does not mean reducing to minor but managing ‘moderate’ ones effectively and efficiently.
In addition, a backhoe dredger will be used to minimise sediments suspended.

Bird disturbance – dredging and construction (installation of sheet piling and piles) are likely to generate both noise and visual disturbance. The wharf extension is located in relative close proximity to redshank roosts. 11 to 17% of the redshank population in Langstone Harbour may be disturbed or displaced by proposed wharf extension works. The impact of disturbance to this roost was assessed to be of moderate significance, despite not being the preferred roost within the SPA. Disturbance to roosting, feeding and nesting grounds in the wider area was initially assessed to be of moderate significance, but was later reduced to minor significance as timing of the works are proposed to take place outside of bird sensitive periods. Construction is expected to take 3 to 4 months between 1st April and 30th September. Such measures are expected to sufficiently mitigate disturbance to overwintering birds.

At a TLE level for shellfish dredging, visual disturbance and noise disturbance were screened in. On further investigation (contained within this HRA), both impact pathways have been screened out. The reason for this is largely due to the limited potential for direct impact since the activity occurs at high tide and feeding/foraging takes place at low tide, thus largely eliminating the possibility of disturbance. In further support of this, the SPAs are subject moderate and high levels of vessel traffic and it is likely that some bird species become habituated to these types of disturbance.

At a TLE level for shellfish dredging, abrasion/disturbance/penetration of the substrate on the surface or below the surface of the seabed and smothering and siltation rate changes were screened in, however these impact pathways do not result in changes to the extent of the feature. Common impact pathways with the project therefore relate to sediment disturbance and subsequent impacts. The level of increase in suspended sediment concentrations associated with the project have been shown to be at the same magnitude as those which occur naturally and are likely to far exceed those caused by dredging. Increases in suspended sediment concentrations from shellfish dredging are localised and temporary in nature. Studies have reported suspended sediment rapidly returns to low levels with distance from the dredge activity (Kyte et al., 1976; Mairer et al., 1998), with 98% resettling within 15 m (Mercaldo-Alleen & Goldberg, 2011).

The project and its relevant impact pathways were considered from not significant to negligible and are likely to be of small scale and localised in their nature. Knowledge of shellfish dredging activity reveals that the area of the project and surrounding areas is not subject to the activity, limiting the potential for in-combination effects due to a lack of spatial overlap. Based on the limited significance and small scale of the project impact pathways and locality of the activity in relation to the project, it is unlikely the project and activity will lead to in-combination effects.
### Royal Pier Phase 2 – reclamation and capital dredge

#### In planning

Relevant impact pathways identified in relation to the project include an increase in suspended sediment concentrations and increase in sedimentation rates.

Increases in suspended sediment concentrations and subsequent increases in sedimentation rates may arise from a number of different pathways including dredging, reclamation works and piling works. The area of proposed dredging will extend to 18,700 metres and will remove around 37,000 cubic metres of material. The area to be dredged is one of low flow speeds and sediments disturbed during dredging will return to the bed in the vicinity of the dredging site. Any sediment release within the dredging site is most likely to occur in the bottom metre of the water column, increasing to suspended sediment concentrations to around 10,000 mg/l, reducing to a few hundred mg/l through the water column before resettling to the seabed. The predicted sediment plume will be largely confined to the dredge area due to very flows. Modelling estimates the suspended sediment concentrations of 10-20 mg/l could occur in the water column up to 50 to 100 m from the source. Increases of more than 10 mg/l are not expected beyond 250 m up and down estuary in the direction of the main channel and within 100 m of the outer extent of the dredge. Accumulation will be in the order of 0.1-0.2 m over the dredge area. The proposed dredging works are predicted to lead to a negligible increase in suspended sediment concentrations in and around the site and are predicted to not be significant.

Dewatering activities associated with the proposed land reclamation will have the potential to create a sediment plume, resulting in sediment dispersion and deposition in the vicinity of the site. This will be minimised by the use of silt busters and/or sediment filters. Dewatering activities will last between 3 and 5 days.

Proposed piling works have the potential to release sediments from the seabed a result of minor disturbance to sediments surrounding the piles. Suspended sediment concentrations are predicted to increase by 10-30 mg/l around each pile being driven. As a result of the low tidal flows, the maximum extent of dispersion will be no greater than 100 m up and down estuary from the site and no further than the north eastern edge of the navigation channel. The relatively small areas of piling and demolition mean the effects will be negligible and not significant.

The project will involve 10 weeks of piling which could lead to visual and auditory disturbance to birds. However, given the distance to the nearest SPA (800m) the effects were concluded to be insignificant.

It was concluded that the small scale of the works and distance from designated nature conservation sites, mean the proposed land reclamation and dredging will not significantly affect features of the sites. Similarly, the impacts resulting from piling work were considered negligible and not significant.

At a TLOSE level for shellfish dredging, smothering and siltation rate changes, and disturbance were screened in. Sediment disturbance from shellfish dredging is localised and temporary in nature. Studies have reported suspended sediment rapidly returns to low levels with distance from the dredge activity.
(Kyte et al., 1976; Mairer et al., 1998), with 98% resettling within 15 m (Mercaldo-Allen & Goldberg, 2011). When this is combined with the small scale of the work, localised impacts and distance from the SPA, it is unlikely that there will be in-combination effects with shellfish dredging.

### Portchester to Emsworth Coastal Defence Strategy

Relevant impact pathways identified in relation to the project include the loss of intertidal habitat and bird disturbance (construction).

Loss of intertidal - The Portsea Island Coastal Strategy Study [PICSS] was approved in 2011 and covers the whole of Portsea Island. The strategy confirms the North Solent Shoreline Management Plan [SMP] policy (2010) for Portsea Island of ‘Hold the Line‘ and splits Portsea Island into 7 discrete flood cells. Under the North Portsea Island scheme, covering 8.4 km of coastline from Tipner through to Milton, works have been identified including raising of seawalls and improving seawalls structural integrity. These proposed works are planned over the first ten years and these follow a phased approach, including Phase 1, Ports Creek Railways Bridge to Kendall’s Wharf Northern Boundary, and Phase 2, Milton Common and Great Salterns Quay. Coastal squeeze loss of 11.69 ha of intertidal will be caused by sea level rise and the delivery of the strategic policy option of ‘Hold the Line‘. An appropriate assessment concluded that because of the calculated coastal squeeze losses, that implementation of the strategy would have an adverse effect on designated sites. The AA however also concluded there is justification for these adverse effects as there is no alternative policy and there is an overriding public need to protect life and property and so an Imperative Reasons of Overriding Public Interest statement was made. Environmental compensation will be achieved through the Regional Habitat Creation Programme which promotes the realignment of defences elsewhere in the Solent to create new intertidal habitats. This was signed off by Defra in April 2011.

The phases that are currently underway or in planning have a small working footprint during their construction which is strictly controlled by a Construction and Environment Management Plan. Direct disturbance to the sediment is minimal and in discrete locations at any one time. For phase 1 there was an access footprint of 15m and in phase 2 a maximum access footprint of 10 m along the Milton Common Frontage and 20 m around Great Salterns Quay. No LSE is expected as any disturbance to discrete working areas is minimal, temporary and must follow good working practices as outlined in the Construction and Environment Management Plan. This is expected to lead to no longer term impacts in these areas which are considered less sensitive bird feeding areas as areas are highly disturbed and so is not well utilised by birds. In addition, works are undertaken outside of bird sensitive periods and so the impact of the works on food availability is further reduced. Phase 2 works will lead to the gain of 2,460m² mudflat habitat within Langstone Harbour from the removal of Great Salterns Quay.

