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This document has been distributed for information and comment to:

Title	Name	Date sent	Comments received
HRA – Portsmouth Harbour SPA – Clam Dredging (v1.2)	Natural England	27/10/2015	02/12/2015
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HRA – Portsmouth Harbour SPA – Clam Dredging (v1.7)	Natural England	03/08/2016	26/08/2016
HRA – Portsmouth Harbour SPA – Clam Dredging (v1.9)	Natural England	09/09/2016	20/09/2016

Southern Inshore Fisheries and Conservation Authority (IFCA)

Fisheries in EMS Habitats Regulations Assessment for amber and green risk categories

European Marine Site: Portsmouth Harbour SPA (UK9011051)

Feature(s): Nationally and **i**nternationally important populations of regularly occurring migratory species (Dark-bellied brent goose; Red-breasted merganser; Black-tailed godwit; Dunlin)

Generic Feature(s): Estuarine birds

Site Specific Sub-feature(s)/Supporting Habitat(s): Intertidal mudflats and sandflats

Generic Sub-feature(s)/Supporting Habitat(s): Intertidal mud and sand

Gear type(s) Assessed: Clam dredging

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1. Introduction

1.1 Need for an HRA assessment

Southern IFCA has duties under Regulation 9(3) of the Conservation of Habitats and Species Regulations 2010 as a competent authority, with functions relevant to marine conservation to exercise those functions so as to secure compliance with the Habitats Directive. Article 6.2 of the Habitats Directive requires appropriate steps to be taken to avoid, in Natura 2000 sites, the deterioration of natural habitats and habitats of species as well as significant disturbance of the species for which the area has been classified.

Management of European Marine Sites 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 36 of the Species and Habitats Regulations (2010):

“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. This assessment, in line with Article 6.2 of the Habitats Directives, will form part of that audit trail, as will other assessments regarding the fishing activities within the Solent EMS. It is considered that some level of management will be required for high risk activities within the EMS.

This audit trail will be achieved through Southern IFCA’s responsibilities under the revised approach to the management of commercial fisheries in European Marine sites announced by the Department for Environment, Food and Rural Affairs (DEFRA).

The objective of this revised approach is to ensure that all existing and potential commercial fishing activities in European Marine Sites are managed in accordance with Article 6 of the Habitats Directive. Articles 4.1 and 4.2 of the Birds Directive also require that the Member States ensure the species mentioned in Annex I and regularly occurring migratory bird species are subject to special conservation measures concerning their habitat in order to ensure survival and reproduction in their area of distribution. This affords Special Protection Areas (SPAs) a similar protection regime to that of Special Areas of Conservation (SACs).

This approach is being implemented using an evidence-based, risk-prioritised, and phased approach. Risk prioritisation is informed by using a matrix of the generic sensitivities of the sub-features of the EMS to a suite of fishing activities as a decision making tool. These sub-feature-activity combinations have been categorised according to specific definitions, as red[1], amber[2], green[3] or blue[4].

Activity/feature interactions identified within the matrix as red risk have the highest priority for implementation of management measures by the end of 2013 in order to avoid the deterioration of Annex I features in line with obligations under Article 6(2) of the Habitats Directive.

Activity/feature interactions identified within the matrix as amber risk require a site-level assessment to determine whether management of an activity is required to conserve site features. Activity/feature interactions identified within the matrix as green also require a site level assessment if there are "in-combination effects" with other plans or projects.

Site level assessments are being carried out in a manner that is consistent with the provisions of Article 6(3) of the Habitats Directive, but are required to meet the 6(2) responsibilities of Southern IFCA as a competent authority. The aim of the assessment will be to consider if the activity could significantly disturb the species or deteriorate natural habitats or the habitats of the protected species and from this, a judgement can be made as to whether or not the conservation measures in place are appropriate to maintain and restore the habitats and species for which the site has been designated to a favourable conservation status (Article 6(2)). If measures are required, the revised approach requires these to be implemented by 2016.

The purpose of this site specific assessment document is to assess whether or not in the view of Southern IFCA the fishing activity 'Clam Dredging' has a likely significant effect on the Nationally and internationally important populations for regularly occurring migratory species and supporting habitats of the Portsmouth Harbour SPA; and as part of this assessment to test whether the proposed management measures will be sufficient to ensure that the Southern IFCA meets its responsibilities as a Competent Authority and ensure that the conservation objectives will be met in relation to Clam Dredging over the features/supporting habitats of the Portsmouth Harbour SPA.

1.2 Documents reviewed to inform this assessment

- SEMs Annual Monitoring Report 2015
- SEMs Delivery Plan 2014
- Natural England's risk assessment Matrix of fishing activities and European habitat features and protected species[5]
- Reference list[6] (Annex 1)
- Natural England's Regulation 33 advice[7]/Natural England's interim conservative advice

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[1] Where it is clear that the conservation objectives for a feature (or sub-feature) will not be achieved because of its sensitivity to a type of fishing, - irrespective of feature condition, level of pressure, or background environmental conditions in all EMSs where that feature occurs – suitable management measures will be identified and introduced as a priority to protect those features from that fishing activity or activities.

[2] Where there is doubt as to whether the conservation objectives for a feature (or sub-feature) will be achieved because of its sensitivity to a type of fishing, in all EMSs where that feature occurs, the effect of that activity or activities on such features will need to be assessed in detail at a site specific level. Appropriate management action should then be taken based on that assessment.

[3] Where it is clear that the achievement of conservation objectives for a feature is highly unlikely to be affected by a type of fishing activity or activities, in all EMSs where that feature occurs, further action is not likely to be required, unless there is the potential for in combination effects.

[4] For gear types where there can be no feasible interaction between the gear types and habitat features, a fourth categorisation of blue is used, and no management action should be necessary.

[5] See Fisheries in EMS matrix: http://www.marinemanagement.org.uk/protecting/conservation/documents/ems_fisheries/populated_matrix3.xls

[6] 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)

- Site map(s) – sub-feature/feature location and extent (Annex 3)
- Fishing activity data (map(s), etc) (Annex 4)
- Fisheries Impact Evidence Database (FIED)
- Natural England's scoping advice on the potential impacts of clam dredging within Portsmouth Harbour SPA (Annex 5)

2. Information about the EMS

- Portsmouth Harbour SPA (UK9011051)

2.1 Overview and qualifying features

- **Nationally and internationally important populations of the regularly occurring migratory species** (A046a *Branta bernicla bernicla*; Dark-bellied brent goose (Non-breeding); A069 *Mergus serrator*; Red-breasted merganser (Non-breeding); A149 *Calidris alpina alpina*; Dunlin (Non-breeding); A156 *Limosa limosa islandica*; Black-tailed godwit (Non-breeding))
    - Saltmarsh
    - Intertidal mudflats and sandflats
    - Shallow coastal waters

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]

2.2 Conservation Objectives

The conservation objective for the Portsmouth Harbour SPA features:

- Nationally and internationally important populations of the regularly occurring migratory species

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

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

The high level conservation objectives for the Portsmouth Harbour SPA are available online at: http://publications.naturalengland.org.uk/publication/4857883850178560

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[7] Solent EMS Regulation 33 Conservation Advice: http://publications.naturalengland.org.uk/publication/3194402

[8] Information taken from: http://jncc.defra.gov.uk/default.aspx?page=2036

3. Interest feature(s) of the EMS categorised as 'Red' risk and overview of management measure(s) (if applicable)

- Subtidal eelgrass *Zostera marina* beds (supporting habitat of the bird interest features)

A red risk interaction between bottom towed gears and eelgrass/seagrass beds was identified and subsequently addressed through the creation of the 'Bottom Towed Fishing Gear' byelaw[9] and 'Prohibition of Gathering (Sea Fisheries Resources) in Seagrass Beds' byelaw[10]. The 'Bottom Towed Fishing Gear' prohibits the use any bottom towed fishing gear within sensitive areas (characterised by reef features or eelgrass/seagrass beds) in European Marine Sites throughout the district. The byelaw also states that if transiting through a prohibited area carrying bottom towed fishing gear, all parts of the gear are inboard and above the sea. Within the Solent EMS, which includes waters to the north of the Isle of Wight, all eastern harbours and Southampton Water, there are 20 prohibited areas. The 'Prohibition of Gathering (Sea Fisheries Resources) in Seagrass Beds' byelaw prevents digging, fishing for or taking any sea fisheries resource in or from prohibited areas containing eelgrass/seagrass beds in European Marine Sites throughout the District. Exceptions to the prohibition include if a net, rod and line or hook and line are used, in addition to the use of a vessel as long as the vessel's hull is not in contact with the seabed. It is also prohibited to carry a rake, spade, fork or any similar tool within specified areas. Within the Solent EMS, which includes north of the Isle of Wight, all eastern harbours and Southampton Water, there are 25 prohibited areas.

4. Information about the fishing activities within the site

4.1 Activities under Consideration/Summary of Fishery

Clam dredging takes place all year round within the Portsmouth Harbour SPA and predominantly targets the non-indigenous Manila clam (*Ruditapes philippinarum*), although the activity also targets American hard-shell clam (*Mercenaria mercenaria*). Occasional catches of the indigenous Grooved Carpet Shell clam (*Ruditapes decussatus)* also occur.

Manila clam is thought to have been introduced into the Solent and Southampton Water in 2005 (Tumnoi, 2012) and a fishery for the species developed a number of years later in 2007/08.

4.2 Technical Gear Specifications

A type of mechanical dredge, known as a box dredge, is used to fish for clams in the Portsmouth Harbour SPA. 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. These teeth penetrate into the sediment disturbing the buried clams which are subsequently caught and

[9] Bottom Towed Fishing Gear Byelaw: https://secure.toolkitfiles.co.uk/clients/25364/sitedata/files/PDFbyelaw_bottomtowedfishi.pdf
[10] Prohibition of Gathering (Sea Fisheries Resources) in Seagrass Beds Byelaw: https://secure.toolkitfiles.co.uk/clients/25364/sitedata/files/PDFbyelaw_prohibitionofgat.pdf

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.

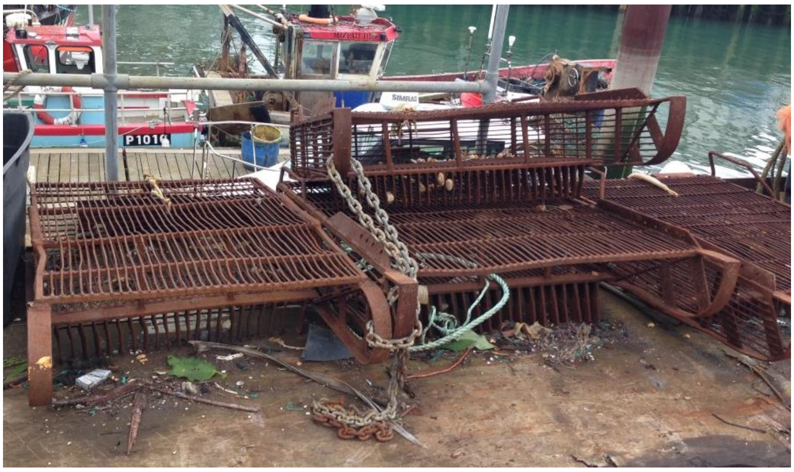

Figure 1. Box dredge used in the Solent clam fishery.

Figure 2. Box dredge tow riddle (highlighted in the red box). Two tow riddles are present on the front of the top of the riddle, one of each side. A rope attaches to the dredge through the holes in the tow riddle.

4.3 Location, Effort and Scale of Fishing Activities

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 4). These sites occur both intertidally (at high tide) and subtidally, with vessels often operating in very shallow waters.

Sightings data in Annex 4 (split between 2005 to 2011 and 2012 to 2015) illustrates how clam dredge areas have changed over this time period. In Portsmouth Harbour, sightings from 2005 to 2011 show clam dredging was concentrated on the eastern side of the harbour, particularly to the north within the channels and intertidal zone. Clam dredge sightings also illustrate that the activity occurs on the western side of the Portsmouth Harbour, although to a lesser extent. Sightings on the western side of the harbour are largely concentrated on the periphery of the intertidal zone and within the channels. From 2012 to 2015, sightings data demonstrates a shift in clam dredging activity, where it is concentrated in the upper eastern reaches of the harbour in an area known as Fareham Creek in 2014. This area is however unclassified (see section 6.6). There are also a small number of sightings from 2012 which occur on the eastern side of the harbour, largely concentrated within the channels as well as a small number occurring on the intertidal. 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 ten year period covered by sightings data (2005-2015), it is likely that the geographical extent of the fishery is well reflected, however intensity may be skewed by aforementioned factors.

At its peak in 2007/2008, the clam fishery supported approximately 15 vessels. Since 2012, the number of vessels operating within the fishery has decreased to approximately 7, with an average of 0 to 1 operating on any one day. The number of vessels sighted in the whole Solent by Southern IFCA are summarised in Table 1. Table 1 shows a decline in the average number of fishing vessels sighted 5 times or more between in a month 2012 and 2015 and in all years no vessels were sighted 10 or more times in a month. The average number of vessels sighted per month and average number of vessels sighted 2 or more times in a month was lower in 2013 to 2015, when compared with 2012. In 2012 and 2014, the winter months appear to be characterised by higher levels of fishing activity, whilst in 2013, the highest levels of fishing activity occurred between June and August.

Table 1. Clam dredging vessel sightings in the Solent from 2012 to 2015, from data collected during sea and land patrols.

Year	Month	No. of fishing vessels sighted	No. of fishing vessels sighted twice or more	No. of fishing vessels sighted 5 times or more	No. of fishing vessels sighted 10 times or more
2012	Jan	11	8	2	0
	Feb	11	9	2	0
	Mar	9	5	0	0
	Apr	3	0	0	0
	May	7	3	0	0
	Jun	4	3	0	0
	Jul	6	0	0	0
	Aug	5	0	0	0
	Sep	11	6	0	0
	Oct	11	1	0	0
	Nov	5	0	0	0
	Dec	7	1	0	0
	Average	**7.5**	**3**	**0.3**	**0**
2013	Jan	6	0	0	0
	Feb	4	0	0	0
	Mar	5	2	0	0
	Apr	3	0	0	0
	May	0	0	0	0
	Jun	9	3	0	0
	Jul	7	3	1	0
	Aug	9	6	0	0
	Sep	4	0	0	0
	Oct	0	0	0	0
	Nov	0	0	0	0
	Dec	0	0	0	0

	Total	**3.9**	**1.2**	**0.1**	**0**
2014	Jan	8	6	0	0
	Feb	11	5	0	0
	Mar	2	0	0	0
	Apr	3	1	0	0
	May	4	1	0	0
	Jun	1	0	0	0
	Jul	5	0	0	0
	Aug	3	0	0	0
	Sep	2	1	0	0
	Oct	4	2	0	0
	Nov	5	0	0	0
	Dec	11	1	0	0
	Average	**4.9**	**1.4**	**0**	**0**
2015	Jan	3	1	0	0
	Feb	1	0	0	0
	Mar	5	3	0	0
	Apr	4	1	0	0
	May	3	1	0	0
	Jun	2	1	0	0
	Jul	1	0	0	0
	Aug	1	0	0	0
	Sep				
	Oct				
	Nov				
	Dec				
	Average	**2.5**	**0.9**	**0**	**0**

Vessels that take part in the fishery largely operate out of Portsmouth Harbour, with other vessels operating out of Warsash and Langstone Harbour. Landings data provided by the Marine Management Organisation (MMO) show the greatest quantities of all clam species between 2005 and 2014 were landed into Portsmouth, with Southampton landing the next greatest quantities of clams (Table 2). There are clear changes in the overall landings of each clam species within the Solent EMS (Figure 3). The development of the Manila clam fishery in 2007/2008 is well demonstrated by the jump in landings of 12.3 tonnes in 2007 to 185.1 tonnes in 2008. Landings of this fishery continued to rise until its peak in 2010, however since then landings have declined, explaining the reduction in vessels participating in the fishery since 2012. The magnitude of American Hard-Shell clam and Grooved Carpet Shell clam is much less than that of Manila clam. The low level of Grooved Carpet Shell clam landings appears to show a general decline since 2008 which may be explained by simultaneous expansion of the non-indigenous Manila clam population. Landings of American Hard-Shell clam appear to remain relatively stable between 2007 and 2013, despite dipping in 2009 and 2013, although catches showed a large increase in 2014 to 43.7 tonnes. Please note that landings data should be viewed with caution, although reflective of the overall trends of the fishery. Exact figures are not always accurate; however this data represents the best available information to date.

Table 2. Landings (in tonnes) of key clam species (Manila clam - *Ruditapes philippinarum*, American Hard-Shell clam - *Mercenaria mercenaria,* Grooved Carpet Shell clam - *Ruditapes decussatus*) into ports located within the Solent European Marine Site (EMS).

Data was provided by the Marine Management Organisation (MMO).