Bird disturbance – construction works, particularly to seawalls, are expected to generate some level of noise and visual disturbance. The sensitivity of the Phase 1 area is considered to be of low sensitivity due to existing activities which occur in...
and around the Harbour. Works will run outside of the most sensitive overwintering period. The installation of noise absorbing screens will also be adopted if levels reach 69 dB or higher at the location of overwintering birds (Phase 1). The use hand operation machinery has also been used to reduce noise levels. The working footprint of the intertidal area will be strictly controlled, keeping direct disturbance to sediments to a minimum and in one discrete location at any one time (phased approach). This means that disturbance will be both localised and temporary and there will be vast 'free from disturbance' areas available at any one time. Access will remain similar to existing access and therefore no additional disturbance is expected above existing levels, with some areas (in Phase 2 works) seeing large reductions in access. No LSE is expected on interest features present.

At a LSE level for shellfish dredging, visual disturbance and noise disturbance were screened in. On further investigation (contained within this HRA), both impact pathways have been screened out. The reason for this is largely down to the limited potential for direct impact since the activity occurs at high tide and feeding/foraging takes place at low tide, thus largely eliminating the possibility of disturbance. In further support of this, the three SPAs are subject to high levels of vessel traffic and it is likely that some bird species become habituated to these types of disturbance. At a LSE level for shellfish dredging, physical damage and abrasion were screened in. It was recognised that shellfish dredging causes disturbance to the seabed but did not result in the physical loss of the extent of the feature.

The combined impacts of phased small scale coastal defence works and shellfish dredging will not lead to in-combination effects, with respect to noise and visual disturbance. Disturbance caused by the project are localised, temporary and very small in scale, as well as being concentrated during the least sensitive periods, whilst shellfish dredging has limited potential to cause disturbance due to the nature of the activity. The general loss of intertidal from the overall strategy has been signed off by Defra under an Imperative Reasons of Overriding Public Interest statement. As shellfish dredging does not lead to a loss of habitat there will not be an in combination effect.

Cowes breakwater (shrape extension), marina construction and capital dredge
Cowes breakwater (shrape extension), marina construction and capital dredge
Cowes breakwater (shrape extension), marina construction and capital dredge

There have been a number of delays in the delivery of the Shrape Breakwater Extension and Eastern Channel Dredge. However, the final planning consent has been recently granted and it is expected there will be more certainty on this matter by the end of the summer (2018). If all goes ahead, it is proposed the Eastern Channel will be dredged over winter 2018/19 and the Shrape Breakwater extension will occur at the same time. The MMO have consented for the works to take place from 1st March 2018 to the end of March 2019.

The environmental statement or habitats regulation assessment is currently not available (as of 26/10/2018) and so there is a lack of information regarding the impact pathways which may arise from this project, thus making it hard to assess. Potential and relevant impact pathways are likely to include increases in suspended sediment concentrations and increase in sedimentation rates. These impact pathways are likely to
arise from dredging of the new Eastern Channel. The dredging is likely to be small scale and as such increases in suspended sediment and sedimentation rates are likely to be limited, localised and temporary in nature.

This project is not located in close proximity to any SPA and therefore is unlikely to cause any significant disturbance effects to designated SPA birds.

At a TLE level for shellfish dredging, smothering and siltation rate changes were screened in. Sediment disturbance from shellfish dredging is localised and temporary in nature. Studies have reported suspended sediment rapidly returns to low levels with distance from the dredge activity (Kyte et al., 1976; Mairer et al., 1998), with 98% resettling within 15 m (Mercaldo-Allen & Goldberg, 2011). It is therefore not anticipated that the project and activity will lead to any in-combination effects.

### IFA2 Subsea Power Cable

Consented but not completed

<table>
<thead>
<tr>
<th>Relevant impact pathways identified in relation to the project and activity</th>
<th>Include damage to intertidal and subtidal habitats.</th>
</tr>
</thead>
</table>

Solent and Southampton Water SPA is crossed by the cable route with landfall of the cable at Chilling and Daedalus landfalls. The project considered potential effects to birds including visual and noise disturbance during construction, loss of habitat and/or changes to prey supply, and accidental spills. Of these, only disturbance was found to have the potential for significant effects, and therefore detailed mitigation measures were developed. These included the use of HDD at Chilling to avoid effects on the intertidal habitats, sensitive timing of the construction phase to minimise any potential effects on wintering birds, and other measures to minimise disturbance to, and monitor, intertidal birds. Overall, following mitigation measures, no significant effects to birds were predicted.

At a TLE level for shellfish dredging, smothering and siltation rate changes were screened in. Sediment disturbance from shellfish dredging is localised and temporary in nature. Studies have reported suspended sediment rapidly returns to low levels with distance from the dredge activity (Kyte et al., 1976; Mairer et al., 1998), with 98% resettling within 15 m (Mercaldo-Allen & Goldberg, 2011).

At a TLE level for shellfish dredging, visual disturbance and noise disturbance were screened in. On further investigation (contained within this HRA), both impact pathways have been screened out. The reason for this is largely down to the limited potential for direct impact since the activity occurs at high tide and feeding/foraging takes place at low tide, thus largely eliminating the possibility of disturbance. In further support of this, the three SPAs are subject to high levels of vessel traffic and it is likely that some bird species become habituated to these types of disturbance.

The project and its relevant impact pathways are considered to have no significant effect on benthic communities, visual/audial disturbance to birds and are of negligible to minor significance in relation to the physical environment and are further mitigated through a number of measures (i.e. using HDD). Knowledge of shellfish dredging activity reveals it has the potential to occur in the vicinity of the project however as both conclude no

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SIFCA Reference:
significant disturbance to birds there will not be an _in combination_ effect. Furthermore, closures to bottom towed fishing gear prohibit shellfish dredging at the Chilling landfall.

Aquind Interconnector

Relevant impact pathways identified in relation to the project include damage to intertidal and subtidal habitats and increase in suspended sediment concentrations.

The project involves the development of a new subsea and underground High Voltage Direct Current (HVDC) power cable between Normandie in France and the south coast of England. The subsea cable route will be between 190 km to 230 km in length, spanning between two landfall sites at Eastney (UK) and Pourville or Dieppe (France).

Potential impacts of the installation, operation and decommissioning phases of the Proposed development on the physical environment may include physical disturbance to seabed geology and impacts to local sediment regimes. Such impacts are expected to be limited to a narrow corridor and would arise from installation activities and maintenance operations.

The proposed Eastney landfall section of the 0.5 km wide cable corridor passes through supporting habitats, including Chichester and Langstone Harbour SPA. The following impacts may occur on benthic ecology during installation (and decommissioning); seabed disturbance, deposition of sediment (smothering), deposition of sediment (smothering) and temporary increase in suspended sediment concentrations. During operation, the following impacts have been identified habitat loss and seabed disturbance. As of (05/07/2018), no mitigation measures have been identified as no environment impact assessment or HRA has been completed.

Chichester and Langstone Harbour SPA is crossed by the cable route with the route passing through the intertidal area in the mudflats next to Farlington Marshes. As the project is still in planning no information is available yet as to the effect of disturbance on SPA bird species or the mitigation of these effects. At the ILSE level for shellfish dredging disturbance to birds was screened in however the location of the cable route which crosses the SPA is a site where shellfish dredging is not permitted under the Solent Bottom Towed gear byelaw and therefore there cannot be an _in combination_ disturbance effect.

At a ILSE level for shellfish dredging, abrasion/disturbance/penetration of the substrate on the surface or below the surface of the seabed and smothering and siltation rate changes were screened in, however these impact pathways do not result in changes to the extent of the feature. Common impact pathways with the project therefore relate to damage to intertidal and subtidal habitats and sediment disturbance and its subsequent impacts. The level of increase in suspended sediment concentrations associated with the project have been shown to be at the same magnitude as those which occur naturally and are likely to far exceed those caused by dredging. Increases in suspended sediment concentrations from shellfish dredging are localised and temporary in nature. Studies have reported suspended sediment rapidly returns to
low levels with distance from the dredge activity (Kyte et al., 1976; Mairer et al., 1998), with 98% resettling within 15 m (Mercaldo-Allen & Goldberg, 2011).

The project and activity share impact pathways, however using knowledge of shellfish dredging the spatial extent of the two do not overlap and thus are not likely to lead to in-combination effects. Furthermore, the extent of the impacts caused by the project are likely to be limited spatially and temporarily, with the majority occurring during installation. Mitigation against such impacts at this stage is also unknown.

South Hayling Beach Management Plan
Consented but not completed
Relevant impact pathways identified in relation to the project include loss of intertidal habitats.

The project identifies damage to vegetated shingle and drift line habitats through tracking machinery, beach reprofiling and extraction of shingle from Gunner Point. Further damage to these habitats, in addition to intertidal and subtidal sandflats was also identified from the extraction of sand from around the Hayling Island Sailing Club slipway. Increased suspended sediments during construction was also identified.

An array of mitigation measures are being put in place to avoid impacts to vegetated shingle / drift line habitats, including vegetation surveys to inform works, general avoidance of vegetated areas for haulage routes and no works during March to August. To avoid impacts of intertidal / subtidal sandflats, any sand extracted will be intertidal sand and this will remain as intertidal sand, with any material removed being placed back into the same intertidal sediment system, thus preventing loss of intertidal sandflat with some minor reworking of it. No change in subtidal habitat will occur as material will not be removed from the subtidal area.

At a TLSE level for shellfish dredging, abrasion/disturbance/penetration of the substrate on the surface or below the surface of the seabed, however these impact pathways do not result in changes to the extent of the feature.

The project and its relevant impact pathways largely refer to impacts on vegetated shingle and drift line habitats which are not impacted by shellfish dredging, and impact pathways which are relevant to intertidal and subtidal habitats i.e. loss of habitat have not been identified for shellfish dredging, thus the project and activity do not share common impact pathways and as such will not lead to in-combination effects. The spatial extent of the project and activity do also not overlap. Any impacts from the project are mitigated through a number of measures.

Southsea Coastal Scheme
In planning
The environmental statement or habitats regulation assessment is currently not available (as of 26/10/2018) and so there is a lack of information regarding the impact pathways which may arise from this project, making it harder to assess.

Plans to survey the area identify that the construction works will result in some disturbance to the intertidal area, the loss of a small amount of foreshore in some locations and also some disruption to the shallow subtidal areas in other areas.
Potential and relevant impact pathways are likely to include loss of intertidal habitats. The project covers a relatively small stretch of the coastline, occurring outside the SPA, and as such impacts will be very localised.

At a TLE level for shellfish dredging, abrasion/disturbance/penetration of the substrate on the surface or below the surface of the seabed, however these impact pathways do not result in changes to the extent of the feature.

The project and activity do not share impact pathways (loss of intertidal habitat), and the spatial extent of the two do not overlap, thus not leading to any in-combination effects. Furthermore, it appears the spatial extent of the project occurs outside the SPA.

The RNLI plan to undertake works to improve the slipway and extend its lifetime by another 10 years. Two options are being considered; replacement of slipway, edge protection under slab and topping over existing slipways, new lower section, steel sheet piles edge protection.

In the area near to or within the proposed construction the area surrounding the station has small amounts of intertidal mixed sediments. Works are likely to be carried out, including piling over the sensitive bird period however it is considered that the area is not an important bird roost or feeding area and therefore effect are unlikely to be significant. It has been identified a TLE will be required and undertaken as part of the development of the application. It is believed any potential impacts are likely to be short-lived and localised to the working area during construction particularly in relation to the sediments which are highly mobile in the area. The preparation of a construction environmental management plan (CEMP) is considered to be sufficient to ensure risks to the environment are managed. The maximum footprint of the works would be 60m².

At a TLE level for shellfish dredging, abrasion/disturbance/penetration of the substrate on the surface or below the surface of the seabed, however these impact pathways do not result in changes to the extent of the feature. At a TLE level for shellfish dredging disturbance to birds was screened in however according to the information supplied within this HRA this has now been screened out. Furthermore, there is no overlap between this project shellfish dredging activity and therefore there cannot be a disturbance in combination effect.

The project and activity do not share the impact pathway (loss of intertidal habitat), and the spatial extent of the two do not overlap, thus not leading to any in-combination effects.

### 9.2 Other fishing activities

<table>
<thead>
<tr>
<th>Fishing Activity</th>
<th>Status</th>
<th>Potential for in-combination effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Light otter trawling (for sand eels)</td>
<td>Ongoing</td>
<td>Common impact pathways were identified at a TLE level and these include: Abrasion/penetration/disturbance to the substrate of the seabed, smothering and siltation rate changes and removal of target species.</td>
</tr>
</tbody>
</table>
Light otter trawling for sand eels occurs in one area of Langstone Harbour known as Sword Sands located in the main channels in the southern and central parts of the harbour. Clam dredging is often focused in areas on softer sediment in distinct, small spatial areas where shellfish beds exist. These largely include the north eastern quarter of Langstone Harbour. These sites occur intertidally (fished at high tide) and subtidally, with vessels often operating in very shallow waters. There is no spatial overlap between the two activities and therefore there are likely to be no in-combination effects for any of the impact pathways identified.

Sightings data presented in Annex 18 (indicative of recent fishing activity) reveals there is no spatial overlap between the two activities and therefore there are likely to be no in-combination effects for any of the impact pathways identified.

In Solent and Southampton Water no impact pathways were identified at a TLE level for light otter trawling. The reason for this is the low incidence of trawling within the Solent and Southampton Water SPA as the activity is concentrated subtidally. The two activities target different species and therefore there will be no in-combination effects with respect to selective extraction of species.

Demersal netting
Ongoing
No impact pathways were identified at a TLE level for demersal netting. The activity is low impact and unlikely to lead to any in-combination effects. In addition, static gear types such as netting and mobile gear types such as clam dredging are not compatible and often occur in different areas, thus largely eliminating any spatial overlap between the two activities.