		Landings (Tonnes)									
	Port of Landing	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**
Manila Clam	Emsworth							0.1	0.2		
	Hamble	0.1			0.5	17.8	4.4	21.7	7.5		
	Isle Of Wight			0.2				0.0			
	Lymington and Keyhaven		4.9	2.1	4.8	2.5	1.8	0.6	6.2	3.4	0.4
	Portsmouth		0.5	5.5	169.8	130.9	263.6	101.8	172.6	69.5	68.6
	Southampton		3.5	4.6	10.1	41.8	79.9	52.3	22.1	10.6	4.1
	Total	**0.1**	**8.9**	**12.3**	**185.1**	**193.0**	**349.6**	**176.5**	**208.6**	**83.5**	**73.1**
Hard-Shell American Clam	Hamble				0.1		0.2	0.3	0.1		
	Lymington and Keyhaven		1.7	5.0	1.2	0.0	0.0	0.0	0.1		
	Portsmouth		0.0	1.6	9.6	0.4	7.2	6.1	7.7	1.6	43.7
	Southampton		3.6	1.7	0.2	0.6	1.8	4.5	4.7	0.0	
	Total	**0.0**	**5.3**	**8.3**	**11.1**	**1.0**	**9.1**	**10.9**	**12.6**	**1.8**	**43.7**
Grooved Carpet Shell Clam	Hamble				6.8	0.2		1.0	0.5		
	Isle of Wight			0.5					0.0		
	Lymington and Keyhaven			0.9	1.5	2.8					
	Portsmouth			0.1	10.9	5.0	11.4	1.3	2.0		
	Southampton				3.2	0.8	0.6	1.0			
	Total			**1.5**	**22.4**	**8.8**	**12.0**	**3.3**	**2.5**		

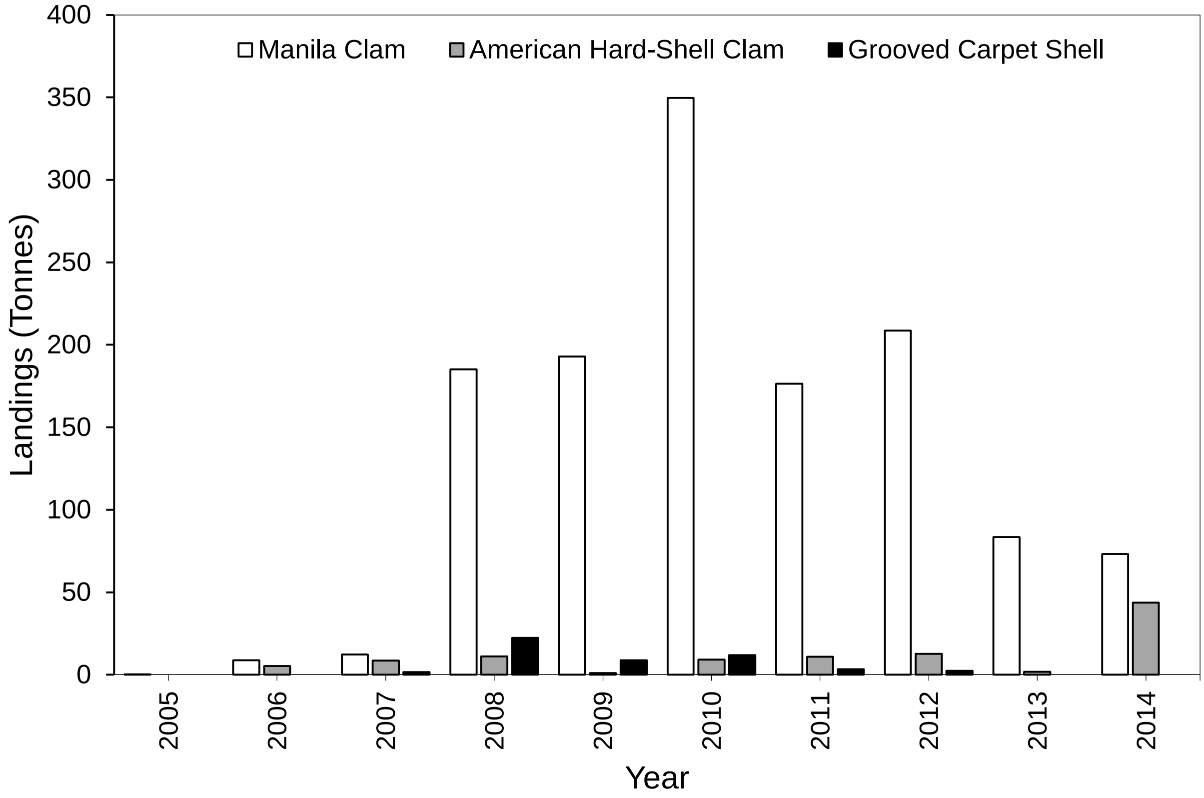

Figure 3. Total landings (in tonnes) of key clam species (Manila clam - *Ruditapes philippinarum*, American Hard-Shell clam - *Mercenaria mercenaria*, Grooved Carpet Shell clam - *Ruditapes decussatus*) into ports located within the Solent European Marine Site (EMS). Data was provided by the Marine Management Organisation (MMO).

5. Test of Likely Significant Effect (TLSE)

The Habitats Regulations assessment (HRA) is a step-wise process and is first subject to a coarse test of whether a plan or project will cause a likely significant effect on an EMS[11]. Each feature/sub-feature was subject to a TLSE, the results of which are summarised in table 3 and 4.

5.1 Table 3: Summary of LSE Assessment(s) – Estuarine birds

1. Is the activity/activities directly connected with or necessary to the management of the site for nature conservation?	**No**

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

2. What potential pressures, exerted by the gear type(s), are likely to affect the feature(s)/supporting habitat(s)?	Regulation 35 Advice (Draft)/SPA Toolkit: 1. Above water noise/Underwater noise changes/Displacement 2. Changes in suspended solids (water clarity)/Increased turbidity 3. Collision above/below water with static or moving objects 4. Hydrocarbon and PAH contamination 5. Introduction of light 6. Introduction of microbial pathogens 7. Introduction of other substances 8. Introduction or spread of non-indigenous species 9. Synthetic compound contamination 10. Transition elements and organo-metal 11. Visual disturbance/Displacement 12. SPA Toolkit: Competition for prey 13. SPA Toolkit: Changes in food availability	
3. Is the feature(s)/supporting habitat(s) likely to be exposed to the pressure(s) identified?	Pressure	Screening - Justification
	1.	IN – Vessels can operate close inshore and noise disturbance is can result from the presence/movement of fishing vessels and operation of fishing gear. The magnitude of disturbance and displacement is influenced by the intensity of fishing (no. of vessels, frequency and duration) and the activities relative proximity to sensitive bird species (wildfowl & waders). Further investigation is therefore necessary into the scale activity and location of sensitive bird species.
	11.	IN – Vessels can operate close inshore and visual disturbance is possible from the presence/movement of fishing vessels and operation of fishing gear. The magnitude of disturbance and displacement is influenced by the intensity of fishing (no. of vessels, frequency and duration) and the activities relative proximity to sensitive bird species (wildfowl & waders). Further investigation is therefore necessary into the scale activity and location of sensitive bird species.
	13.	IN – Clam dredging can have an indirect impact on bird species by affecting the availability of prey through community structure changes as a result of physical disturbance, removal/mortality of non-target organisms, smothering of prey species and physical damage to supporting habitats. Further assessment of clam dredging impacts on non-target species is needed, with consideration given to the sensitivity of different prey types and the key prey groups of different bird features

4. What key attributes of the site are likely to be affected by the identified pressure(s)?	Regulation 35 Advice (Draft)/Scoping Advice: - Supporting habitat: minimising disturbance caused by human activity - Supporting habitat: food availability within supporting habitat - Supporting habitat: extent and distribution of supporting non-breeding habitat	
5. Potential scale of pressures and mechanisms of effect/impact (if known)	Refer to full LSE	
6. Is the potential scale or magnitude of any effect likely to be significant?	**Alone** Yes	**OR In-combination**[12] N/A
6. Have NE been consulted on this LSE test? If yes, what was NE's advice?	Please refer to letters from Natural England dated 19/11/2015 & 08/01/16.	

5.2 Table 4: Summary of LSE Assessment(s) – Intertidal mud and sand; Intertidal mixed sediments

1. Is the activity/activities directly connected with or necessary to the management of the site for nature conservation?	**No**	
2. What potential pressures, exerted by the gear type(s), are likely to affect the feature(s)/supporting habitat(s)?	Regulation 35 Advice (Draft): 1. Abrasion/disturbance of the substrate on the surface of the seabed/ Penetration and/or disturbance of the substrate below the surface of the seabed, including abrasion 2. Introduction of other substances 3. Introduction or spread of non-indigenous species 4. Physical change (to another seabed type) 5. Siltation rate changes (high), including smothering	
3. Is the feature(s)/supporting	Pressure	Screening - Justification

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

habitat(s) likely to be exposed to the pressure(s) identified?	1.	IN – Clam dredging is known to cause abrasion and subsurface disturbance to the seabed surface through the penetration of the dredges 'teeth' into the sediment. Supporting habitats including intertidal mudflats and sandflats and sand and shingle are all considered vulnerable to physical damage by abrasion. The exposure to activities and one-off developments that may cause abrasion is higher for intertidal mudflats, sandflats and mixed sediment communities. Repeated or permanent damage can adversely affect the ability of the habitats to recover and may ultimately lead to loss. Further assessment on the local of vessel sightings, supporting habitats and species distribution is necessary to confirm this.
4. What key attributes of the site are likely to be affected by the identified pressure(s)?	Physical loss through removal and smothering has been screened out and there is no relevant attribute which relates to the physical damage of the supporting habitat.	
5. Potential scale of pressures and mechanisms of effect/impact (if known)	Refer to full LSE.	
6. Is the potential scale or magnitude of any effect likely to be significant?	**Alone** Yes	**OR In-combination**[13] N/A
6. Have NE been consulted on this LSE test? If yes, what was NE's advice?	Please refer to letters from Natural England dated 19/11/2015 & 08/01/16.	

[13] If conclusion of LSE alone an in-combination assessment is not required.

6. Appropriate Assessment

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

Key areas favoured by designated bird species in the Portsmouth Harbour SPA are summarised in table 5.

Table 5. Key areas for designated bird species in the Portsmouth Harbour SPA. Source: Portsmouth Harbour Draft Regulation 35 Advice.

Common Name	Latin Name	Favoured Area(s)
Dunlin	*Calidris alpina*	**At high tide**, dunlin roost on pontoons near Wicor Shore, on saltmarsh at RNAD Gosport, Bedenham or on an island adjacent to Priddy's Hard. Dunlin also fly over to Langstone Harbour to roost at high tide (Potts, 2014). **At low tide**, dunlin feed in high densities in the north western corner of the harbour around Cams Bay and Wicor Lake. High densities also feed at Foulton Lake and along the western side of the harbour (Austin *et al*., 2014). See also low tide WeBS data distribution maps presented in Annex 7 and 8.
Dark-bellied brent goose	*Branta bernicla bernicla*	**At low tide**, high densities of brent geese often feed at Paulsgrove Lake and Porchester in the north and also at Foulton Lake in the west of the harbour (Austin *et al*., 2014). Pewit Island is an important high tide feeding site for dark-bellied brent geese within the SPA (King, 2010). In the Solent, dark-bellied brent geese show diverse feeding habits and will also feed at high tide in areas outside the SPA. These areas include farmland with cereals and pasture along with amenity grasslands and coastal grazing marsh (King, 2010). Important **high tide** feeding sites are RNAD Gosport in Bedenham, Cams Hall, Portchester, Priddy's Hard, Tipner Ranges, St George's playing field and Port Solent on Horsea Island (King, 2010; Potts, 2014). See also low tide WeBS data distribution maps presented in Annex 7 and 8.
Black-tailed godwit	*Tadorna tadorna*	**At high tide**, black-tailed godwits roost on upper saltmarsh areas in Portsmouth Harbour and on coastal grazing marsh outside the SPA boundary. Important roost sites are located at RNAD Gosport in Bedenham, Pewit Island and at Farlington Marshes in Langstone Harbour. In wet weather, black-tailed godwits also move between Portsmouth Harbour and Titchfield Haven in the Meon Valley (Potts, 2014). **At low tide**, high densities of black-tailed godwit feed on the mudflats in the north

		western section of Portsmouth Harbour at Cams Bay and Wicor Lake (Austin *et al*., 2014). See also low tide WeBS data distribution maps presented in Annex 7 and 8.
Red-breasted merganser	*Mergus serrator*	No information available.

In general, areas of particular importance are located in RNAD Gosport in Bedenham, Pewit Island, Cams Bay, Wicor Lake, Priddy's Hard and Forton Lake. Bird roosting sites from the Solent Waders and Brent Goose Strategy are presented in Annex 10.

A map of clam dredge sightings and supporting habitats can be found in Annex 6. This map reveals where fishing activity occurs in relation to the designated supporting habitats of the site. In Portsmouth Harbour, clam dredging is shown to occur on intertidal mud and on the fringes of a small area of intertidal mixed sediments. Using knowledge presented in table 6, low tide WeBS data distribution maps (presented in Annex 7 and 8) and data provided in the Solent Overwintering Birds Workshop in Annex 9, clam dredging may have some effect on sites used by Dunlin including Fareham Creek and Paulsgrove, Black-tailed godwit including Fareham Creek and potentially Paulsgrove and Dark-bellied brent geese including Fareham Creek and Paulsgrove. The area of Fareham Creek is currently unclassified (see section 6.6). It is important to note that low tide WeBS data, illustrated in Annex 7 and 8, will be indicative on when birds are feeding are low tide and clam dredging occurs at high tide, so it is likely that clam dredging will have very little direct impact on the disturbance of designated bird species feeding on the intertidal sediments.

Please note that the low tide count WeBS data distribution map displayed in Annex 8 represent counts made in 2008/09. This map represents dot density and not the location of individual counts. It is important to note that the low tide count WeBS data collection is undertaken in the Solent during the winter period on neap tides, two hours either side of low water. This means a number of areas will be missed as they will be covered by water and is particularly true in Portsmouth Harbour. On a spring tide a larger area of the intertidal is exposed and this can lead to a greater number of birds. The maps can therefore only provide a snap shot in time.

6.2 Potential Impacts on Birds and Supporting Habitats

The potential impacts of shellfish dredging on Portsmouth Harbour SPA designated bird species, identified by Natural England (2014), include direct impacts through disturbance and displacement caused by human activity and competition for prey and indirect impacts through changes in prey availability. 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).

6.2.1 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, it is thought that mussels act as a buffer during periods when cockle numbers are low (Atkinson *et al*., 2003; Velhurst *et al*., 2004). In the Wash, oystercatcher mortality occurred during winters when stocks of both species were low (Atkinson *et al*., 2003).

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

There have also been changes in the bird populations in other areas were cockle fisheries are known exist. Like the Wash, the Burry 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 Burry Inlet cockle fishery on the survival and numbers of overwintering oystercatchers. Results of the study concluded that at present intensities (2 fishing units in the Exe estuary and 50 fishing units in Burry Inlet) in both fisheries does not cause oystercatcher mortality to be higher than it would be in absence of the activity (Stillman *et al*., 2001). Theoretical changes in management, such as fishing effort, a reduction in the minimum size of target species and increase in the daily catch quota were shown to have an impact on oystercatcher mortality and population size (Stillman *et al*., 2001). Different fishing methods were investigated as part of the study. The model predicted the use of dredges on either estuary increased the time birds would spent feeding and the use of supplementary feeding areas (Stillman *et al*., 2001). As would be expected, the removal rates of mussels and cockles using mussel dredges and suction dredges were much greater that hand-raking or hand-picking (Stillman *et al*., 2001). Sixty suction dredges could kill all the Burry Inlet oystercatchers (Stillman *et al*., 2001). Hand-raking for mussels however was found to reduce the area of beds, permanently increase interference and disturb birds, temporarily increasing interference, whilst dredging for mussels only decreased bed area (Stillman *et al*., 2001). The varying impacts of different fishing methods reflect differences in the way they deplete shellfish stocks (Stillman *et al*., 2001).

Size of prey species

The exact role of the fishery and its effect on bird population, as a result of direct competition, will largely depend on the different size fractions of the stock that may be exploited by fishers and birds (Schmechel, 2001). Whilst there may be an overlap in the size of cockles taken by both fishers and birds, most bird predation is of a smaller size class than fishers take (Norris *et al*., 1998). If sizes overlap there can be a genuine conflict of interest between the birds and the fishery, therefore larger minimum sizes are therefore more favourable to birds (Lambeck *et al*., 1996). Oystercatchers have shown a preference for older cockles, 20 to 40 mm, and will not take cockles less than 10 mm when these larger size classes are available (Hulscher, 1982; Zwarts *et al*., 1996a). On the other hand, oystercatchers do not necessarily chose 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 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). The magnitude of the response of fauna to bottom towed fishing gear varied with gear type, habitat (including sediment type) and among taxa (Collie *et al*., 2000).