Demersal longlining
Ongoing
No impact pathways were identified at a TLE level for demersal longlining. The activity is low impact and unlikely to lead to any in-combination effects. In addition, static gear types such as longlining and mobile gear types such as clam dredging are not compatible and often occur in different areas, thus largely eliminating any spatial overlap between the two activities.

Handlines & Jigging/Trolling
Ongoing
No impact pathways were identified at a TLE level for handlines and jigging/trolling. The activity is very low impact and unlikely to lead to any in-combination effects.

10 Summary of consultation with Natural England

<table>
<thead>
<tr>
<th>Consultation</th>
<th>Date submitted</th>
<th>Response from NE</th>
<th>Date received</th>
</tr>
</thead>
</table>

SIFCA Reference: SIFCA/HRA/_PPSDPByelaw2018
11 Integrity test

Overall the Solent dredge Permit Byelaw will provide greater opportunity to monitor fishing effort within the Solent clam and oyster dredge fisheries. The permit will provide a direct route by which further management options can be brought in, if once in operation, it becomes apparent that this is required. Seasonal and area restrictions will remain underpinned by the dredge permit byelaw and bottom towed fishing gear byelaw ensuring high risk habitats are not at risk, and time is given for the recovery of fished areas. A small increase in daily fishing period of two hours, will not lead to a daily two-hour increase in fishing effort as this is largely governed by physical restrictions acting upon the fishery including tidal state, weather, water depth, vessel length and draft, meaning that to date fishing pressure has been lower than anticipated.

Based on the mitigation measures, in the form of permit conditions under the Solent Dredge Permit byelaw, and closures under the Bottom Towed Fishing Gear byelaw, it is concluded the introduction of permits for shellfish dredging within the Solent will not have an adverse effect, alone or in-combination, on the features and supporting habitats of the Chichester and Langstone Harbours SPA, Portsmouth Harbour SPA and Solent and Southampton Water SPA.
Annex 1: Reference List


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Annex 2: The Key Principles of the SEMS Management Scheme
(http://www.solentems.org.uk/sems/management_scheme/)

Principle 1 - Favourable Condition

The SEMS has qualified for designation against the background of current use and there is a working assumption that the features for which the site is designated are in favourable condition from the time of designation. The Management Scheme and the monitoring to be carried out by 2006 will test this assumption.

Principle 2 - Sustainable Development

The aim of the Management Scheme is not to exclude human activities from SEMS, but rather to ensure that they are undertaken in ways which do not threaten the nature conservation interest, and wherever possible, in ways that support it. The Management Scheme should ensure a balance of social, economic and environmental objectives when considering the management of activities within the Solent.

Principle 3 - Regulatory Use of Bye-laws

New bye-laws may be used as a regulatory mechanism for the SEMS. These should only be introduced into the Management Scheme when all other options have been considered and it is the only effective solution.

Principle 4 - Links to Existing Management and Other Plans/Initiative

Where appropriate the SEMS Management Scheme will directly utilise management actions from other existing management plans. The actions identified in the Management Scheme will therefore serve to inform and support existing management effects rather than duplicate them. The management measures identified in other plans will remain the mechanism through which these are to be implemented.

Principle 5 - Onus of Proof

The wording for principle 5 is based on the following three-stage process:

Stage 1 - Evidence must be established that a site feature is in deterioration. This evidence must be scientific, credible and unambiguous but it need not originate from English Nature itself. It is acknowledged that other Relevant Authorities will be undertaking monitoring regimes and if their programmes flag up something of interest, it would be expected that they would present it to English Nature for further comment and verification.

Stage 2 - English Nature, as the Government's body with responsibility for nature conservation, must believe that a site feature is in deterioration. If the evidence to support this view has come from their own monitoring - or if it has come from an external, authoritative source - EN should act as a conduit to demonstrate this fact to the Relevant Authority with responsibility for the management of the activity suspected of having detrimental effect.

Stage 3 - English Nature and the Relevant Authority (ies) involved should work together to establish any cause and effect relationship. From this, changes to management actions may be made.

Consideration of this process had led to the following definition of onus of proof: If through their own site condition monitoring programme or that of another Relevant Authority, English Nature can demonstrate that they have reasonable evidence to indicate that a deterioration in the condition of a SEMS feature or species exists, then English Nature and the Relevant Authorities concerned will work together to identify any cause and effect relationship.
Principle 6 - Management Actions

Where reasonable evidence is found to clearly demonstrate the cause and effect relationship the Relevant Authorities involved will instigate changes to the management of the activity, which will be within a RAs statutory obligation and will provide a solution that is in accordance with the Regulations and be fair, balanced, proportionate and appropriate to the site and the activity. Where the cause and effect relationship are uncertain but deterioration in the condition is still significant the Relevant Authorities should consider any potential changes in management practices in light of the precautionary principle and the cost effectiveness of proposed measures in preventing damage. However, the precautionary principle should not be used to prevent existing management actions continuing where there is no evidence of real risk of deterioration or significant disturbance to site features.

All forms of environmental risk should be tested against the precautionary principle which means that where there are real risks to the site, lack of full scientific certainty should not be used as a reason for postponing measures that are likely to be cost effective in preventing such damage. It does not however imply that the suggested cause of such damage must be eradicated unless proved to be harmless and it cannot be used as a licence to invent hypothetical consequences. Moreover, it is important, when considering whether information available is sufficient, to take account of the associated balance of likely costs, including environmental costs, and benefits.” (DETR & the Welsh Office, 1998).
Annex 3: Supporting Habitat(s) Site Feature Map for the Solent SPAs (Langstone Harbour only, Portsmouth Harbour and Solent and Southampton Water)
Annex 4: Bottom Towed Fishing Gear 2016 byelaw permanent closure areas in the Solent SPAs (Langstone Harbour only, Portsmouth Harbour, Solent and Southampton Water).
Bottom Towed Fishing Gear Byelaw - 2016

Numbered Points

Bottom Towed Fishing Gear Byelaw - 2016 - Prohibited Areas

SUBMARINE CABLES

Mariners are advised not to anchor or travel in the vicinity of submarine cables.

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SIFCA Reference: SIFCA/HRA_/PPSDPByelaw2018
Annex 5: Co-Location of Recent Shellfish Dredging Sightings and Site Feature(s)/Sub-Feature(s) in the Solent SPAs (Langstone Harbour only, Portsmouth Harbour & Solent and Southampton Water).
Annex 6: Low tide WeBS data distribution maps for Grey plover, Dunlin, Redshank, Dark-bellied brent goose, Shelduck, Teal, Ringed plover, Curlew, Turnstone, Wigeon, Pintail and Shoveler in the Solent taken from Stillman et al., (2009).
Map 16: Low tide WeBS data for teal
Solent disturbance and mitigation project: Phase I

25 November 2008
Scale 1:228500

Number of birds

- 1900 or more
- 75 to 149
- 35 to 74
- 20 to 34
- 10 to 19
- Less than 10
- 7 to 9
- 4 to 6
- 2 to 3
- 1
- 0
- No data

Map produced by the University of Winchester
Survey map by Acorn Environmental with the permission of the Department for Environment, Food and Rural Affairs
Copyright © 2008. All rights reserved.
Coastline produced by Ordnance Survey. All Ordnance Survey data reproduced through Hampshire County Council.