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

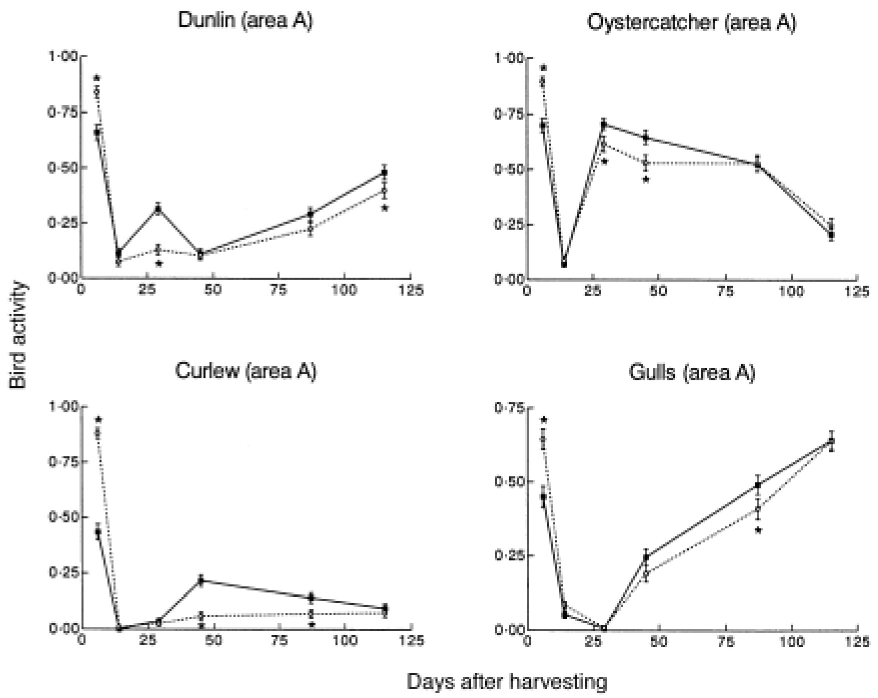

Figure 4. Mean proportion (±SD) of samples in control (black squares) and harvested (white circles) sectors containing footprints of different bird species. Significant differences between sectors are indicated by an asterisk and estimated by bootstrapping. Source: Ferns *et al*., 2000

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, modile or sessile and soft-bodied or hard-shelled (Mercaldo-Allen & Goldberg, 2011). Epifauna, organisms inhabiting the seabed surface, are subject to crushing or at risk of being buried, in addition to effects of smothering, whilst infauna, organisms living within sediment, may be excavated and exposed (Mercaldo-Allen & Goldberg, 2011). A number of studies have found soft-bodied, deposit feeding crustaceans, polychaetes and ophiuroids to be most affected by dredging activities (Constantino *et al*., 2009). This is supported by a meta-analysis conducted by Collie *et al*. (2000) who predicted a reduction of 93% for anthozoa, malacostraca, ophiuroidea and polychaete after chronic exposure to dredging. Furthermore, a study looking at the effects of mechanical cockle harvesting in intertidal plots of muddy sand and clean sand, found that annelids declined by 74% in intertidal muddy sand and 32% in clean sand and molluscs declined by 55%in intertidal muddy sand and 45% in clean sand (Ferns *et al*., 2000). Similar results were reported by EMU (1992), who found a distinct reduction in polychaetes, but less distinct difference in bivalves, after dredging had taken place and between dredged and control samples. This corresponds with analysis completed by Collie *et al*. (2000) who reported that bivalves appeared to less sensitive to fishing disturbance than anthozoa, malacostraca, ophiuroidea, holothuroidea, maxillopoda, polychaeta, gastropoda and echinoidea,

A number of studies have highlighted species that are particularly vulnerable to dredging as well as those which appear to be more tolerant. For example, the polychaete *Lanice conchilega* are highly incapable of movement in response to disturbance and therefore take a significant period of time to recolonise disturbed habitats (Goss-Custard, 1977). Deep burrowing molluscs, such as *Macoma balthica*, also have limited capability to escape. Following suction dredging for the common cockle on intertidal sand, the abundance of *Macoma* declined for 8 years from 1989 to 1996 (Piersma *et al*., 2001). Ferns *et al*. (2000) reported reductions of 30% in the abundance of *Lanica conchilega* in intertidal muddy sand after mechanical cockle harvesting (using a tractor) took place, although abundances of *Macoma balthica* increased. The same study also revealed large reductions of 83% and 52% in the abundance of the polychaete *Pygospio elegans* and *Nephtys hombergii*, respectively (Ferns *et al*., 2000). The former species remained significantly depleted in the area of muddy sand for more than 100 days after harvesting and the latter for more than 50 days (Ferns *et al*., 2000). Other polychaete species also thought to be particularly affected are *Arenicola*, *Scoloplos*, *Heteromastus* and *Glycera* (Collie *et al*., 2000).

Recovery

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

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

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 13). 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 12.

Species-specific diets

While shorebirds will typically eat a range of different prey species such as molluscs and annelids, the type of preferred prey species will vary between bird species (Natural England, 2014). It is important to knowledge these variations in prey preference as the impacts of dredging on bird species are likely to be reflective vary depending on the vulnerability of prey species to impacts of dredging. The plasticity of a bird’s diet will also vary depending on the species and it is important to consider alternate prey species as bird will not be restricted to one source of food. Table 6 provides details of prey items taken by designated bird species within the Portsmouth Harbour SPA. For example, oystercatchers will prey upon small cockles, Baltic tellins, soft-shell clams, lug-worms and ragworms (Wheeler *et al*., 2014). Some prey items may be of low value to the birds and not a major component of their diet (Zwarts *et al*. 1996ab; Atkinson *et al*. 2003 in Wheeler *et al*., 2015). Alternative prey sources may also be less available as organisms may bury deeper into the sediment and thus require the birds to expend a greater amount of energy (Zwarts *et al*. 1996ab). Birds may directly compete with the fishery if both target the same species. The key bird species at risk from changes in prey availability are non-breeding overwintering species as food requirements are considerably greater during winter due to thermoregulatory needs and metabolic costs (Wheeler *et al*., 2014).

Table 6. Typical prey items known to be taken by designated bird species in the Portsmouth Harbour SPA. 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.

Common Name	Latin Name	General Prey Preference	Prey Species
Dunlin	*Calidris alpina*	Molluscs, insects, worms	*Macoma, Hydrobia* spp., *Nereis, Crangon, Carcinus*
Dark-bellied brent goose	*Branta bernicla bernicla*	Plants/grasses/seeds	*Zostera* spp., *Enteromorpha, Ulva lactuca*
Black-tailed godwit	*Limosa limosa*	Insects, worms, plants/grasses/seeds	*Hediste diversicolor, Cerastoderma edule, Macoma baltica, Cardium, Neresis*
Red-breasted merganser	*Mergus serrator*	Fish	Gobies, flatfish, herring fry (<11cm), shrimp, sticklebacks, *Nereis* spp.

6.2.2 Disturbance and displacement

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 response (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*. (2001) 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*., 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).

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 effected by visitors (Stillman *et al*., 2012). Disturbance was predicted to result in increases in the level of time spent feeding intertidally by dunlin, ringed plover, redshank and grey plover, with no effect on black-trailed godwit and reductions in oystercatcher and curlew (Stillman *et al*., 2012). This was related to the ability of modelled birds to feed in terrestrial habitats, as those unable to do so spent longer feeding in intertidal habitats (Stillman *et al*., 2012).

Species-specific response

Responsiveness to disturbance is thought to be a species-specific trait (Yasué, 2005). Gathe and Hüppop (2004) developed a wind farm sensitivity index (WSI) for seabirds. The index was based on nine factors, derived from specie' attributes, and include; flight manoeuvrability, flight altitude, percentage of time flying, nocturnal flight activity, sensitivity towards disturbance by ship and helicopter traffic, flexibility in habitat use, biogeographical population size, adult survival rate and European threat and conservation status (Gathe & Hüppop, 2004). Each factor was scored on a 5-point scale from 1 (low vulnerability of seabirds) to 5 (high vulnerability of seabirds). The WSI was used by King *et al*. (2009) to develop sensitivity scores for species likely to be susceptible to cumulative impacts of offshore wind farms development. Table 7 provides available sensitivity scores of species within Portsmouth Harbour SPA, with details of scores given for the species vulnerability to disturbance by ship and helicopter traffic.

Table 7. Sensitivity scores for designated bird species in the Portsmouth Harbour SPA to offshore wind farm developments. Higher scores are indicative of a greater sensitivity. Information on species vulnerability to disturbance by ship or helicopter traffic is also provided. Scores were taken from King *et al*. 2009 who calculated scores using methods by Garthe & Huppop (2004).

Species	**Total sensitivity score**	**Disturbance by ship and helicopter traffic (1 – very flexible in habitat use, 5 – reliant on specific habitat characteristics)**
Dark-bellied Brent Goose	21.7	2
Black-tailed godwit	9.9	1
Red-breasted Merganser	21.0	3
Dunlin	3.3	1

There is great variation in the escape flight distances between species (Kirby *et al*., 2000) and the distance at which birds fly away from a disturbance can be viewed as a specie-specific trait (Blumstein *et al*., 2003). Response distances can depend on a number of different factors, including the time of year, tide, frequency, regularity and severity of disturbance, flock size and age of bird (WWT Consulting, 2012). Body mass has also been shown to be positively related to response distance (Liley *et al*., 2010). Table 8 and 9 provides details of response distances of species within Portsmouth Harbour SPA, with Table 9 providing details of response distances in relation to different types of activities.

Table 8. Distances from disturbance stimuli (in metres) at which study waterbird species took flight. Taken from Kirby *et al*., 2004 in WWT Consulting 2012.

	Study						
	Tydeman 1978	Cooke 1980	Tensen and van Zoest	Watmough 1983a,b	Smit and Visser 1993	Smit and Visser 1993	Smit and Visser 1993
Activity	Boats	Researcher	People	Researcher	People	Kayaks	Surfers
Distance measure	Min	Mean	Mean	Mean	Mean	Mean	Mean
Brent goose					105		
Dunlin		30			71/163		

Table 9. 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.

Species	**No response**		**Disturbance occurred**		**Significance**
	Median	Range	Median	Range	
Brent goose	97	17-215	51.5	5-178	P<0.01

Dunlin	115	29-200	75	25-300	P<0.01

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 were 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).

6.3 Site-Specific Seasonality Table

Table 10 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 calender 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 re 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 10. Presence by month of mobile designated features at the Portsmouth Harbour SPA. Grey indicates periods of presence in significant numbers whereas blank (white) indicates either periods of absence or of presence but only in numbers of less significance.

Common Name	Latin Name	Designated Season	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Reference
Black-tailed godwit	*Limosa limosa*	Nonbreeding; Wintering													Wernham *et al*., 2002
Dark-bellied brent goose	*Branta bernicla bernicla*	Nonbreeding; Wintering													Cramp & Simmons, 1977
Dunlin	*Calidris alpha*	Nonbreeding; Wintering													Wernham *et al*., 2002; Cramp & Simmons, 1983
Red-breasted merganser	*Mergus serrator*	Nonbreeding; Wintering													Cramp & Simmons, 1977

6.4 Site Condition

6.4.1 Condition Assessments

Natural England provides information on the condition of designated sites and describes the status of interest features. This is derived from the application of ‘Common Standards Monitoring Guidance’ which is applied to a subset of ‘attributes’ of site features as set out in the sites’ Regulation 33/35 Conservation Advice document. 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. Natural England’s current process for conducting condition assessments for marine features was developed due to requirements to report on condition of Annex 1 features at the national level in 2012/13 under Article 17 of the Habitats Directive. Since then, the methods have been reviewed and Natural England are actively working to revise this process further so that it better fulfils obligations to inform management actions within MPAs and allows them to report on condition. In light of this revision to the assessment methods, the condition assessments for the features of European Marine Sites have not been made available in the timeframe required under the revised approach.

An indication of the condition of site interest features can be inferred, if available, from assessments of SSSIs[14] that underpin the SPA. There are a number of SSSIs which exist within the area covered by Portsmouth Harbour SPA and these, along with relevant feature condition assessments are summarised in Table 11. Note that only SSSI sites where clam dredging is known to occur have been chosen.

Table 11. Condition assessments of SSSI units within the Portsmouth Harbour SPA.

SSSI Site Name	Habitat	Unit Name	Condition	Condition Threat Risk	Comments
Portsmouth Harbour	Littoral Sediment	Frater	Favourable[15]	Medium	This unit has been assessed as favourable for its intertidal mudflats, saltmarsh and over-wintering bird features, which represents an improvement in condition since the last assessment of ‘unfavourable recovering’ in November 2010. This unit comprises Littoral mud with saltmarsh on the high shore. Characteristic infaunal species of the mudflats include *Hydrobia Ulvae, Tubificoides benedii, Tubificiodes pseudogaster, Streblospio,* Nematodes*, Corophium* sp. and *Arenicola marina*. A thin layer of *Entermorpha* and *Ulva* covers the intertidal. In the most recent assessment (March 2014), the cover of *Ulva* and *Enteromorpha* was below the 75% cover

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

[15] Favourable definition - The designated feature(s) within a unit are being adequately conserved and the results from monitoring demonstrate that the feature(s) in the unit are meeting all the mandatory site specific monitoring targets set out in the FCT. The FCT sets the minimum standard for favourable condition for the designated features and there may be scope for the further (voluntary) enhancement of the features / unit. A unit can only be considered favourable when all the component designated features are favourable.

					threshold for adverse effects on the sediment and infauna. This area has low levels of recreational disturbance impacts due to lack of public access. The site has seen increases in populations of dunlin, dark-bellied brent goose and black-tailed godwit, although slight declines in the numbers of grey plover since 1992/93.
Portsmouth Harbour	Littoral Sediment	Port Solent to Horsea	Unfavourable - recovering[16]	Medium	This unit compromises of littoral mud and polychaete/oligochaete dominated upper estuarine mud shores, with littoral coarse sediment on the upper shore and around Horsea Island. Characteristic infaunal species of the mudflats include *Hydrobia ulvae, Tharyx* sp., *Tubificoides benedii, Aphelochaeta marioni, Nematodes, Cerastoderma edule* and *Carcinus maenas*. Opportunistic green macroalgae cover was below adverse cover threshold levels. There are potentially high levels of contamination from the historic landfill at Paulsgrove. Anthropogenic impacts in this section of the harbour include litter and discarded man-made items. This area has low levels of recreational disturbance impacts due to lack of public access. The site has seen increases in populations of dunlin, dark-bellied brent goose and black-tailed godwit, although slight declines in the numbers of grey plover since 1992/93. These bird interest features have been assessed as being in favourable condition.

[16] Unfavourable recovering definition - Units/features are not yet fully conserved but all the necessary management mechanisms are in place. At least one of the designated feature(s) mandatory attributes are not meeting their targets (as set out in the site specific FCT). Provided that the recovery work is sustained, the unit/feature will reach favourable condition in time.

Portsmouth Harbour	Littoral Sediment	Whale Island	Unfavourable - recovering	Medium	This intertidal area comprises Littoral mud (A2.3), including Polychaete/oligochaetes-dominated upper estuarine mud shores (A2.32), and gravel (pebble) and shingle shores (A2.11). Characteristic infaunal species of the mudflats include *Tubificoides benedii, Aphelochata marioni, Chaetozone gibber, Tharyx killariensis, Hydrobia ulvae, Pagarus bernhardus, Crepidula fornicata, Cerastoderma edule*, and *Littorina littorea*. Levels of *Enteromorpha* and *Ulva* macroalgae which are present across most of the intertidal were below adverse cover threshold levels. Other anthropogenic impacts in this section of the harbour include litter and discarded man-made items such as tyres and metal work. There is no public access along the foreshore in this unit so recreational disturbance impacts are lower than in other parts of the harbour. The site has seen increases in populations of dunlin, dark-bellied brent goose and black-tailed godwit, although slight declines in the numbers of grey plover since 1992/93. These bird interest features have been assessed as being in favourable condition.
Portsmouth Harbour	Littoral Sediment	Portchester	Unfavourable - recovering	Medium	This intertidal area comprises Littoral mud (A2.3), with polychaete / oligochaete dominated upper estuarine mud shores (A2.32) and *Tubificiodes benedii* and other oligochaetes in littoral mud (A2.323), and gravel (pebble) and shingle shores (A2.11) on the upper shore in front of the sea walls. Characteristic infaunal species of the mudflats include *Tubificoides benedii, Tharyx killariensis, Hydrobia ulvae,* Nematodes*, Littorina littorea, Arenicola* and *Nephtys* spp. The intertidal mudflats in this unit had less than 25% cover of opportunistic macroalgae (*Enteromorpha* and *Ulva*) and no

					anoxic layer was present. Much of this unit has potentially high levels of historic contamination due to previous and further investigation is required to determine the potential impact of this. There is a public footpath along the whole frontage of this unit. Disturbance to feeding and roosting birds is being addressed through the Solent Disturbance and Mitigation Project. The site has seen increases in populations of dunlin, dark-bellied brent goose and black-tailed godwit, although slight declines in the numbers of grey plover since 1992/93. These bird interest features have been assessed as being in favourable condition.
Portsmouth Harbour	Littoral Sediment	Bombketch Lake	Unfavourable - recovering	Medium	This intertidal area comprises Littoral mud (A2.3), including the biotopes Polychaete/bivalve dominated mid estuarine mud shores (A2.31), Polychaete/oligochaetes-dominated upper estuarine mud shores (A2.32) and *Tubificoides benedii* and other oligochaetes in littoral mud (A2.323). Characteristic infaunal species of the mudflats include *Tubificoides benedii, Tubificoides galiciensis, Melinna palmate*, Nematodes, *Streblospio* sp., *Scrobicularia plana, Arenicola marina* and *Hydrobia ulvae*. Levels of *Enteromorpha* and *Ulva* macroalgae which are present across most of the intertidal were below adverse cover threshold levels. Saltmarsh across the whole harbour is declining in extent due to coastal squeeze resulting from the presence of hard sea defences. The site has seen increases in populations of dunlin, dark-bellied brent goose and black-tailed godwit, although slight declines in the numbers of grey plover since 1992/93. These