Page 192 of 236  SIFCA Reference: SIFCA/HRA/_PPSDPByelaw2018
Map 18: Low tide WeBS data for shoveler
Solent disturbance and mitigation project: Phase I

25 November 2008
Scale 1:228500

Number of birds:
- 40 to 50
- 30 to 39
- 25 to 29
- 20 to 24
- 15 to 19
- 10 to 14
- 5 to 9
- 2 to 4
- 1
- 0
- No data

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Page 198 of 236
SIFCA Reference: SIFCA/HRA/_PPSDPByelaw2018
Annex 7: WeBS Low Tide Count (LTC) scheme point data distribution maps for the three Solent SPAs bird features (Langstone Harbour and Portsmouth Harbour) Recent Solent and Southampton Water maps not available. [https://app.bto.org/webs-reporting/](https://app.bto.org/webs-reporting/)
Annex 8: Bird roosting sites from the Solent Waders and Brent Goose Strategy. Taken from https://solentwbgs.wordpress.com/page-2/_. Taken on 03/10/2018.

Current Use Mapping 2017 Key:

- Core Areas
- Primary Support Areas
- Secondary Support Areas
- Low Use
- Candidate
- SPA site
Annex 9: Classification of Bivalve Mollusc Production Areas interacting with the three Solent SPAs (Langstone Harbour Only, Portsmouth Harbour and Solent and Southampton Water).
Langstone Harbour - M. mercenaria

Scale - 1:50000

Classification: Class A Class B Class C Prohibited
Status: LT Class B Seasonal Class B/C

Classification of Marine Mollusc Production Areas. Effective from 1 September 2018
The areas delineated above are those classified as marine mollusc production areas under EU Regulation 854/2004.
Further details on the classified species and the areas may be obtained from the responsible Port Authority. Queries regarding the areas should be directed to: Hampshire Environment (02392 770770) or Portsmouth Port Health Authority (01364 386176), or via email: info@portsmouthport.co.uk. Portsmouth Port Authority is a registered charity, registered number: 708850.

N.B. Lat/Lon quoted are WGS84
Units: nautical miles, north-west corner refers to ordnance datum: OS 7 1:25,000 mean high water line.

Food Authority: Portsmouth Port Health Authority

Langstone Harbour - O. edulis

Scale - 1:50000

Classification: Class A Class B Class C Prohibited
Status: LT Class B Seasonal Class B/C

Classification of Marine Mollusc Production Areas. Effective from 1 September 2018
The areas delineated above are those classified as marine mollusc production areas under EU Regulation 854/2004.
Further details on the classified species and the areas may be obtained from the responsible Port Authority. Queries regarding the areas should be directed to: Hampshire Environment (02392 770770) or Portsmouth Port Health Authority (01364 386176), or via email: info@portsmouthport.co.uk. Portsmouth Port Authority is a registered charity, registered number: 708850.

N.B. Lat/Lon quoted are WGS84
Units: nautical miles, north-west corner refers to ordnance datum: OS 7 1:25,000 mean high water line.

Food Authority: Portsmouth Port Health Authority

SIFCA Reference: SIFCA/HRA/_PPSDPByelaw2018
Portsmouth Harbour - C. edule

Classification: Class A, Class B, Class C, Prohibited

Status: LT Class B, Seasonal Class B/C

Classification of Bivalve Molluscs Production Areas, Effective from 1st September 2018

The areas delineated above are those classified as bivalve molluscs production areas under EU Regulation 854/2004.

Further details on the classified species and areas may be obtained from the responsible Food Authority. Enquiries regarding the maps should be directed to: Shellfish Microbiology, CEFAS Weymouth Laboratory, Barrack Road, the Rother, Weymouth, Dorset DT4 8LY.

(Tel: 01305 206600 Fax: 01305 206601)

N.B. Lat/Longs quoted are WGS84

Unless otherwise stated, non-straight line boundaries between co-ordinates follow the OS 1:25,000 mean high water line.

Separate maps available for Tapes spp. and M. mercenaria at Portsmouth Harbour

Food Authority: Portsmouth Port Health Authority

Portsmouth Harbour - M. mercenaria

Classification: Class A, Class B, Class C, Prohibited

Status: LT Class B, Seasonal Class B/C

Classification of Bivalve Molluscs Production Areas, Effective from 1st September 2018

The areas delineated above are those classified as bivalve molluscs production areas under EU Regulation 854/2004.

Further details on the classified species and areas may be obtained from the responsible Food Authority. Enquiries regarding the maps should be directed to: Shellfish Microbiology, CEFAS Weymouth Laboratory, Barrack Road, the Rother, Weymouth, Dorset DT4 8LY.

(Tel: 01305 206600 Fax: 01305 206601)

N.B. Lat/Longs quoted are WGS84

Unless otherwise stated, non-straight line boundaries between co-ordinates follow the OS 1:25,000 mean high water line.

Separate maps available for Tapes spp. and C. edule at Portsmouth Harbour

Food Authority: Portsmouth Port Health Authority
Portsmouth Harbour - O. edulis

Scale - 1:50000

Classification of Bivalve Mollusc Production Areas: Effective from 1 September 2018

The areas delineated above are those classified as bivalve mollusc production areas under EU Regulation 854/2004.

Further details on the classified species and the areas may be obtained from the responsible Food Authority. Enquiries regarding the maps should be directed to: Shellfish Microbiology, CEFAS Weymouth Laboratory, Barrack Road, the Nathe, Weymouth, Dorset DT4 8RU.

Tel: 01305 208600 Fax: 01305 208601

N.B. Lat/Longs quoted are WGS84
Separate maps available for O. edulis, C. edule, Tapes spp. and M. mercenaria at Portsmouth Harbour
Unless otherwise stated, non-straight line boundaries between co-ordinates follow the OS 1:25,000 mean high water line.
Food Authority: Portsmouth Port Health Authority

Portsmouth Harbour - Tapes spp.

Scale - 1:50000

Classification of Bivalve Mollusc Production Areas: Effective from 1 September 2018

The areas delineated above are those classified as bivalve mollusc production areas under EU Regulation 854/2004.

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Tel: 01305 208600 Fax: 01305 208601

N.B. Lat/Longs quoted are WGS84
Unless otherwise stated, non-straight line boundaries between co-ordinates follow the OS 1:25,000 mean high water line.
Separate maps available for M mercenaria and C. edule at Portsmouth Harbour

Food Authority: Portsmouth Port Health Authority
Solent (East) - O. edulis

Classification:
- Class A
- Class B
- Class C
- Prohibited

Status:
- LT Class B
- Seasonal Class B/C

Classification of Bivalve Mollusc Production Areas: Effective from 1 September 2018

The areas delineated above are those classified as bivalve mollusc production areas under EU Regulation 854/2004.

Further details on the classified species and the areas may be obtained from the responsible Food Authority. Enquiries regarding the maps should be directed to: Sheddian Microbiology, CEFAS Weymouth Laboratory, Barrow Road, The Nore, Weymouth, Dorset DT4 8LH.