					bird interest features have been assessed as being in favourable condition.
Portsmouth Harbour	Littoral Sediment	Fleetlands	Unfavourable - recovering	Medium	The Fleetlands intertidal area comprises Littoral mud (A2.3) and littoral mixed sediment (A2.421) with saltmarsh on the high shore. Characteristic infaunal species of the mudflats include *Hediste diversicolor, Tubificoides benedii, Pygospio elegans, Streblospio*, Nematoda, *Cerastoderma edule, Corophium* sp. and *Scrobicularia plana*. The intertidal mudflats in this unit were devoid of opportunistic macroalgae and no anoxic layer Salterns recreation ground, Cams Bay, Wicor and Cador Drive all have potentially high levels of historic contamination with previous uses including a bone works, refuse sites, sewage works, quarries and possibly a burial site. There is no public access along this part of the foreshore so recreational disturbance impacts are lower than in other parts of the harbour. Whilst there have been slight declines in numbers of grey plover since the site was re-notified in 1992/3, populations of dunlin, dark-bellied brent goose and black-tailed godwit have increased. As a result these bird interest features have been assessed as being in `favourable? condition
Portsmouth Harbour	Littoral Sediment	Fareham Creek	Unfavourable - recovering	Medium	The lower Fareham Creek intertidal area comprises Littoral mud (A2.3) and littoral mixed sediment (A2.421) with littoral coarse sediment (A2.1) on the upper shore. A small area of saltmarsh is present in the north of the unit. Characteristic infaunal species of the mudflat include *Streblospio, Tharyx* sp., *Tubificoides benedii, Tubificoides pseudogaster* and Nematoda. Many areas in this unit have potentially high levels of historic contamination with previous uses including a bone works,

					refuse sites, sewage works, quarries and possibly a burial site. There is public access along the foreshore on both sides of the Creek and therefore recreational disturbance pressures are high. Disturbance to feeding and roosting birds is being addressed through the Solent Bird Disturbance Project. Whilst there have been slight declines in numbers of grey plover since the site was re-notified in 1992/3, populations of dunlin, dark-bellied brent goose and black-tailed godwit have increased. As a result these bird interest features have been assessed as being in \`favourable' condition.
Portsmouth Harbour	Littoral Sediment	Cams Bay	Unfavourable - recovering	High	The Cams Bay intertidal area comprises Littoral mud (A2.3) with polychaete / oligochaete dominated upper estuarine mud shores (A2.32) and *Hediste diversicolor* in littoral mud (A2.322) and saltmarsh on the high shore. There is a large seagrass (*Zostera noltii*) bed present in Cams Bay. Characteristic infaunal species of the mudflats include *Tubificoides benedii*, Nematodes, *Hydrobia ulvae, Nereididae, Streblospio. Littorina littorea* and *Cerastoderma edule*. The intertidal mudflats in this unit had less than 25% cover of opportunistic macroalgae and no anoxic layer was present. Much of this unit has potentially high levels of historic contamination. There is a public footpath along the whole frontage in this unit and, therefore, recreational disturbance pressures are high. Disturbance to feeding and roosting birds is being addressed through the Solent Disturbance and Mitigation Project. Whilst there have been slight declines in numbers of grey plover since the site was re-notified in 1992/3, populations of dunlin, dark-bellied brent goose and black-tailed godwit have

					increased. As a result these bird interest features have been assessed as being in `favourable' condition.

Overall, the SSSI condition assessments appear to suggest that littoral sediments within selected SSSI sites are favourable or unfavourable, but recovering. When examining reasons for this, it appears from the condition assessment comment that the reasons for this are largely explained by a combination of different factors including contamination, coastal squeeze, litter and disturbance.

6.4.2 Population Trends

Population trend data, where available, can be used to identify site-specific pressures. Information on population trends comes from Wetland Bird Survey (WeBS) Alerts and JNCC's Seabird Monitoring Programme (SMP) population data. WeBS Alert data is only available for one of the four regularly occurring migratory species (Dark-bellied brent goose) and provides information on population sizes, from which trends in numbers and distribution can be detected. The most recent WeBS report is based upon Alerts status as of 2009/10 and identifies no site-specific decline in populations of dark-bellied brent geese in Portsmouth Harbour. Unfortunately the other three species are not assessed due to a lack of data.

It is important to note that the data used to inform WeBS Alerts was collected in 2009/10 and therefore this data may not have captured the effects of fishing activities that have since commenced or increased since publication. The effects of fishing activities may not necessarily be captured in the next WeBS Alerts report (due in 2015) due to the time lag between cause and effect. With respect to clam dredging, the level of fishing effort has been seen to decrease in recent years and therefore any effects of fishing activity is likely to be reduced when compared to 2009/10.

6.5 Existing Management Measures

- **Bottom Towed Fishing Gear** byelaw – prohibits bottom towed fishing gear over sensitive features including reef features and seagrass within the Portsmouth Harbour SPA most of the site to these activities.
- **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 and restricted to carry less static 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.

- **Bass Nursery Areas** – fishing for bass or fishing for any fish using sand-eels as bait by any fishing boat within designated areas is prohibited between 30 April and 1 November. Designated areas include Southampton Water (Cadland foreshore to the Warsash foreshore, but excluding those waters above the Redbridge Causeway on the River Test) and Langstone Harbour (Gunnery Range Light at Eastney Point to Langstone Fairway Buoy, then to the foreshore east of Gunner Point) and all year round in a 556 m radius around the Fawley Power Station outfall.
- **Fixed Engines** byelaw states that the placing and use of fixed engines, other than Fyke Nets, for the taking of seafish is prohibited during the period from 1 April to 30 September in any year in all parts of the Rivers Test and Itchen upstream of the line due East and West from the Southern end of the Port of Southampton Dockhead.
- **Prohibition of Gathering (Sea Fisheries Resources) in Seagrass Beds** byelaw. This prohibits any person from digging for, fishing for or taking any sea fisheries resource in or from the prohibited areas and does not apply to fishing/taking fisheries resources by means of net, rod and line and hook and line. It also does not apply to fishing for/taking sea fisheries resources using a vessel, provided that no part of the vessels hull in contact with the seabed. No person shall carry a rake, spade, fork or any similar tool in prohibited areas
- **Fishing for Oysters, Mussels and 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 south so designed to take shellfish only when towed along the sea bed.
- **Oysters, Clams, Mussels – Prohibition on Night Fishing** byelaw – No person shall dredge or fish or take any before 8.00 am or after 4.00 pm, although this byelaw does not apply to the taking of clams and mussels during any close season for oysters. This byelaw does also not apply to the dredging or fishing or taking of clams in Southampton Water North of the line joining the Northern ends of the Hamble and Fawley Oil Terminal Jetties.
- **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.
- **Regulation of the Use of Stake or Stop Nets in Langstone Harbour** – north of a line across the harbour entrance (Gunnar point to Eastney Lake Pumping Outfall Light), no person shall place or maintain or partly across a channel or creek at any place which becomes dry at low water, any stake, stop or dosh net during the period between the commencement of the last hour before the tide leaves that place and the expiration of the first hour after the tide has begun to reflow.
- **Oyster Close Season** 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.
- **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. In the context of this byelaw, 'shellfish' refers to mussels, oysters and clams. Currently this byelaw has been used to close the Solent Oyster fishery for the 2015 season based on results

of the survey of Solent Oyster Beds, except for a two week season (1st November to 15th November) in Langstone and Portsmouth Harbours.

- The **Scallop Fishing (England) Order 2012** states that no more than 8 dredges per side to be towed at any one time and provides details for dredge configuration (i.e. the frame cannot exceed 85 cm in width). The **Scallop Fishing** Southern Sea Fisheries District Committee legacy byelaw states the maximum number of dredges which can be towed at any time is twelve, provides details of dredge configuration and that no person shall fish for or take any scallop from any fishery on any day before 0700 and after 1900 local time
- 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.
- **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.
- European minimum size, listed under Council Regulation (EEC) 850/98, Statutory Instruments specify the minimum size for Manila clams (*Ruditapes philippinarum*) is 3.5 cm and for Grooved Carpet Shell clams (*Ruditapes decussatus*) is 4.0 cm.

6.6 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 clam 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. Included in Annex 11 are the classification maps produced by CEFAS for clam species that interact with Portsmouth 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 August 2015. A key area in Portsmouth Harbour, known as Fareham Creek in the north west region of the harbour, is currently unclassified, therefore any clam dredging in this area is prohibited under Food Safety and Hygiene (England) Regulations 2013.

6.7 Table 12: Summary of Impacts

The potential pressures, associated impacts, level of exposure and mitigation measures are summarised in table 11. Only relevant attributes identified through the TLSE process have been considered here.

Feature	Supporting habitat(s)	Attribute	Target	Potential Pressure(s) and Associated Impacts	Nature and Likelihood of Impacts	Mitigation measures[17]

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

Nationally and internationally important regularly occurring migratory species	Intertidal mudflats and sandflats	Food availability	Presence and abundance of suitable prey species should not deviate significantly from an established baseline, subject to natural change	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 and American hard-shell clam 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*., 2000; Hiddink *et al*., 2003). In a meta-analysis of 39 studies, those investigating the effect of intertidal dredging commonly reported 100%	Reports of clam dredging within Portsmouth Harbour SPA from local IFCOs indicate a decline in fishing effort since 2012, with an average of 2.5 vessels sighted per month in the Solent in 2015. At present, 0 to 1 vessels operate on any one day. Feature data provided by Natural England, combined with sightings data, reveals that clam 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. Using available information on the diet of designated bird species and WeBS low tide count data distribution maps (Annex 7 and 8), designated bird species sensitive to changes in food availability within intertidal mudflats and sandflats subject to clam dredging include Dunlin, Black-tailed godwit and Dark-bellied brent goose. The main areas of concern include Paulsgrove on the eastern side of the harbour and Fareham Creek in the upper north western corner of the harbour. Prey preferences exhibited by the dark-bellied brent goose 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 (Sea	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 that ought to not be fished until it becomes established.

				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-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).	Fisheries Resources) in Seagrass Beds byelaw and Bottom Towed Fishing Gear byelaw. The main species of concern is therefore Dunlin and Black-tailed godwit, both of which express preference for worms, with Dunlin also preferring molluscs. Higher density feeding areas, identified from low tide WeBS data distribution maps in Annex 7 and 8, where clam dredging takes place include Paulsgrove on the eastern side of the harbour. Fareham Creek, an area identified above, is unclassified and shellfish collection is prohibited. SSSI condition assessments regard these areas as in unfavourable condition but recovering condition, with all bird interest features in these areas considered in favourable condition. Significant numbers of Dunlin occur between November and March and significant numbers of Black-tailed godwits occur between September and February. 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 mollusc (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.	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 Portsmouth Harbour 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

					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 12. 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.	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.
Dark-bellied brent goose	All	Disturbance	No significant reduction in numbers or displacement of wintering birds from an established baseline, subject to natural change.	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	Reports of clam dredging within Portsmouth Harbour SPA from local IFCOs indicate a decline in fishing effort since 2012, with an average of 2.5 vessels sighted per month in the Solent in 2015. At present, 0 to 1 vessels operate on any one day. Dark-bellied brent geese are known to feed on intertidal mudflats and sandflats and in 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 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. The Solent European Marine Site (Prohibition of Method of Dredging) Order 2004 prevents pump scooping as a means of taking shellfish. The Bottom Towed Fishing Gear byelaw prohibits bottom towed fishing gear over sensitive

				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.	Dark-bellied brent geese occur from October to March. The wind-farm sensitivity index indicates the Dark-bellied brent goose has 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. Portsmouth Harbour is an area 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 Portsmouth Harbour, it is therefore highly unlikely that clam dredging will lead to a significant adverse effect on the feature. In addition, Portsmouth Harbour is subject to recent maintenance dredging that is likely to lead to greater disturbance than that caused by shellfish dredging.	features including reef features and seagrass within the Solent and Portsmouth Harbour 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.
Red-breasted merganser	All	Disturbance	No significant reduction in	Disturbance and displacement through visual presence and noise were identified as	Reports of clam dredging within Portsmouth Harbour SPA from local IFCOs indicate a decline in fishing	Vessels Used in Fishing byelaw prohibits commercial fishing vessels over 12 metres from the

			numbers or displacement of wintering birds from an established baseline, subject to natural change.	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.	effort since 2012, with an average of 2.5 vessels sighted per month in the Solent in 2015. At present, 0 to 1 vessels operate on any one day. Red-breasted mergansers are a type of diving duck known to feed on small fish. Clam dredging therefore may cause disturbance to the species when feeding. Unfortunately there is a lack of information of where the species is known to feed to determine if this overlaps with areas of clam dredging. Red-breasted mergansers occur in significant numbers from November to April. The wind-farm sensitivity index indicates the Red-breasted merganser has moderate sensitivity to wind farm developments. Portsmouth Harbour is an area 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 Portsmouth Harbour, it is therefore unlikely that clam dredging will lead to a significant adverse effect on the feature. In addition, Portsmouth Harbour is subject to recent maintenance dredging that is likely to lead to greater disturbance than that caused by shellfish dredging.	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. The Bottom Towed Fishing Gear byelaw prohibits bottom towed fishing gear over sensitive features including reef features and seagrass within the Solent and Portsmouth Harbour 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.
Black-tailed godwit	All	Disturbance	No significant reduction in numbers or displacement of wintering birds from an established baseline, subject to natural change.	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	Reports of clam dredging within Portsmouth Harbour SPA from local IFCOs indicate a decline in fishing effort since 2012, with an average of 2.5 vessels sighted per month in the Solent in 2015. At present, 0 to 1 vessels operate on any one day. Black-tailed godwits are known to feed at low tide in areas where clam dredging activity also occurs. 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. 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	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. The Bottom Towed Fishing Gear byelaw prohibits bottom towed fishing gear over sensitive features including reef features and seagrass within the Portsmouth Harbour SPA most of the site to these activities. The Bottom Towed Fishing Gear byelaw prohibits bottom towed fishing gear over sensitive features including reef features and seagrass within the Solent and Portsmouth Harbour SPA, closing most of the site to these activities. Southern IFCA is currently amending this byelaw to

				and intensity at which shellfish dredging takes place. Responsiveness to disturbance is largely thought to be a species-specific trait.	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). Portsmouth Harbour is an area 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 Portsmouth Harbour, it is therefore highly unlikely that clam dredging will lead to a significant adverse effect on the feature. In addition, Portsmouth Harbour is subject to recent maintenance dredging that is likely to lead to greater disturbance than that caused by shellfish dredging.	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.
Dunlin	All	Disturbance	No significant reduction in numbers or displacement of wintering birds from an established baseline,	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	Reports of clam dredging within Portsmouth Harbour SPA from local IFCOs indicate a decline in fishing effort since 2012, with an average of 2.5 vessels sighted per month in the Solent in 2015. At present, 0 to 1 vessels operate on any one day. Dunlin are known to feed at low tide in areas where clam dredging activity also occurs. It is however thought that	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

			subject to natural change.	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.	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. Dunlin are present in significant numbers from November to March. The wind-farm sensitivity index indicates the Dunlin have a very has low sensitivity to wind farm developments. The escape flight distance exhibited by the species ranges, in one study the distance from the disturbance stimuli 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. Portsmouth Harbour is an area 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	Dredging) Order 2004 prevents pump scooping as a means of taking shellfish. The Bottom Towed Fishing Gear byelaw prohibits bottom towed fishing gear over sensitive features including reef features and seagrass within the Solent and Portsmouth Harbour 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

					occur within Portsmouth Harbour, it is therefore highly unlikely that clam dredging will lead to a significant adverse effect on the feature. In addition, Portsmouth Harbour is subject to recent maintenance dredging that is likely to lead to greater disturbance than that caused by shellfish dredging.	well as supporting breeding shellfish populations.

7. Management options

In recognition of the potential pressures of clam dredging upon designated features, sub-features and supporting habitats, Southern IFCA is currently in the process of introducing new bottom towed fishing gear measures to manage shellfish dredging in the Solent European Marine Sites (SEMS). In the Portsmouth Harbour SPA, these measures consist of spatial and seasonal restrictions on shellfish dredging via the introduction of dredge fishing management areas.

Three dredge fishing management areas will be introduced by Southern IFCA; of which one (Portsmouth Harbour) will cover the designated features/supporting habitats of the Portsmouth Harbour SPA (figure 5). Within this dredge fishing management area, shellfish dredging will be prohibited for 35 weeks of the year during the spring, summer and autumn months (1st March to 31st October inclusive) 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. As the summer months represent the period of highest biological activity for invertebrate infauna of mudflats, the closure of the clam fishery during this time will support these communities to recover from the effects of human and/or natural disturbance. The timescale for recovery of disturbed habitats from shellfish dredging is based on a number of different factors, including sediment type, associated fauna, rate of natural disturbance and the level/scale of impact (Robert *et al*., 2010; Jones, 1992). As such, determining a suitable period for recovery is particularly difficult and is further compounded by a lack of data on the condition and species that occur within the site. To help overcome these difficulties it is important to examine existing literature (which represents best available evidence) on recovery rates from similar activities to infer potential timescales for recovery, in conjunction with site specific knowledge. A total of five studies were examined, all of which cover the impacts of shellfish dredging on intertidal habitats and four of which are based in the UK (details given in Annex 13). Recovery rates range from no effect (thus no recovery needed) up to 12 months. Spencer *et al*. (1998) reported a recovery rate of up to 12 months, although inferred it was not possible to be certain that recovery had not occurred before as not all treatment replicates were taken 4 and 8 months after sampling. The authors speculated that the greater length of recovery when compared with similar studies that reported recovery rates of 56 days and 7 months after harvesting was related to the protected nature of the site (Spencer *et al*. 1998). This study highlights the importance of exposure (i.e. rate of natural disturbance) as a factor in determining recovery rates. The Solent harbour areas accessible to shellfish dredging, as illustrated in Figure 5, are subject to relatively large tidal fluctuations, in addition to currents and wind exposure and are therefore considered to be areas of moderate energy. Based on the level of disturbance and periods of recovery reported from other studies, it is anticipated that 35 weeks will provide a sufficient period to allow recovery of impacted habitats. It is however important to note there the difficulty in determining a period of recovery due to a number of data gaps, which will be made easier with condition data and any results from arising monitoring studies.

The summer months represent the period of highest biological activity for invertebrate infauna of mudflats and the closure to shellfish during this time will support the recovery of communities from the effects of human and/or natural disturbance. As such, the timing of the recovery period has been 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 14 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 by 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 14 for recolonization strategies of key species).

Shellfish dredging in the Portsmouth Harbour dredge fishing management area will be permitted for 120 days annually: from 1st November to 28th February inclusive. During this period, dredging will only be permitted between 07.00 and 17.00 each day in order to further manage fishing effort and to aid compliance

While it is acknowledged that clam dredging will continue to take place within the Portsmouth Harbour SPA, the short duration of the fishing season combined with the prohibition on fishing during the biologically productive summer months is considered sufficient to enable the physical and biological recovery of designated supporting habitats. On this basis, the restriction of clam fishing in the SPA to a 120 day period will not hinder the site from achieving its conservation objectives.

A network of permanent bottom towed fishing gear closure areas also forms part of the new bottom towed fishing gear measures to manage shellfish dredging in the Solent European Marine Sites. The network is designed to protect good examples of SAC features and by virtue also covers overlapping SPA supporting habitats outside of Portsmouth Harbour. The network of closure areas 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. Portsmouth Harbour is not contained within the Solent Maritime SAC, unlike Langstone Harbour, Southampton Water and areas of the wider Solent and therefore, no new bottom towed fishing gear permanent closure areas will be introduced in Portsmouth Harbour. With respect to SPAs alone, the main concern surrounding shellfish dredging relates to the 'food availability' attribute, whilst attributes relevant to SACs include the following 'distribution and extent of characteristic range of biotopes', 'Presence and spatial distribution of communities', 'Presence and abundance of typical species' and 'Species composition of component communities'. The Habitat Regulations Assessment therefore did not indicate the need to protect good examples of SPA habitat through permanent closures and it is believed the spatial and seasonal restrictions on shellfish dredging via the introduction of dredge fishing management areas are sufficient to maintain site integrity. With respect to food availability, the length of the closure is designed to allow for sufficient recovery of potential prey species and the timing of the closure coincides with the arrival of overwintering birds (September to November), thus ensuring sufficient food availability during this crucial period. In addition, there appears to be a lack of evidence to suggest a site-specific link between shellfish dredging and adverse effects on designated bird species as a result of reductions in food availability. Available scientific literature is largely focused on the decline of bird populations when the fishery and bird species target the same species, which is not the case in Portsmouth Harbour. The monitoring strategy, proposed to take place in conjunction with the introduction of new bottom towed fishing gear management (see paragraph below), will help to address any concerns surrounding food availability during the open season. It is also important to remember a large proportion of Portsmouth Harbour is already prohibited to bottom towed fishing gear as part of management measures introduced for red risk gear-feature interactions (i.e. bottom towed fishing gear and seagrass beds). Such areas provide additional feeding areas not subject to bottom towed fishing gear.

7.1 Monitoring

To ensure shellfish dredging within the Portsmouth Harbour SPA continues to be managed in a manner consistent with the conservation objectives of the site Southern IFCA aims to monitor the impact of fishing activity upon designated features and sub-features. Monitoring will be undertaken in partnership with other organisations including Natural England, whose statutory duties include monitoring the condition of European Marine Sites, as well as other agencies where appropriate. The initial monitoring strategy will look to compare fished areas to non-fished (control) areas before and after the fishing season in relation to key attributes including sediment character and faunal composition. A formal monitoring plan incorporating the above strategy will finalised with Natural England prior to the implementation of management measures. It is important to note that any monitoring strategy is subject to resources and funding and any additional monitoring requirements, such as the monitoring of newly closed permanent areas, will be subject to such restrictions. Available data on bird populations (i.e. WeBs) will also be incorporated to allow monitoring of any potential impacts of new management on designated bird species. Monitoring may help to fill a number of data gaps including an indication of site condition (in the absence of condition data) and site specific recovery rates.

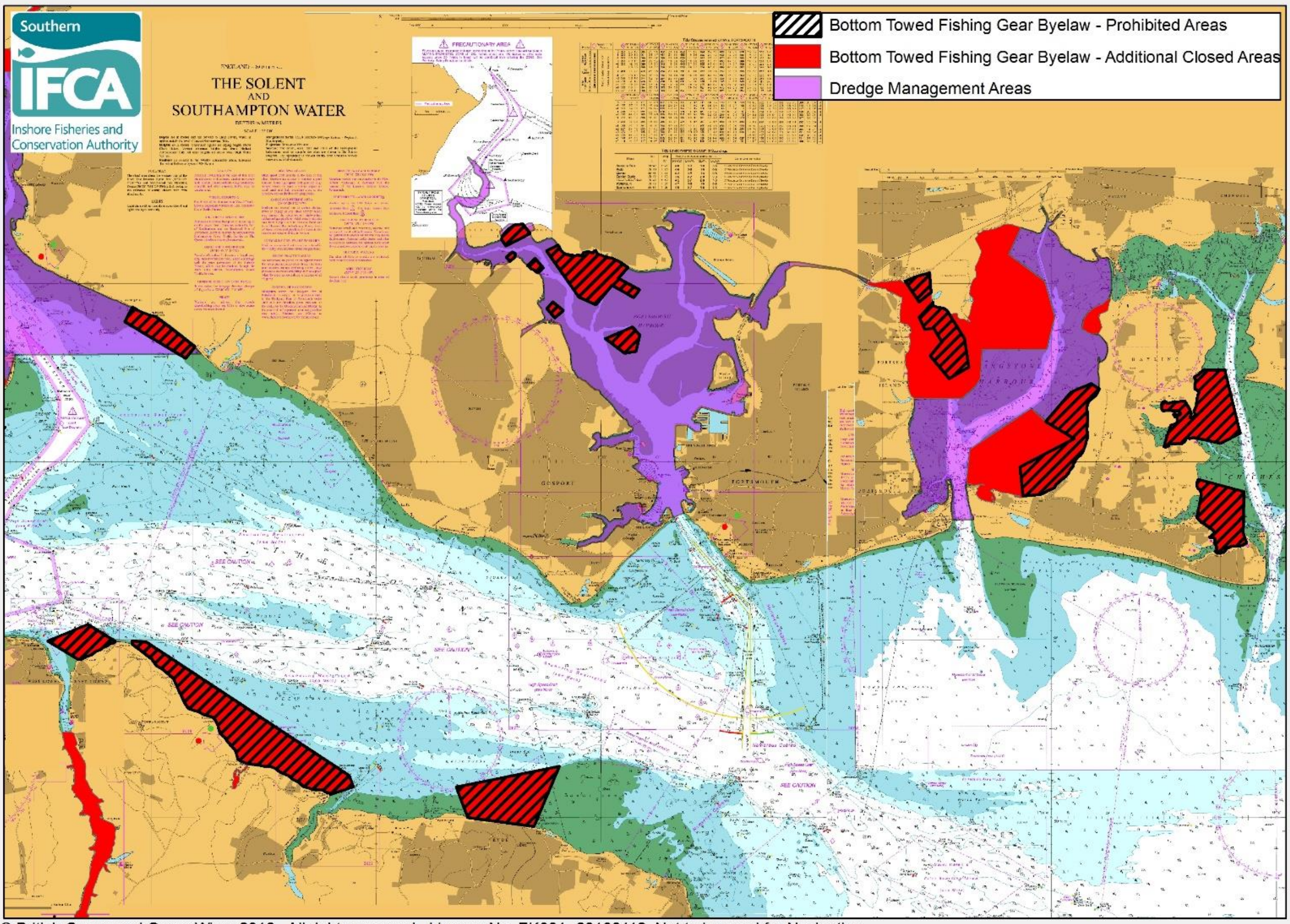

Figure 5. Proposed Portsmouth Harbour permanent bottom towed fishing gear closure areas and dredge fishing management area

8. Conclusion[18]

In order to conclude whether clam dredging has an adverse effect on the integrity of the Portsmouth Harbour SPA, it is necessary to assess whether the impacts of this activity will hinder the site's conservation objectives, namely:

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

- The extent and distribution of the habitats of the qualifying features

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

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

The review of research into the impacts of shellfish dredging (detailed in section 6.2) identifies that this activity has the capability to disturb regularly occurring migratory birds and waterfowl species and lead to changes in prey availability. Disturbance can occur visually or through noise. Changes in prey availability 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 an adverse effect upon the following SPA attributes:

- Disturbance
- Food availability

The likelihood and magnitude of adverse effects upon these attributes will be determined by the following variables:

i) Number of vessels participating
ii) Location of dredging activity
iii) Timing and duration of dredging activity
iv) Sensitivity of site features/supporting habitats to dredging
v) Ability of supporting habitats to recover from the effects of dredging

Additionally, the location, timing, duration and intensity of clam dredging activity within the site will be influenced by existing management measures (see section 6.5) and/or those being developed to mitigate adverse effects (see section 7).

Having reviewed a wide range of evidence, including scientific literature, sightings data and feature mapping, it has been concluded that at current levels and location of clam dredging, the activity has the potential to have a significant adverse effect on the qualifying features and sub-features of the Portsmouth Harbour SPA. The risks to site integrity are addressed through the introduction of proposed management measures for bottom towed gear outlined in section 7 and therefore based on the introduction of these management measures it is concluded that clam dredging will not have an adverse effect on site integrity. The rationale for this conclusion is summarised below:

- Fisheries data held by the Southern IFCA indicates that the number of vessels clam dredging within the SPA is relatively low. A decline in fishing effort has been observed since 2012, with approximately 7 fishing vessels regularly partaking in the fishery and an average of 0 to 1 vessels operating on any one day (section 4.3).

- While sightings data confirms that clam dredging does take place over supporting habitats of the SPA, it only occurs in distinct spatial areas where shellfish beds exist (Annex 6). Consequently, there are large areas of the site which are not impacted by dredging.

- Potential impacts upon SPA supporting habitats will be mitigated through the introduction of a dredge fishing management area within Portsmouth Harbour. Dredging will only be permitted for a total of 120 days within this area. During this period, dredging will only be permitted between 07.00 and 17.00 each day in order to further manage fishing effort and to aid compliance.

- It is acknowledged that the restriction of clam dredging to 120 days within Portsmouth Harbour could lead to an increase in the intensity of fishing effort; however each of the three dredge fishing management areas (Southampton Water, Langstone Harbour and Portsmouth Harbour) will be opened simultaneously in order to dilute fishing effort over this period, avoiding any 'honey-pot' effect (section 7). This is not anticipated to result in an adverse effect on the SPA, due to the shortened duration of the season and the low number of vessels participating in the fishery.

- Clam dredging is unlikely to lead to the disturbance of designated bird species for a number of reasons. Birds which feed on the intertidal do so at low tide and clam dredging is undertaken at high tide, thus effectively eliminating the possibility of disturbance during feeding periods. Bird species within Portsmouth Harbour and the wider Solent are also subject to high levels of vessel traffic and so are likely to be habituated to such types of disturbance. Furthermore, the prohibition of clam dredging within Portsmouth Harbour for 35 weeks of the year will eliminate potential disturbance from fishing vessels during this period.

- A review of scientific literature indicates that the impacts of shellfish dredging on benthic organisms, which form potential prey items, is species-specific and largely related to their biological characteristics and physical habitat (section 6.2.1). Sightings data reveals that clam dredging in the Portsmouth Harbour SPA occurs over intertidal mud and on the fringes of a small area of intertidal mixed sediment, which provide feeding habitat for Dunlin, Black-tailed godwit and Dark-bellied brent goose (Annexes 7-8). Potentially adverse effects upon this supporting habitat will be mitigated through the introduction of seasonal and spatial restrictions on clam dredging within the SPA. Furthermore, the prey preferences exhibited by Dark-bellied brent geese include plants, grasses and seeds, which makes this species less sensitive to changes in benthic food availability.

- It is acknowledged that habitat recovery times are difficult to predict, being determined by a range of site-specific factors such as sediment type, associated fauna and rates of natural disturbance. Previous research indicates that recovery times will be greater in areas of lower energy (section 7); and those comprised of softer sediment habitats (section 6.2.1). In order to mitigate potentially adverse effects upon such habitats in the Portsmouth Harbour SPA, the restriction of fishing to 120 days will result in a corresponding recovery period of 35 weeks. As the summer months represent the period of highest biological activity for invertebrate infauna, the closure of the clam fishery during this time will support these communities to recover from the effects of human and/or natural disturbance.

In summary, it is concluded that clam dredging alone will not have an adverse effect on the Portsmouth Harbour SPA and will not hinder the site from achieving its conservation objectives with the introduction of proposed bottom towed fishing gear management measures. It is Southern IFCA's duty as the competent and relevant authority to manage damaging activities that may affect site integrity and lead to deterioration of the site.

In order to ensure that the management of clam dredging remains consistent with the conservation objectives of the site, Southern IFCA aim to implement a monitoring programme, in partnership with Natural England, to assess the impacts of fishing activity upon supporting habitats. In addition to this, Southern IFCA will continue to monitor fishing effort through sightings data and information from IFCOs. In the short term a change in the status of the fishery is unforeseen, however it is recognised that the status of a fishery may change. On this basis, the management of clam dredging will be reviewed as appropriate should new evidence on activity levels and/or gear-habitat interaction become available.

9. In-combination assessment

Based on the introduction of proposed bottom towed fishing gear management measures, no adverse effect on bird features and their supporting habitats was concluded for the effects of clam dredging alone within the Portsmouth Harbour SPA. Clam dredging occurs in the Portsmouth Harbour SPA alongside other fishing activities and commercial plans and projects and therefore requires an in-combination assessment.

Commercial plans and projects that occur within or may affect the Portsmouth Harbour SPA are considered in section 9.1. The impacts of these plans or projects require a Habitat Regulations Assessment in their own right, accounting for any in-combination effects, alongside existing fisheries activities.

There is the potential for clam dredging to have a likely significant effect when considered in-combination with other fishing activities that occur within the site. These are outlined in section 9.2. Any fishing activities that were screened out as part of the revised approach assessment process will not be considered (see Portsmouth Harbour SPA screening summary for details of these activities). In the Portsmouth Harbour SPA, commercially licensed fishing vessels are known to utilise a number of different gear types and can be engaged in multiple fishing activities and this, whilst dividing effort between gear types, may lead to cumulative impacts different to those of a single fishing activity.