Tel: 01305 206060 Fax: 01305 206900

N.B. Lastings quoted are WGS84

Unless otherwise stated, non-straight line boundaries between co-ordinates follow the OS 1:25,000 mean high water line.

Separate maps available for M. mercenaria at Solent.

Food Authorities:
- Fareham Borough Council
- Gosport Borough Council
- Isle of Wight Council
- Portsmouth Port Health Authority
- Southampton Port Health Authority

Solent (East) - M. mercenaria

Classification:
- Class A
- Class B
- Class C
- Prohibited

Status:
- LT Class B
- Seasonal Class B/C

Classification of Bivalve Mollusc Production Areas: Effective from 1 September 2018

The areas delineated above are those classified as bivalve mollusc production areas under EU Regulation 854/2004.

Further details on the classified species and the areas may be obtained from the responsible Food Authority. Enquiries regarding the maps should be directed to: Sheddian Microbiology, CEFAS Weymouth Laboratory, Barrow Road, The Nore, Weymouth, Dorset DT4 8LH.

Tel: 01305 206060 Fax: 01305 206900

N.B. Lastings quoted are WGS84

Unless otherwise stated, non-straight line boundaries between co-ordinates follow the OS 1:25,000 mean high water line.

Separate maps available for O. edulis at Solent.

Food Authorities:
- Fareham Borough Council
- Gosport Borough Council
- Isle of Wight Council
- Portsmouth Port Health Authority
- Southampton Port Health Authority
Annex 10. Table of recovery rates of prey species taken by bird species which may be impacted by changes in prey availability as a result of clam dredging in Chichester and Langstone Harbour SPA, Portsmouth Harbour, and Solent and Southampton Water SPA. Taken from Ferns et al., (2000).

<table>
<thead>
<tr>
<th>Species</th>
<th>% Change After Harvesting – Muddy Sand</th>
<th>% Change After Harvesting – Clean Sand</th>
<th>Recovery Period</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corophium arenarium</td>
<td>-53%</td>
<td>0%*</td>
<td>&gt;86 days (muddy sand)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>0 days* (clean sand)</td>
</tr>
<tr>
<td>Crangon crangon</td>
<td>-</td>
<td>-38%*</td>
<td>&gt;86 days (muddy sand)</td>
</tr>
<tr>
<td>Macoma balthica</td>
<td>55%</td>
<td>-6%</td>
<td>&gt;86 days (muddy sand)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>0 days (muddy sand)</td>
</tr>
<tr>
<td>Cerastoderma edule</td>
<td>-35%</td>
<td>-15%</td>
<td>&gt;86 days (muddy sand)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>0 days (clean sand)</td>
</tr>
<tr>
<td>Hediste diversicolor</td>
<td>-</td>
<td>-33%*</td>
<td>-</td>
</tr>
<tr>
<td>Hydrobia ulvae</td>
<td>-60%</td>
<td>-56%</td>
<td>&gt;86 days (muddy sand)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>8 days (clean sand)</td>
</tr>
<tr>
<td>Retusa obtusa</td>
<td>-</td>
<td>-</td>
<td>&gt;86 days* (muddy sand)</td>
</tr>
</tbody>
</table>

*Low abundances were found
Annex 11: Seabed scars (shown as numerous lines), visible from Google Earth, potentially caused by clam dredging within Langstone Harbour. These images were taken on 22/04/2015. Source: Google Earth.
### Annex 12. Table of studies investigating the impacts of shellfish dredging and recovery rates.

<table>
<thead>
<tr>
<th>Study</th>
<th>Location and Exposure</th>
<th>Gear Type and Target Species</th>
<th>Sediment Type</th>
<th>Recovery Period</th>
<th>Species-Specific Recovery</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ferns, P.N., Rostron, D.M. &amp; Sima, H.Y. 2000. Effects of mechanical cockle harvesting on intertidal communities. Journal of Applied Ecology, 37, 464-474.</td>
<td>Burry Inlet, South Wales</td>
<td>Tractor-towed cockle harvester - Common cockle - <em>Cerastoderma edule</em></td>
<td>Intertidal clean sand and muddy sand</td>
<td>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.</td>
<td>Muddy sand: <em>Pygospio elegans</em> - &gt;174 days <em>Hydrobia ulvae</em> - &gt;174 days <em>Nephtys hombergii</em> – 51 days <em>Bathyporeia pilosa</em> – 51 days <em>Lanice conchilega</em> – 0 days <em>Corophium arenarium</em> – 0 days <em>Macoma balthica</em> - &gt;86 days <em>Cerastoderma edule</em> - &gt;174 days <em>Pygospio elegans</em> - &gt;86 days <em>Crangon creangon</em> - &gt;86 days <em>Retusa obtusa</em> - &gt;86 days Clean sand: <em>Bathyporeia pilosa</em> – 39 days <em>Macoma balthica</em> - &lt;86 days <em>Cerastoderma edule</em> – 0 days <em>Pygospio elegans</em> - &gt;86 days <em>Nephtys hombergii</em> - &lt;86 days <em>Carcinus maenas</em> - &lt;86 days</td>
</tr>
<tr>
<td>Kaiser, M.J., Edwards, B. &amp; Spencer, B.E. 1996. Infaunal community changes as a result of commercial clam cultivation and harvesting. Aquatic Living Resources, 9, 57-63.</td>
<td>Whitstable, Kent, south-east England</td>
<td>Suction dredge - Manila clam – <em>Tapes philippinarum</em></td>
<td>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.</td>
<td>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.</td>
<td><em>Nephtys hombergii</em> contributed to the most similarity between samples taken from the clam lay 7 months after harvesting and was also dominant in control areas.</td>
</tr>
</tbody>
</table>
as sedimentation had nearly restored sediment structure.

| 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. *Journal of Applied Ecology*, 34, 497-517. | 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 = 3.5a, 88µm) (near to the study area). Silt/clay fraction (<62.5 µm) ranges from 25 to 60% in the centre. | 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. 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. | 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*. 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 interaction occurred for *P. elegans*, *Nephtys* 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 differences were still apparent between treatment and control plots (excluding previously net-covered plot and the harvested plot). | *Pygospio elegans* abundance was greater in the harvested plot than any other four months after harvesting, whilst *Nephtys hombergii* abundance remained lower. |
| 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. | 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. | Trenches (10 cm deep) left by suction dredging were infilled within 2 to 3 months. |
Annex 13. Table of recolonization strategies and reproductive seasons of potential key species in the Solent European Marine Site. These species were selected from the potential species list in Annex 15.