9.1 Other plans and projects

Project details	Status	Potential for in-combination effect
Tipner Housing redevelopment	Consented but not constructed yet	Relevant impact pathways identified for this project including bird disturbance (construction and operation). The site is adjacent to the Portsmouth Harbour SPA. Low level construction vibration is anticipated from piling activities. A startle reaction from piling works could temporarily disrupt feeding and /or roosting birds and closer to construction works birds may be temporarily displaced to other areas. Survey work established important roosting areas for some bird species along the frontage and that important numbers of several SPA species forage within the wider area of Tipner Lake. Measures have been incorporated into the project to minimise disturbance to these areas to reduce impacts to the point where they are unlikely to be significant. Construction operations will be rotated around the site to prevent continuous disruption in one location. Piling operations on and around the waterfront will not take place during the sensitive overwintering period. The derelict jelly will be removed and replaced with a high tide roost in the form of a floating pontoon 50m from the shore, prior to autumn when birds return to the harbour. There will be no access to the foreshore at

		any point along the development frontage to reduce disturbance further and the coastal walkway will be partially screened from the intertidal. New residents will receive packs containing information on important areas and the necessity to act responsibly when undertaking recreational activities. Interpretation boards will also be used as an educational tool. In addition, activities currently taking place in the harbour, as well as the presence of the M275 which runs next to the site, means noise from construction activity is likely to be indistinguishable from background noise. Based on the mitigation measures that will be undertaken, there will be no likely significant effects on ecology. At a tLSE level for clam 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, Portsmouth Harbour is subject to high levels of vessel traffic and it is likely that some bird species become habituated to these types of disturbance. Based on the mitigation measures that will be undertaken as part of the project and the lack of potential for bird disturbance from clam dredging, it is anticipated that there will be no in-combination effects.
Queen Elizabeth aircraft carrier capital dredge	Consented and underway	Relevant impact pathways identified in relation to the project include increase in suspended sediment concentrations, increase in sedimentation rates, bird disturbance (operation and construction) and loss of intertidal. Increase in suspended sediment concentrations/ sedimentation rates - the capital dredging operation in Portsmouth Harbour and approach channel will result in resuspension of sediment into the water column and potentially result in smothering of sensitive habitats. A likely significant effect on Portsmouth Harbour SPA for internationally important populations of regularly occurring migratory species was concluded with respect to increased suspended sedimentation, associated siltation and localised smothering from the approach channel dredge. These impacts could affect intertidal invertebrates and epifloral communities. Modelling of deposition

		rates within Portsmouth Harbour, around Hamilton Bank and the outer approaches, confirmed deposition of fine sediment is expected to occur within and outside of the dredging area with a maximum accretion of less than 5 mm. In the north and north west of Foundation Lake Approach and turning circle, accretion rates are predicted in the range of 10 to 30 mm. Intertidal infaunal communities within the harbour are characteristic of muddy sediments which suggests increases in fine subtidal sediments is unlikely to have a negative impact these communities. Very little sediment would be expected to be deposited over intertidal areas as a result of dredging activity. Localised adverse impacts could occur with respect to *Zostera* spp. if beds are located directly adjacent to the dredge footprint. Mapping however shows that locations of *Zostera* recorded in 2012 do not overlap with areas of increased suspended sediment. A more detailed appropriate assessment concluded that suspended sediment and sedimentation rates would not result in an adverse effect on the interest features of the site. Bird disturbance – noise disturbance to SPA bird species could occur during the installation of navigation aids and middle slip jetty refurbishment and a likely significant effect was concluded for both project elements. Installation of navigation aids could lead to disturbance and displacement over an area of approximately 250 metres from the construction site. Bird surveys however have revealed at locations in close proximity to the construction works, that utilisation of mudflats by birds relatively low when compared with other areas in the harbour and bird density is also low. The bird surveys have also shown that birds appear to be habituated to the noise and disturbance associated with regular harbour activities. The duration of the works is also short. Mitigation measures, where possible, include avoiding construction in the upper harbour during the overwintering period (January and February) and the use of shrouds to reduce noise. Piling works associated with the Middle Slip Jetty refurbishment has the potential for disturbance. Nearest areas of mudflat are 400 to 600m away. At such distances noise levels are less than 70 dB LAeq, which is significantly below the 85 dB threshold where flight and temporary displacement has been observed. The distance from intertidal areas mean it is unlikely to give rise to disturbance and any changes would be expected to be short-lived. A more detailed appropriate assessment concluded that noise

		disturbance arising from different project elements would not result in an adverse effect on the interest features of the site. Loss of intertidal – the approach channel dredge is expected to lead to an average increase of 2 to 4 mm in water levels at low water within the harbour. This permanent rise in water level translates to a loss of approximately 1 hectare of low intertidal mudflat distributed throughout the harbour, representing a loss of 0.12% of intertidal resources. This corresponds to a reduction in mudflat exposure around low water for approximately three hours per month (0.001 percent of mudflat hectare exposure per month). Increases of 2 to 4 mm are not sufficient to prevent Brent Geese from feeding within these areas. Zostera and Enteromorpha would still be present in the affected area and so still available to Brent Geese. The increase in water level is expected to have a negligible impact on the species with respect to foraging. A reduction in foraging duration (1 ha of intertidal mud for 10 minutes at low water on a neap tidal cycle) is also not expected to have a significant impact on Brent Geese. There is also a potential loss of intertidal mudflat due to the installation of navigation aids. Two sets of transit lights may be installed within the inner harbour, either immediately adjacent to or over intertidal mudflat, with the preferred option to locate them subtidally. If located intertidally however there would be loss of mudflat habitat of between 110 to 216 square metres (0.0026% of the intertidal resource). A more detailed appropriate assessment concluded that loss of intertidal, arising from different project elements, would not result in an adverse effect on the interest features of the site. At a tLSE level for clam 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, Portsmouth Harbour is subject to high levels of vessel traffic and it is likely that some bird species become habituated to these types of disturbance. Changes in suspended solids (water clarity/ increased turbidity) and siltation rate changes (high), including smothering were screened out on the basis that increases in the turbidity are only

		temporary and unlikely to cause significant impact on feeding success. Impacts surrounding the project come from several different project elements and each have been considered to not have an adverse effect on the interest feature of the site. Due to the lack of overlapping impact pathways (loss of intertidal, increase in suspended sediment concentrations and increase in sedimentation rate) between the activity and project and the relatively localised and short duration (during the construction period) of impacts caused by the project (noise disturbance) it is unlikely that in-combination effects will be significant.
Portchester to Emsworth Coastal Defence Strategy	In planning	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 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 alterative policy and there is an over-riding 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 2,460m^2 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 tLSE level for clam 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, Portsmouth Harbour is subject to high levels of vessel traffic and it is likely that some bird species become habituated to these types of disturbance. The combined impacts of phased small scale coastal defence works and clam 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 clam 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.

9.2 Other fishing activities

Fishing activity	Potential for in-combination effect
Oyster dredging	Common impact pathways identified at a tLSE level and these include physical damage – siltation, physical damage – abrasion and selective extraction of species. The two activities target different species and the type of dredge used for oyster dredging (large mesh size) is unlikely to retain Manila clams, but may retain larger American hard-shell clams. Based on this and mitigation measures such as minimum sizes, which are present for each target species, it is unlikely there will be significant in-combination effects with respect to selective extraction. Oyster dredging is concentrated takes place in distinct, small spatial areas where shellfish beds exist. Sightings data, indicative of recent fishing effort, is presented in Annex 16 and illustrates areas where the two activities could potentially overlap in the subtidal channels in the north east of Portsmouth Harbour where the main channel splits. Historic sightings data presented in Annex 17 shows a clear overlap of the two activities in the same locality, in addition to a small number of overlapping sightings in the western subtidal channel which extends towards and up into Fareham Creek. Data presented in Annex 16 is indicative of recent fishing effort from 2012 to 2015 for clam dredging and oyster dredging. Data presented in Annex 17 is indicative of historic fishing effort from 2005 (when sightings data is available from) until 2015. No sightings data exists for 2013. Please note oyster dredging was historically managed through an regulating order until 2010 but due to poor catches the order was not renewed. In an effort to curb further reductions in stock and limit impact to the fishery, Southern IFCA used its Temporary Closure of Shellfish Beds byelaw to limit the fishery in the 2013/14, 2014/15 and 2015/16 seasons, including spatial restrictions with fishing limited to Portsmouth and Langstone Harbour. Based on the nature of both gear types, which are forms of shellfish dredges known to penetrate into the seabed, and the known impact

	pathways of both activities, oyster dredging and clam dredging have the potential to cause in-combination effects. The areas of concern are those where the activities are known to overlap which is mainly in subtidal areas or on the fringes of the intertidal. The upper reaches of the intertidal are much less at risk of in-combination effects due to the lack of oyster dredging taking place over these features. These in-combination effects, which include physical damage through abrasion (and penetration) and potentially siltation, can only take place when both activities are allowed i.e. within the oyster season. It is also worth noting the differences in the design of both dredges. The design of the oyster dredge, is likely to cause less damage than those used for clam dredging which can have teeth of up to 14 cm. The ladder on an oyster dredge can be up to 8.5 cm long. An oyster dredge is designed to be towed on top of the seabed, thus limiting penetration into the sediment, the clam dredge is designed to penetrate into the sediment. This is linked to the ecology of the target species. The oyster fishery has been restricted spatially and temporally through the 'Temporary Closure of Shellfish Beds' byelaw since the 2013/14 oyster season. The most recent season (2015/16) was restricted to two weeks in length and fishing was only allowed to take place in Langstone and Portsmouth Harbour, with the wider Solent and Southampton Water prohibited to oyster fishing. These restrictions are and have been applied on an annual basis in order to aid recovery of depleted oyster stocks in the Solent. In the absence of such restrictions, the proposed bottom towed fishing gear management measures, outlined in section 7 (permanent and seasonal closures), which will apply to both oyster dredging and clam dredging, address any risks posed to site integrity through any in-combination effects of the two activities. In addition, the proposed management measures also addresses the potential for future expansion into areas not previously subject to fishing effort, which is likely to occur in the event of stock recovery.
Demersal netting	No impact pathways were identified at a tLSE 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	No impact pathways were identified at a tLSE 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	No impact pathways were identified at a tLSE 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

Consultation	Date submitted	Response from NE	Date received
First draft – excluding management measures	27/10/15	Recommended amendments	02/12/15

(v1.2)			
Revised draft in response to NE recommendations (v1.5)	08/02/16	Accepted amendments	01/03/16
Revised draft – including management measures (v1.6)	03/08/2016	Recommended amendments	26/08/2016
Revised final draft – including changes to conclusion and management options (v1.9)	09/09/2016	Formal advice	20/09/2016

11. Integrity test

Based on the bottom towed fishing gear management measures proposed by Southern IFCA (see section 7), it has been concluded that clam dredging alone will not have an adverse effect on the integrity of the Portsmouth Harbour SPA and will not hinder the site from achieving its conservation objectives. The in-combination assessment concluded the potential for adverse effect between clam dredging and oyster dredging in areas of spatial overlap due to similar impact pathways. However the proposed bottom towed fishing gear management measures, which will apply to both activities, address any risks posed to site integrity through in-combination effects, regardless of restrictions imposed on the oyster fishery through the ‘Temporary Closure of Shellfish Beds’ byelaw and therefore also addresses any risk to the achievement of the sites conservation objectives should the oyster fishery develop.

A change in the current status of the clam and oyster fishery, upon which the Habitats Regulation Assessment is based, is unforeseen, however it is recognised that future changes may occur. For example, efforts are currently being made to restore the Solent oyster population. Southern IFCA will continue to monitor fishing activity within the Portsmouth Harbour SPA, in addition to collating data on the potential impacts of shellfish dredging upon site features/supporting habitats. New evidence on activity levels, and impacts (such as that collected through monitoring), will be periodically reviewed to ensure management of the fishery continues to be compatible with the conservation objectives of the site. In the event new evidence has the potential to hinder the sites conservation objectives, such as an increase in fishing activity, a Habitat Regulations Assessment will be undertaken.

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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.

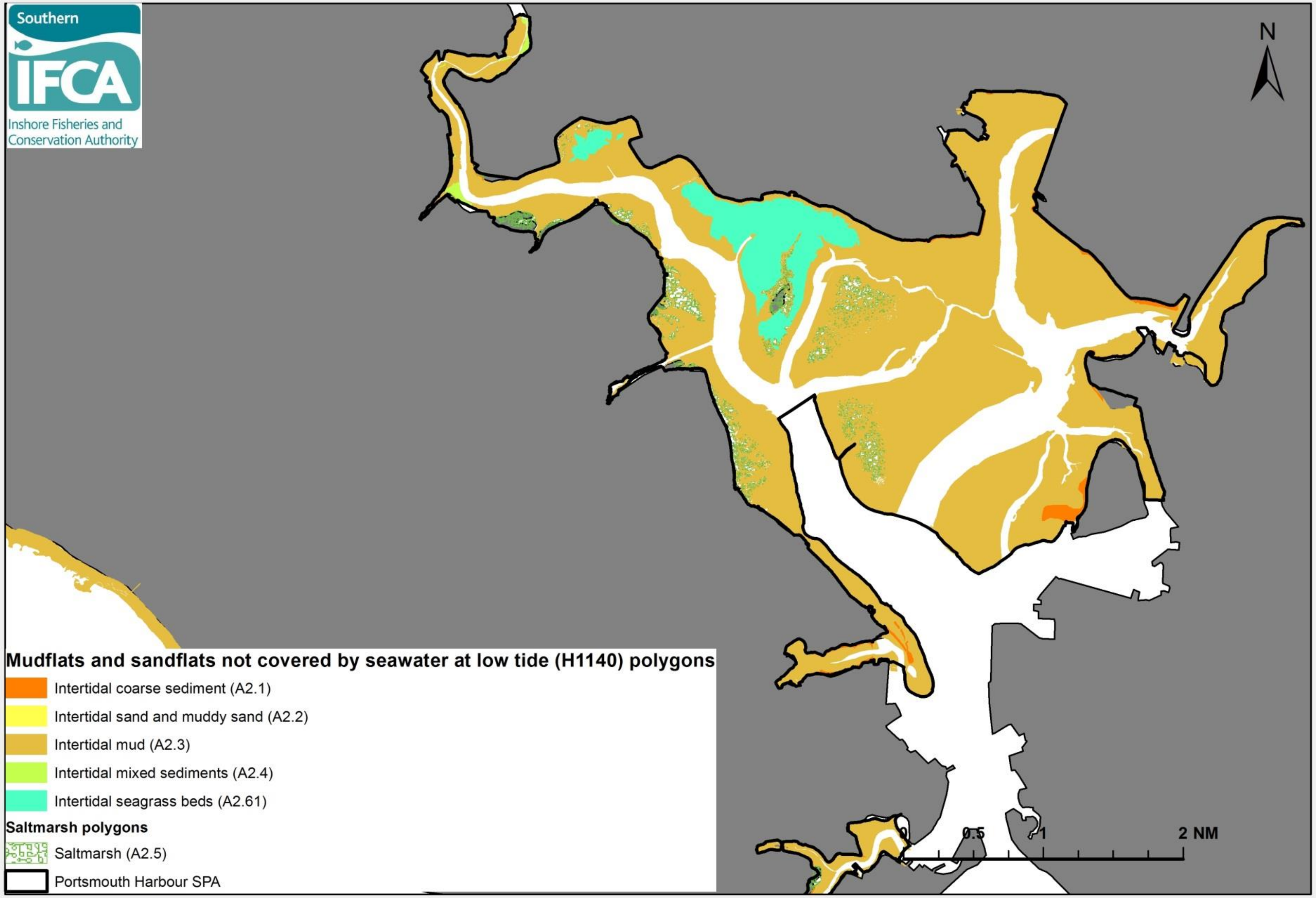
Consideration of this process had led to the following definition of onus of proof: If through their own site condition monitoring programme or that of another Relevant Authority, English Nature can demonstrate that they have reasonable evidence to indicate that a deterioration in the condition of a 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 obligations 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 is 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 Portsmouth Harbour SPA



Southern IFCA
Inshore Fisheries and Conservation Authority
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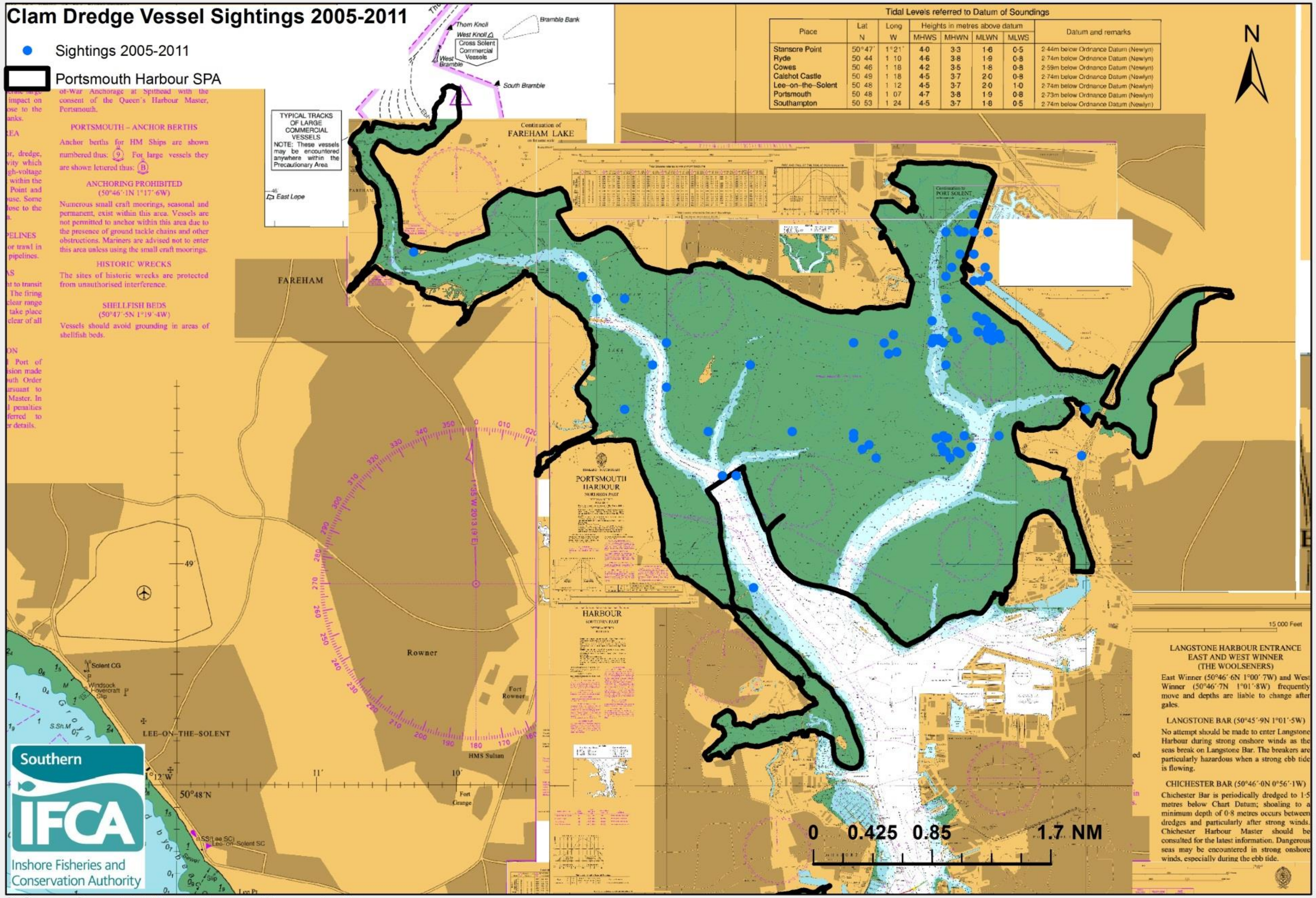
Mudflats and sandflats not covered by seawater at low tide (H1140) polygons
Intertidal coarse sediment (A2.1)
Intertidal sand and muddy sand (A2.2)
Intertidal mud (A2.3)
Intertidal mixed sediments (A2.4)
Intertidal seagrass beds (A2.61)
Saltmarsh polygons
Saltmarsh (A2.5)
Portsmouth Harbour SPA

Annex 4: Fishing Activity Map(s) using Clam Dredging Sightings Data from 2005-2015 (2005-11 & 2012-2015 (broken down by year) in Portsmouth Harbour SPA


Clam Dredge Vessel Sightings 2005-2011
Sightings 2005-2011
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Southern IFCA
Inshore Fisheries and Conservation Authority
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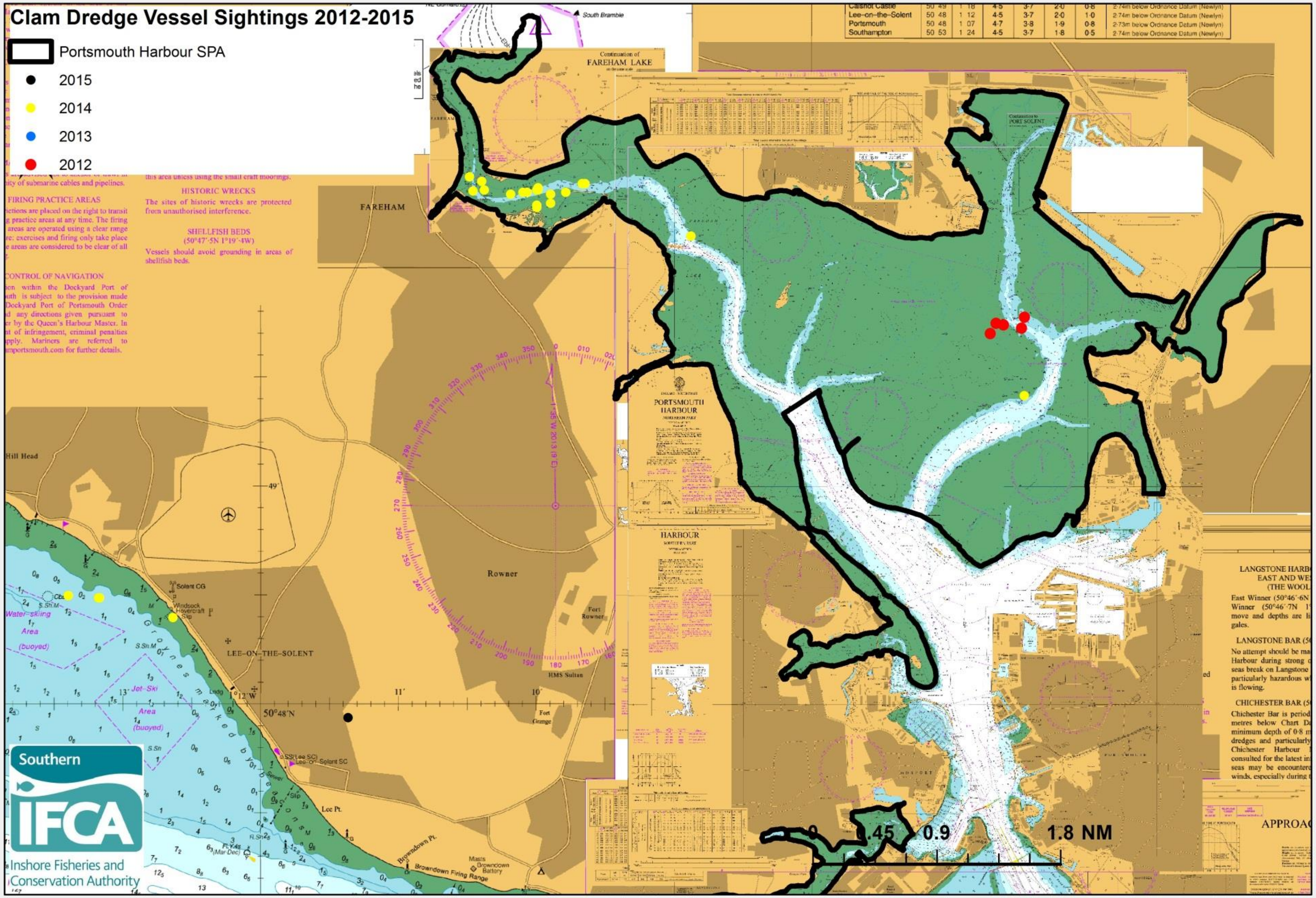
Rowner
LEE-ON-THE-SOLENT
Tidal Levels referred to Datum of Soundings
LANGSTONE HARBOUR ENTRANCE EAST AND WEST WINNER (THE WOOLSENERS)


Clam Dredge Vessel Sightings 2012-2015
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IFCA
Inshore Fisheries and Conservation Authority
FAREHAM
Rowner
LEE-ON-THE-SOLENT
HARBOUR
PORTSMOUTH HARBOUR
Hill Head

Annex 5: Natural England's Scoping Advice

Date: 07 October 2015
Our ref: 163686

NATURAL ENGLAND

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BY EMAIL ONLY

Dear Rob

Natural England's advice on the potential impacts of clam dredging within Portsmouth Harbour

The following constitutes Natural England's formal advice regarding the potential impacts of dredging for clams on the nature conservation features of the following designated sites:

- Portsmouth Harbour Special Protection Area (SPA)
- Portsmouth Harbour Wetland of International Importance under the Ramsar Convention (Ramsar site)

Clam dredging is an established fishing activity that is practised within Portsmouth Harbour and the wider Solent region on a year-round basis. The principal species targeted are the Manila clam (*Tapes phillipinarium*) and the American Hard Shell clam (*Mercenaria mercenaria*), but catches may also include the Carpet Shell clam (*Ruditapes decussatus*). Clam dredging effort within Portsmouth Harbour is focused upon intertidal habitats, with potential impacts on the designated sites listed above.

These sites are protected by the Conservation of Habitats and Species Regulations 2010 (as amended), and are underpinned by Sites of Special Scientific Interest (SSSI) which are afforded protection under the Wildlife and Countryside Act (1981) (as amended under the Countryside and Rights of Way Act 2000). The clam fishery is subject to a number of byelaws that regulate the type of dredge that may be used; the hours during which vessels may fish; the spatial extent of the fishery (to avoid damage to seagrass beds); and a minimum landing size for American Hard Shell clams. Additionally, the Manila clam is subject to a minimum landing size determined by the European Commission. There are currently no byelaw restrictions on the number of licensed vessels that can dredge for clams in Portsmouth Harbour, or the months of the year during which they can operate.

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1. Legal Requirements

Natural England and the Southern Inshore Fisheries and Conservation Authority (SIFCA) have duties under Regulation 9(3) of the Conservation of the Habitats & Species Regulations 2010 as competent authorities with functions relevant to marine conservation to exercise those functions so as to secure compliance with the Habitats Directive. Article 6.2 of the Habitats Directive requires appropriate steps to be taken to avoid, in Natura 2000 sites, the deterioration of natural habitats and habitats of species as well as significant disturbance of the species for which the area has been classified. SIFCA should also ensure that the measures proposed are compatible with the conservation and enhancement of the special interest of relevant SSSIs in line with their status as a Section 28G authority under the Wildlife and Countryside Act 1981 (as amended).

The purpose of this advice is to inform the scope of the assessment required by SIFCA through Defra's revised approach to the management of commercial fisheries within European Marine Sites, to avoid damage or deterioration to the conservation features of the Portsmouth Harbour SPA and Ramsar site.

2. Protected Sites

2.1 Portsmouth Harbour SPA and Ramsar site

2.1.1 Site overview

Portsmouth Harbour is a large industrialised estuary. Together with the adjacent Chichester and Langstone Harbours, it forms one of the most important sheltered intertidal areas on the south coast of England. Portsmouth Harbour SPA and Ramsar site is composed of extensive intertidal mudflats and sandflats with seagrass beds, areas of saltmarsh, shallow coastal waters, coastal lagoons and coastal grazing marsh. The estuarine sediments support rich populations of intertidal invertebrates, which provide an important food source for wintering birds. There are approximately 67 ha of seagrass beds in Portsmouth Harbour, which are found mainly in the north-west of the harbour and provide an important food source for dark-bellied brent geese. The saltmarsh areas are mainly comprised of cordgrass (*Spartina*) swards and provide feeding and roosting areas for overwintering birds.

2.1.2 Features and supporting habitats at risk of impact

Natural England has reviewed the SPA and Ramsar site features and supporting habitats at risk from clam dredging and agrees with the prioritisation exercise conducted by SIFCA. Natural England has identified the following features which we believe are at risk from clam dredging, and could be included within your assessment of this activity within Portsmouth Harbour SPA and Ramsar site:

- Internationally important populations of regularly occurring migratory species (non-breeding):
  - Black-tailed godwit, *Limosa limosa*
  - Dark-bellied brent goose, *Branta bernicla bernicla*
  - Dunlin, *Calidris alpine*
  - Red-breasted merganser, *Mergus serrator*

Natural England notes that clam dredging activity in Portsmouth Harbour occurs within intertidal habitats, but could also take place within the sub-tidal zone. While the Portsmouth Harbour SPA and Ramsar site designation covers both intertidal and sub-tidal areas, the habitats which support the site's qualifying bird features occur within the intertidal zone. On

2

this basis, it may be possible to scope out potential impacts upon sub-tidal habitats within the SPA and Ramsar site. Natural England therefore recommends that SIFCA assess the impacts of clam dredging upon the intertidal habitats that are utilised by regularly occurring migratory species, namely:

- Intertidal coarse sediment
- Intertidal mixed sediments
- Intertidal mud
- Intertidal sand and muddy sand
- Intertidal seagrass beds

As you are aware, Natural England is in the process of revising Conservation Advice packages for Marine Protected Areas. The draft Conservation Advice package for the Portsmouth Harbour SPA and Ramsar site was published by Natural England on 30 March 2015 and has been used to inform this scoping advice. A copy of this draft advice package can be viewed online at: https://www.gov.uk/government/publications/marine-conservation-advice-for-special-protection-area-portsmouth-harbour-uk9011051. Please note that this package does not constitute our formal statutory advice until it is published as final advice and replaces the previous Regulation 33 package. However, it is not envisaged that the advice provided within this letter will change substantively.

Data on the presence and extent of supporting habitats has been provided to SIFCA through Natural England's ongoing Evidence Mapping Project. We recommend that SIFCA use this GIS data as the best available evidence on the presence and extent of habitats, and where possible, seeks to incorporate this data with evidence of clam dredging activity to identify and assess the impacts. Whilst the above supporting habitats have been identified as at risk of impact from clam dredging, it may be possible that clams do not occur within all of these habitats in the Portsmouth Harbour SPA and Ramsar site.

While the use of towed fishing gear has the potential to impact upon saltmarsh and *Spartina* swards in certain locations, informal discussions with SIFCA indicate that clam dredging is unlikely to have a significant effect upon these features in Portsmouth Harbour due to the proximity at which vessels may feasibly operate. However, Natural England recommends that SIFCA seek to confirm this using vessel sightings and habitat mapping data, and also consider the likelihood of this current situation changing in the future (e.g. through the realistic evolution of the fishery).

2.1.3 Conservation Objectives

The Conservation Objectives for the Portsmouth Harbour SPA[1] are as follows:

> With regard to the SPA and the individual species and/or assemblage of species for which the site has been classified (the 'Qualifying Features' listed below), and subject to natural change;
>
> Ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the site contributes to achieving the aims of the Wild Birds Directive, by maintaining or restoring;

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

[1] http://publications.naturalengland.org.uk/publication/4857883850178560

The above objectives should be considered in conjunction with the accompanying draft supplementary advice, which provides more detailed information to help achieve the objectives set out above, including which attributes should be maintained and which restored. The supplementary advice for these objectives is outlined below in section 3.1.

2.1.4 Condition Assessment

While a formal condition assessment of the Portsmouth Harbour SPA and Ramsar site is not currently available, an indication of condition for bird species and their supporting habitats may be obtained from a number of sources; which are detailed below.

The British Trust for Ornithology (BTO) Wetland Bird Survey (WeBS) aims to identify population sizes, determine trends in numbers and distribution, and identify important sites for non-breeding waterbirds in the UK. Data can be used to highlight SPA bird features where population numbers have exhibited trends that are inconsistent with regional and/or national population trends, and thereby may be subject to site-specific pressures. Species that have undergone major changes in numbers are triggered by the issuing of a WeBS Alert, which can be viewed online at: http://blx1.bto.org/webs-reporting/ or through Natural England's SPA Toolkit.

The most recent WeBS report, based upon Alerts status as of 2009/10, only provides an assessment for the Dark-bellied brent goose; for which an alert is not triggered. It should be noted that this data may not have captured the effects of fishing activities that have since commenced or increased in intensity since publication. Similarly, these effects may not necessarily be captured in the next WeBS Alerts report (due in 2015) due to the time lag between cause and effect. Natural England recommends that these observations are given due consideration when assessing the impact of clam dredging upon SPA/Ramsar qualifying features. While an assessment has not conducted for Black-tailed godwit, Dunlin or Red-breasted merganser, data on numbers and trends for these species is provided through the BTO WeBS Core Counts which can also be viewed online at: http://blx1.bto.org/webs-reporting/. As with WeBS Alerts, we would advise caution when using this data for assessments of fishing activity.

In addition to the qualifying bird species and assemblage it is necessary to consider the status of supporting habitats when assessing condition of the SPA and Ramsar site. As noted in section 2.2.2, Natural England has identified habitats within the intertidal zone to be at particular risk of impact from clam dredging. An indication of condition for these supporting habitats may be obtained from the assessment of the Portsmouth Harbour SSSI that underpins the SPA and Ramsar site, which is available online at: http://designatedsites.naturalengland.org.uk/.

Analysis of assessment data for Portsmouth Harbour SSSI reveals that the site is affected by by sea level rise and coastal squeeze; where habitats are unable to retreat landward as levels rise. This issue is being addressed through the creation of compensatory habitat and coastal re-alignment at Medmerry. Some intertidal areas of the site are adversely affected by dense macroalgal mats of *Enteromorpha* species and *Ulva sp.* and a resulting anoxic layer of sediments directly underneath. The Solent Diffuse Water Pollution Plan (DWPP) is in place with actions to address the dense algal mats across the whole harbour by reducing diffuse pollution inputs. Anthropogenic impacts are also evident, including baitdigging and the presence of debris across areas of foreshore. The SSSI provides extensive intertidal mudflats and roosting sites which support internationally important number of wintering waterfowl. Areas of particular importance are located at RNAD Gosport in Bedenham; Pewit

Island; Cams Bay; Wicor Lake; Priddy's Hard and Forton Lake. Natural England is happy to liaise further with SIFCA in identifying bird sensitive areas within the site.

Natural England also recommends that SIFCA consider other threats to the condition of the site as highlighted in the SEMS Delivery Plan (http://www.solentems.org.uk/publications/) when assessing the impact of clam dredging upon SPA/Ramsar qualifying features.

3. Potential impacts on attribute targets that could prevent the achievement of conservation objectives

Having identified the SPA and Ramsar features and supporting habitats at risk of impact from clam dredging in section 2.1.2, the following section outlines the relevant site attributes, targets and impact pathways that should be considered by SIFCA when assessing this activity.

The magnitude of clam dredging impacts on benthic habitats will be determined by a combination of factors which include the location, scale and intensity of harvesting activities, together with local environment conditions such as sediment characteristics, water depth, wave exposure, strength of tidal currents, the presence of algae and seagrass, and intertidal/sub-tidal location (Kaiser et al. 2001; Wheeler et al. 2014). Similarly, the magnitude of impacts upon bird populations will be determined by environmental conditions such as the type and size of target and non-target prey species, climate/weather, alternate foraging sites, competition from other species and the relevant extent of alternate food supplies. Natural England recommends that these attributes are given full consideration when assessing the significance of potential impacts upon the SPA and Ramsar site. In the first instance, we recommend that SIFCA collate spatial/temporal effort data on clam dredging within Portsmouth Harbour and analyse this with respect to the location of sensitive features. Natural England is in the process of providing SIFCA with GIS feature mapping for Marine Protected Areas which collates confidence assessed datasets and represents our best available evidence base. This feature mapping data will include the presence and extent of Portsmouth Harbour SPA supporting habitats, where available.