<table>
<thead>
<tr>
<th>Species</th>
<th>Recolonization Strategy</th>
<th>Reproductive Season</th>
<th>References</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arenicola marina</td>
<td>Above-surface migration</td>
<td>Autumn to winter</td>
<td>McLusky et al. (1983) [<a href="http://www.marlin.ac.uk/biotic/browse.php?sp=4238">http://www.marlin.ac.uk/biotic/browse.php?sp=4238</a>]</td>
</tr>
<tr>
<td>Macoma balthica</td>
<td>Active migration of adults and larval settlement/recolonization</td>
<td>Spring and autumn</td>
<td>[<a href="http://www.marlin.ac.uk/species/detail/1465">http://www.marlin.ac.uk/species/detail/1465</a>]</td>
</tr>
<tr>
<td>Hydrobia ulvae</td>
<td>Active migration</td>
<td>March to October</td>
<td>[<a href="http://www.marlin.ac.uk/habitats/detail/206/crassoderma_edule_and_polychaetes_in_littoral_muddy_sand">http://www.marlin.ac.uk/habitats/detail/206/crassoderma_edule_and_polychaetes_in_littoral_muddy_sand</a>]</td>
</tr>
<tr>
<td>Pygospio elegans</td>
<td>Larval recolonization</td>
<td>December to May or January to August</td>
<td>[<a href="http://www.marlin.ac.uk/habitats/detail/206/crassoderma_edule_and_polychaetes_in_littoral_muddy_sand">http://www.marlin.ac.uk/habitats/detail/206/crassoderma_edule_and_polychaetes_in_littoral_muddy_sand</a>]</td>
</tr>
<tr>
<td>Hediste diversicolor</td>
<td>Adult migration and juvenile recruitment</td>
<td>Spring to summer</td>
<td>Lewis et al. (2002) [<a href="http://www.marlin.ac.uk/biotic/browse.php?sp=6363">http://www.marlin.ac.uk/biotic/browse.php?sp=6363</a>]</td>
</tr>
<tr>
<td>Scrobicularia plana</td>
<td>Larval recolonization</td>
<td>May to September</td>
<td>Lewis et al. (2002) [<a href="http://www.marlin.ac.uk/biotic/browse.php?sp=6363">http://www.marlin.ac.uk/biotic/browse.php?sp=6363</a>]</td>
</tr>
<tr>
<td>Nephtys hombergii</td>
<td>Passive and active migration</td>
<td>Variable; May and September (Tyne Estuary), throughout the year peaking in July and November (Southampton Water), August and September (Århus Bay, Denmark)</td>
<td>Hall and Harding (1997) [<a href="http://www.marlin.ac.uk/biotic/browse.php?sp=4314">http://www.marlin.ac.uk/biotic/browse.php?sp=4314</a>]</td>
</tr>
</tbody>
</table>
Annex 14. Potential Species List for the Solent European Marine Site (derived from SAC biotopes outlined in the Regulation 33 Conservation Advice Package and prey species of vulnerable (to shellfish dredging) SPA bird species).

SAC Species (Summary of key biotopes for SAC sub-features – Appendix XI):
- Pontocrates spp.
- Bathyporeia spp.
- Lanice conchilega
- Corophium*
- Macoma balthica*
- Arenicola marina*
- Cerastoderma edule*
- Hediste diversicolor* (previously Nereis diversicolor)
- Mya arenaria
- Pygospio elegans
- Scrobicularia plana*
- Streblospio shrubsolii
- Aphelochaeta marioni
- Tubificoides
- Nephtys hombergii

Prey species of potentially vulnerable (to shellfish dredging) SPA bird species*:
- Cardium spp
- Nereis spp
- Crangon spp.
- Carcinus spp.
- Retusa obtusa
- Corophium volutator
- Gammarus spp.
- Tubilflex spp.
- Nerine spp.
- Hydrobia ulvae
Annex 16: TSLE Summary for each feature (and sub-feature)

<table>
<thead>
<tr>
<th>Bird</th>
<th>Bar-tailed godwit, Non-breeding</th>
<th>Black-tailed godwit, Non-breeding</th>
<th>Curlew, Non-breeding</th>
<th>Dark-bellied scoter, Non-breeding</th>
<th>Dunlin, Non-breeding</th>
<th>Grey plover, Non-breeding</th>
<th>Pintail, Non-breeding</th>
<th>In/Out</th>
<th>Relevant Attributes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abrasion/disturbance of the substrate on the surface of the seabed</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Out</td>
<td>N/A</td>
</tr>
<tr>
<td>Changes in suspended solids (water clarity)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Out</td>
<td>N/A</td>
</tr>
<tr>
<td>Penetration and/or disturbance of the substratum below the surface of the seabed, including abrasion</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Out</td>
<td>N/A</td>
</tr>
<tr>
<td>Removal of non-target species</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Out</td>
<td>N/A</td>
</tr>
<tr>
<td>Removal of target species</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Out</td>
<td>N/A</td>
</tr>
<tr>
<td>Smothering and siltation rate changes (Light)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Out</td>
<td>N/A</td>
</tr>
<tr>
<td>Visual disturbance</td>
<td>In</td>
<td>In</td>
<td>In</td>
<td>In</td>
<td>In</td>
<td>In</td>
<td>In</td>
<td>Disturbance caused by human activity</td>
<td></td>
</tr>
<tr>
<td>Above water noise</td>
<td>In</td>
<td>In</td>
<td>In</td>
<td>In</td>
<td>In</td>
<td>In</td>
<td>In</td>
<td>Disturbance caused by human activity</td>
<td></td>
</tr>
<tr>
<td>Collision ABOVE water with static or moving objects not naturally found in the marine environment (e.g., boats, machinery, and structures)</td>
<td>In</td>
<td>In</td>
<td>NS</td>
<td>In</td>
<td>In</td>
<td>In</td>
<td>NS</td>
<td>Out</td>
<td>N/A</td>
</tr>
<tr>
<td>Collision BELOW water with static or moving objects not naturally found in the marine environment</td>
<td>In</td>
<td>In</td>
<td>NS</td>
<td>In</td>
<td>In</td>
<td>In</td>
<td>NS</td>
<td>Out</td>
<td>N/A</td>
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<tr>
<td>Deoxygenation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Out</td>
<td>N/A</td>
</tr>
<tr>
<td>Hydrocarbon &amp; PAH contamination</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Out</td>
<td>N/A</td>
</tr>
<tr>
<td>Introduction of light</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Out</td>
<td>N/A</td>
</tr>
<tr>
<td>Introduction of microbial pathogens</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Out</td>
<td>N/A</td>
</tr>
<tr>
<td>Introduction or spread of invasive non-indigenous species (INIS)</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>Out</td>
<td>N/A</td>
</tr>
<tr>
<td>Litter</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Out</td>
<td>N/A</td>
</tr>
<tr>
<td>Nutrient enrichment</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Out</td>
<td>N/A</td>
</tr>
<tr>
<td>Organic enrichment</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Out</td>
<td>N/A</td>
</tr>
<tr>
<td>Physical change (to another seabed type)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Out</td>
<td>N/A</td>
</tr>
<tr>
<td>Physical change (to another sediment type)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Out</td>
<td>N/A</td>
</tr>
<tr>
<td>Synthetic compound contamination (incl. pesticides, antifoulants, pharmaceuticals)</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>Out</td>
<td>N/A</td>
</tr>
<tr>
<td>Transition elements &amp; organo-metal (e.g. TBT) contamination</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Out</td>
<td>N/A</td>
</tr>
<tr>
<td>Underwater noise changes</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Out</td>
<td>N/A</td>
</tr>
<tr>
<td>Environmental Impact</td>
<td>Red-breasted merganser, Non-breeding</td>
<td>Redshank, Non-breeding</td>
<td>Ringed plover, Non-breeding</td>
<td>Sanderling, Non-breeding</td>
<td>Shelduck, Non-breeding</td>
<td>Shoveler, Non-breeding</td>
<td>Teal, Non-breeding</td>
<td>Turnstone, Non-breeding</td>
<td>Wigeon, Non-breeding</td>
</tr>
<tr>
<td>----------------------</td>
<td>--------------------------------------</td>
<td>------------------------</td>
<td>---------------------------</td>
<td>--------------------------</td>
<td>-----------------------</td>
<td>-----------------------</td>
<td>-----------------</td>
<td>------------------------</td>
<td>---------------------</td>
</tr>
<tr>
<td>Out</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
</tr>
</tbody>
</table>

<p>| Abrasion/disturbance of the substrate on the surface of the seabed | Out | N/A |
| Changes in suspended solids (water clarity) | NS | 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 | NS | NS | NS | NS | NS | NS | NS | NS | NS | Out | N/A |
| Above water noise | NS | NS | NS | NS | NS | NS | NS | NS | NS | Out | N/A |
| Collision ABOVE water with static or moving objects not naturally found in the marine environment (e.g., boats, machinery, and structures) | NS | NS | NS | NS | NS | NS | NS | NS | NS | Out | N/A |
| Collision BELOW water with static or moving objects not naturally found in the marine environment | NS | NS | NS | NS | NS | NS | NS | NS | NS | Out | N/A |
| Disevaulation | Out | N/A |
| Hydrocarbon &amp; PAH contamination | IE | IE | IE | IE | IE | IE | IE | IE | IE | Out | N/A |
| Introduction of light | IE | IE | IE | IE | IE | IE | IE | IE | IE | Out | N/A |
| Introduction of microbial pathogens | IE | IE | IE | IE | IE | IE | IE | IE | IE | Out | N/A |
| Introduction or spread of invasive non-indigenous species (INIS) | NS | NS | NS | NS | NS | NS | NS | NS | NS | Out | N/A |
| Litter | NS | NS | NS | NS | NS | NS | NS | NS | NS | Out | N/A |
| Nutrient enrichment | Out | N/A |
| Organic enrichment | Out | N/A |
| Physical change to another seabed type | Out | N/A |
| Physical change to another sediment type | Out | N/A |
| Synthetic compound contamination (incl. pesticides, antifoulants, pharmaceuticals) | IE | IE | IE | IE | IE | IE | IE | IE | IE | Out | N/A |
| Transition elements &amp; organo-metal (e.g. TBT) contamination | IE | IE | IE | IE | IE | IE | IE | IE | IE | Out | N/A |
| Underwater noise changes | NS | NS | NS | NS | NS | NS | NS | NS | NS | Out | N/A |</p>
<table>
<thead>
<tr>
<th>Relevant Attributes</th>
<th>Intertidal</th>
<th>Subtidal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abrasion/disturbance of the substrate on the surface of the seabed</td>
<td>N5</td>
<td>S</td>
</tr>
<tr>
<td>Changes in suspended solids (water clarity)</td>
<td>N5</td>
<td>S</td>
</tr>
<tr>
<td>Penetration and/or disturbance of the substratum below the surface of the seabed, including abrasion</td>
<td>N5</td>
<td>S</td>
</tr>
<tr>
<td>Removal of non-target species</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Removal of target species</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Smothering and siltation rate changes (Light)</td>
<td>N5</td>
<td>S</td>
</tr>
<tr>
<td>Visual disturbance</td>
<td>NA</td>
<td>NA</td>
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<tr>
<td>Collision ABOVE water with static or moving objects not naturally found in the marine environment (e.g., boats, machinery, and structures)</td>
<td>Out</td>
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<tr>
<td>Collision BELOW water with static or moving objects not naturally found in the marine environment</td>
<td>Out</td>
<td>N/A</td>
</tr>
<tr>
<td>Desiccation</td>
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<tr>
<td>Hydrocarbon &amp; PAH contamination</td>
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<td>S</td>
</tr>
<tr>
<td>Introduction of light</td>
<td>N5</td>
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</tr>
<tr>
<td>Introduction of microbial pathogens</td>
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<td>S</td>
</tr>
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<td>N5</td>
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</tr>
<tr>
<td>Litter</td>
<td>NA</td>
<td>NA</td>
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<tr>
<td>Nutrient enrichment</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Organic enrichment</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Physical change (to another seabed type)</td>
<td>N5</td>
<td>S</td>
</tr>
<tr>
<td>Physical change (to another sediment type)</td>
<td>N5</td>
<td>S</td>
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</tbody>
</table>

*Maintenance of the structure, function and availability of the following habitats which support the assemblage feature for all stages (moult, roosting, loafing, feeding) of the non-breeding period.*

*In/Out: In = present, Out = not present. Relevant Attributes: see full TSLE for specific habitat screenings.*
<table>
<thead>
<tr>
<th>Synthetic compound contamination (incl. pesticides, antifoulants, pharmaceuticals)</th>
<th>NS</th>
<th>NS</th>
<th>NS</th>
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<th>NS</th>
<th>NS</th>
<th>NS</th>
<th>NS</th>
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<tr>
<td>Transition elements &amp; organo-metal (e.g. TBT) contamination</td>
<td>NS</td>
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<td>N/A</td>
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<tr>
<td>Underwater noise changes</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>$</td>
<td>Out</td>
<td>N/A</td>
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</table>

<table>
<thead>
<tr>
<th>Relevant Attributes</th>
<th>Intertidal rock</th>
<th>Coastal lagoons</th>
<th>Coastal reedbeds</th>
<th>Freshwater and coastal grazing march</th>
<th>Salicornia and other annuals colonising mud and sand</th>
<th>Atlantic salt meadows</th>
<th>Spartina swards</th>
<th>Infralittoral rock</th>
<th>Circalittoral rock</th>
<th>Subtidal seagrass beds</th>
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<tbody>
<tr>
<td>Abrasion/disturbance of the substrate on the surface of the seabed</td>
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</table>

Page 234 of 236

SIFCA Reference: SIFCA/HRA/_PPSDPByelaw2018
### Advice on Operations Sensitivity Key

<table>
<thead>
<tr>
<th>Sensitivity Category Description</th>
<th>Interaction Type</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SENSITIVE</strong>: 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.</td>
<td>DIRECT(^1)</td>
</tr>
<tr>
<td><strong>INSUFFICIENT EVIDENCE TO ASSESS</strong>: 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.</td>
<td>IE(^1)</td>
</tr>
<tr>
<td><strong>NOT ASSESSED</strong>: 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.</td>
<td>NA(^1)</td>
</tr>
<tr>
<td><strong>NOT SENSITIVE AT THE BENCHMARK</strong>: 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.</td>
<td>NS(^1)</td>
</tr>
<tr>
<td><strong>NOT RELEVANT</strong>: 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</td>
<td></td>
</tr>
</tbody>
</table>

\(^1\) S, IE, NA, NS, IE

\(^2\) S*, IE*, NA*, NS*
**Risk Profile of Pressures Key**

<table>
<thead>
<tr>
<th>RISK CATEGORY</th>
<th>RECOMMENDATION</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>High to Medium Risk</strong></td>
<td>Pressure is commonly induced by activity at a level that needs to be considered further as part of an assessment.</td>
</tr>
<tr>
<td><strong>Low Risk</strong></td>
<td>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.</td>
</tr>
</tbody>
</table>