For data describing the distribution of SPA bird features, Natural England recommends that SIFCA utilise BTO WeBS Core Counts data on numbers and trends, together with that collected through the WeBS Low Tide Count (LTC) scheme. The LTC scheme collects data on feeding waterbirds within major UK estuaries, although sites are counted approximately every six years rather than annually. Data for Portsmouth Harbour can be viewed online at: http://blx1.bto.org/webs-reporting/?tab=lowtide or downloaded in GIS format through Natural England's SPA Toolkit.

Additional data on bird roosting sites is provided in the Solent Waders and Brent Goose Strategy (King, 2010), the outputs of which are available online at: http://www.solentforum.org/forum/sub_groups/Natural_Environment_Group/Waders%20and%20Brent%20Goose%20Strategy/.

3.1 Portsmouth Harbour SPA and Ramsar site

Natural England has reviewed the potential impacts of clam dredging within the Portsmouth Harbour SPA and Ramsar site and identified the following impact pathways through which this activity may affect the qualifying features and supporting habitats:

i) Disturbance and displacement caused by human activity
ii) Competition for prey
iii) Changes in food availability

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iv) Physical damage or loss of non-breeding habitat

3.1.1 Disturbance and displacement caused by human activity

1. Relevant attribute:
Supporting habitat: disturbance caused by human activity

Target:
The frequency, duration and/or intensity of disturbance affecting foraging and/or roosting birds should not reach levels that substantially affect the feature.

Potential impacts:
Disturbance represents the stimulus that alters normal bird behaviour within a given area, and can result in displacement when birds are unable to use an area due to the magnitude of disturbance present. The response of birds to disturbance is influenced by a range of factors, including distance from the source of disturbance and the scale of disturbance (Stillman et al., 2009). Disturbance that results in birds taking flight can simultaneously increase energy demands and reduce food intake with potential consequences for survival and reproduction.

Fishing activity has the potential to cause bird disturbance through a number of direct impact pathways, including: visual and/or noise disturbance resulting from the presence/movement of fishing vessels; the presence/movement of people; and the operation of fishing gear. The magnitude of disturbance and displacement caused by clam dredging within the Portsmouth Harbour SPA and Ramsar site will be influenced by the intensity of fishing activity (including the number of vessels, frequency and duration) relative to the proximity of sensitive bird species.

3.1.2 Competition for prey

1. Relevant attribute/sub-attribute:
Supporting habitat: food availability within supporting habitat

Target:
(i) Maintain overall prey availability at preferred prey sizes.
(ii) Maintain Zostera at least at Good Ecological Potential and restore macroalgae to at least Good Ecological Potential.

Potential impacts:
Fishing activity can have a direct impact upon birds through the targeted removal of organisms which are prey species of the bird features. The food requirements of shorebirds within a cold climate are considerably greater due to thermoregulatory needs (Wheeler et al. 2014). Therefore, the principal bird features at risk from clam dredging impacts upon prey availability are benthic-feeding bird species that utilise the SPA and Ramsar site during the overwintering period (01 October to 31 March).

3.1.3 Changes in prey availability

1. Relevant attribute/sub-attribute:
Supporting habitat: food availability within supporting habitat

Target:
(i) Maintain overall prey availability at preferred prey sizes.
(ii) Maintain Zostera at least at Good Ecological Potential and restore macroalgae to at least Good Ecological Potential.

6

Potential impacts:
Fishing activity can have an indirect impact upon birds by affecting the availability of prey/food, through pathways that do not include targeted removal. These pathways include: physical disturbance to habitats resulting in changes to community structure; removal/mortality of non-target organisms through bycatch or interaction with fishing gear; smothering of prey species from increased sedimentation; and physical damage to supporting habitats such as *Zostera sp.* which is a key food source for Dark-bellied brent geese.

While shorebirds will typically eat a range of species including molluscs and annelids, the type of preferred prey will vary between bird species; this should be acknowledged when assessing impacts. Consistent with impacts resulting from competition for prey (see 3.1.2), the principal bird features at risk from changes in prey availability are non-breeding overwintering bird species.

3.1.4 Physical damage or loss of non-breeding habitat

1. Relevant attribute:
Supporting habitat: landform

Target:
Maintain the density of channel networks within intertidal feeding areas.

Potential impacts:
Shellfish dredging can have a direct impact upon intertidal habitats by physically altering their topography and landform. Typical effects include the creation of depressions and trenches, and the smoothing of ripples or creation of ridges within sand environments (Wheeler et al. 2014). Topography reflects the energy conditions and stability of soft sediment habitats, which in turn influences the distribution of benthic communities. For this reason, Natural England recommends that potential impacts upon the topography and landform of supporting habitats are considered in conjunction with their influence upon prey availability.

2. Relevant attribute/sub-attribute:
Supporting habitat: extent and distribution of supporting non-breeding habitat.

Target:
Maintain the extent and distribution of suitable habitat (either within or outside the site boundary) which supports the feature for all necessary stages of the non-breeding/wintering period (moulting, roosting, loafing, feeding).

Potential impacts:
Fishing activity can have an indirect impact upon birds by physically damaging or removing supporting habitat, including that used for roosting, nesting and feeding. An assessment of impacts from clam dredging upon the above attribute and target should consider effects that are not captured through other pathways (e.g. damage or loss of feeding habitat). Natural England therefore recommends that SIFCA examine the potential impacts of clam dredging with respect to damage or loss of roosting and nesting habitats.

Informal discussions with SIFCA indicate that clam dredging is unlikely to interact with the roosting or nesting habitats of designated bird species within the Portsmouth Harbour SPA and Ramsar site. However, we recommend that further assessment is undertaken using vessel sightings, habitat mapping and species distribution data in order to ascertain that no significant impacts occur.

3.1.5 Impacts which could be scoped out

There are two possible impacts that are not likely to have a significant effect upon features or supporting habitats of the Portsmouth Harbour SPA and Ramsar site and could therefore be screened out of the Habitats Regulations Assessment. These impacts are:

- Mortality: Bird mortality can occur from entrapment within active fishing gear, or from entrapment/ingestion of lost or discarded fishing gear. The main risk is presented to diving seabirds interacting with nets, lines and traps. Due to the bird species present in the site and the type of gear used for clam dredging, Natural England do not consider this impact to have a significant effect upon the features of the SPA and Ramsar site.
- Increased turbidity: Sediment mobilisation from dredging may result in increased turbidity, which can affect the success of birds feeding in the water column due to reduced visibility. The impact of increased turbidity will be determined by foraging strategies, with birds such as cormorants, mergansers and diving ducks being particularly at risk. Natural England has reviewed the potential impacts of increased turbidity upon the bird features listed in section 2.1.2 and do not consider this to have a significant effect due to the nature of their foraging strategies.

4. Additional considerations

The scientific literature recognises that shellfish dredging can have an adverse impact upon benthic habitats, however the magnitude of this impact and its resultant effects upon shorebird populations remains not well understood; particularly with respect to longer-term impacts (Wheeler et al. 2014). Natural England therefore welcomes the opportunity to collaborate with SIFCA and Bournemouth University in supervising a PhD project to explore the impacts of harvesting activities upon birds in the Solent. It is envisaged that this research will provide a key source of evidence in assessing the impacts of clam dredging upon the qualifying features and supporting habitats of the Portsmouth Harbour SPA and Ramsar site.

In addition to the collation of primary data on the site-specific impacts of clam dredging, Natural England recommends that SIFCA consider existing management of fishing activities (including compliance) when assessing impacts upon designated features. Through this process it may be possible to scope out potential impacts upon features where clam dredging is prohibited, for example, within/adjacent to seagrass beds. Similarly, we recommend that SIFCA also consider the future realistic evolution of the clam fishery, including the introduction of methods such as pump scoop dredging which may affect the type and/or magnitude of impacts.

5. Summary

Natural England agrees with the Southern IFCA's prioritisation of clam dredging within Portsmouth Harbour as a high risk amber activity for Defra's revised approach to the management of commercial fisheries within European Marine Sites. The advice provided in this letter identifies the principal features, sub-features and supporting habitats of the Portsmouth Harbour SPA and Ramsar site that may be adversely impacted by clam dredging activity.

Natural England welcomes the opportunity to work collaboratively with SIFCA in assessing the magnitude of these impacts and their resultant effects upon site integrity. As noted previously, this assessment will require the collation and analysis of clam dredging effort data, together with primary and secondary evidence on the impacts of this activity. Natural

England would also be happy to work with SIFCA in developing management measures that may result from this assessment; including site-specific monitoring of fishing activity and impacts.

For any queries relating to the content of this letter please contact me using the details provided below.

Yours sincerely

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Telephone: 0300 060 0240

References

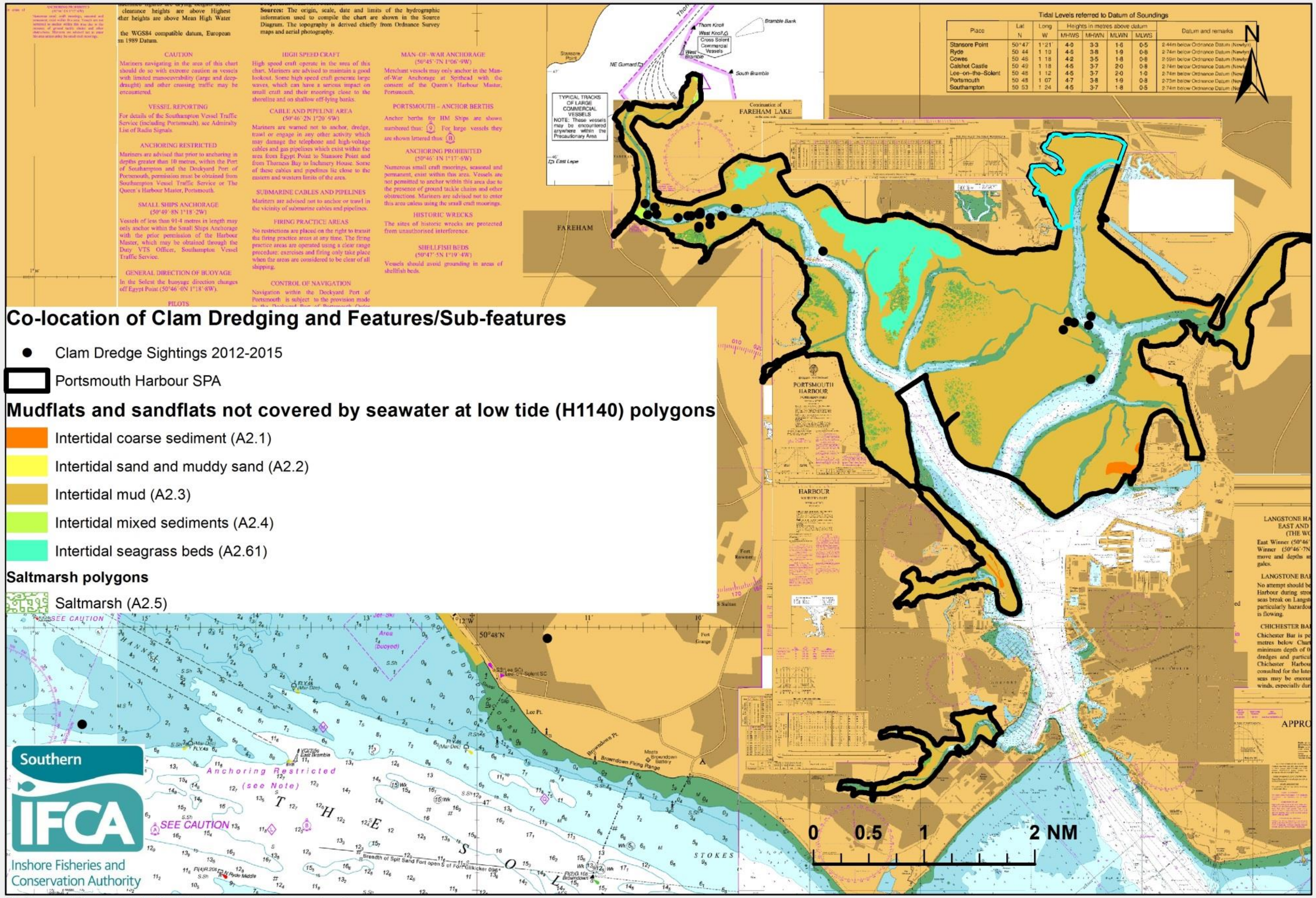
Kaiser, M. J., Broad, G., & Hall, S. J. (2001). Disturbance of intertidal soft-sediment benthic communities by cockle hand raking. *Journal of Sea Research, 45, 119-130.*

King, D. (2010). *Solent Waders and Brent Goose Strategy 2010*. Hampshire and Isle of Wight Wildlife Trust.

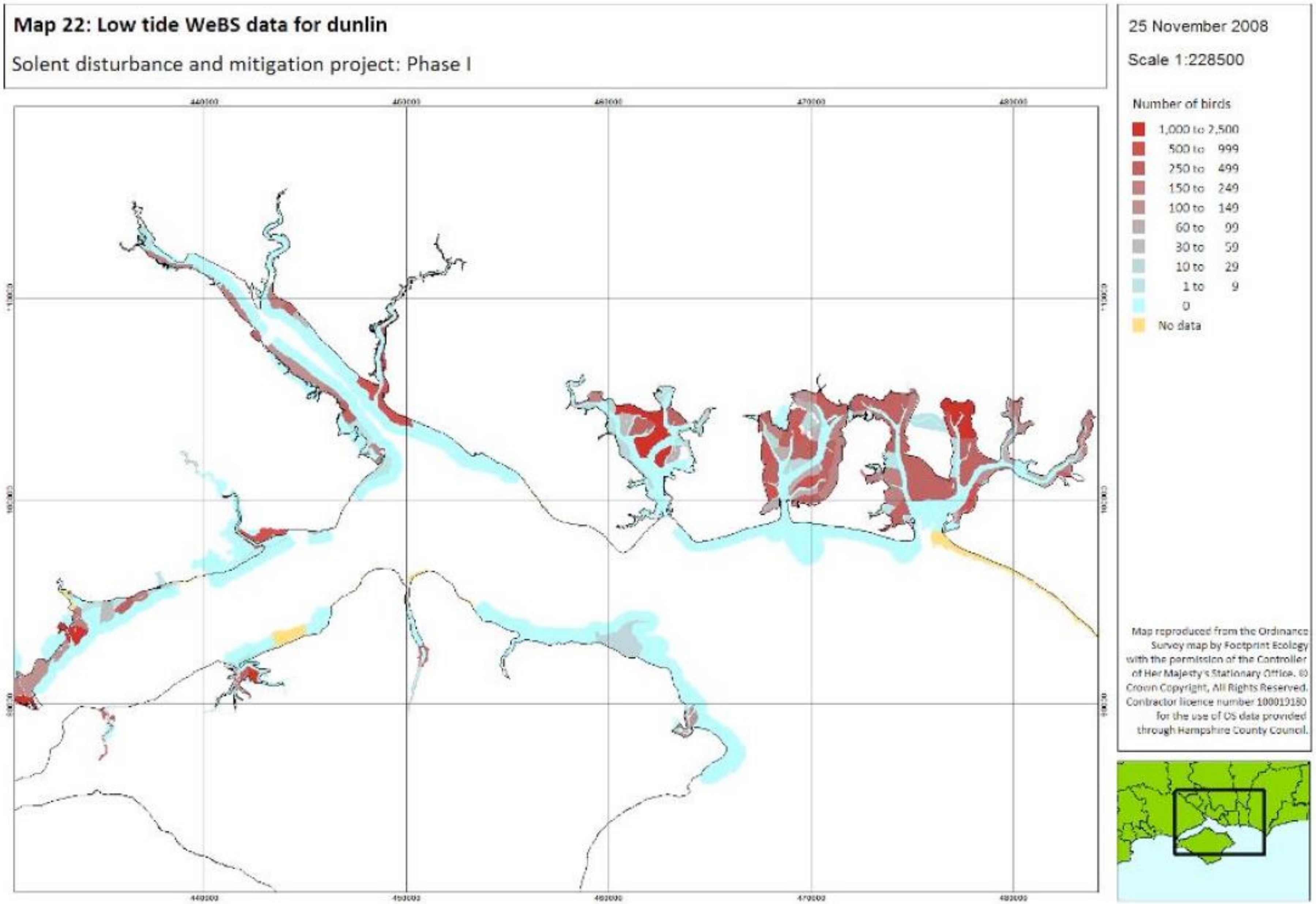
Stillman, R. A., Cox, J., Liley, D., Ravenscroft, N., Sharp, J., & Wells, M. (2009). *Solent disturbance and mitigation project: Phase I report.* Report to the Solent Forum.

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

Annex 6: Co-Location of Fishing Activity and Supporting Habitats

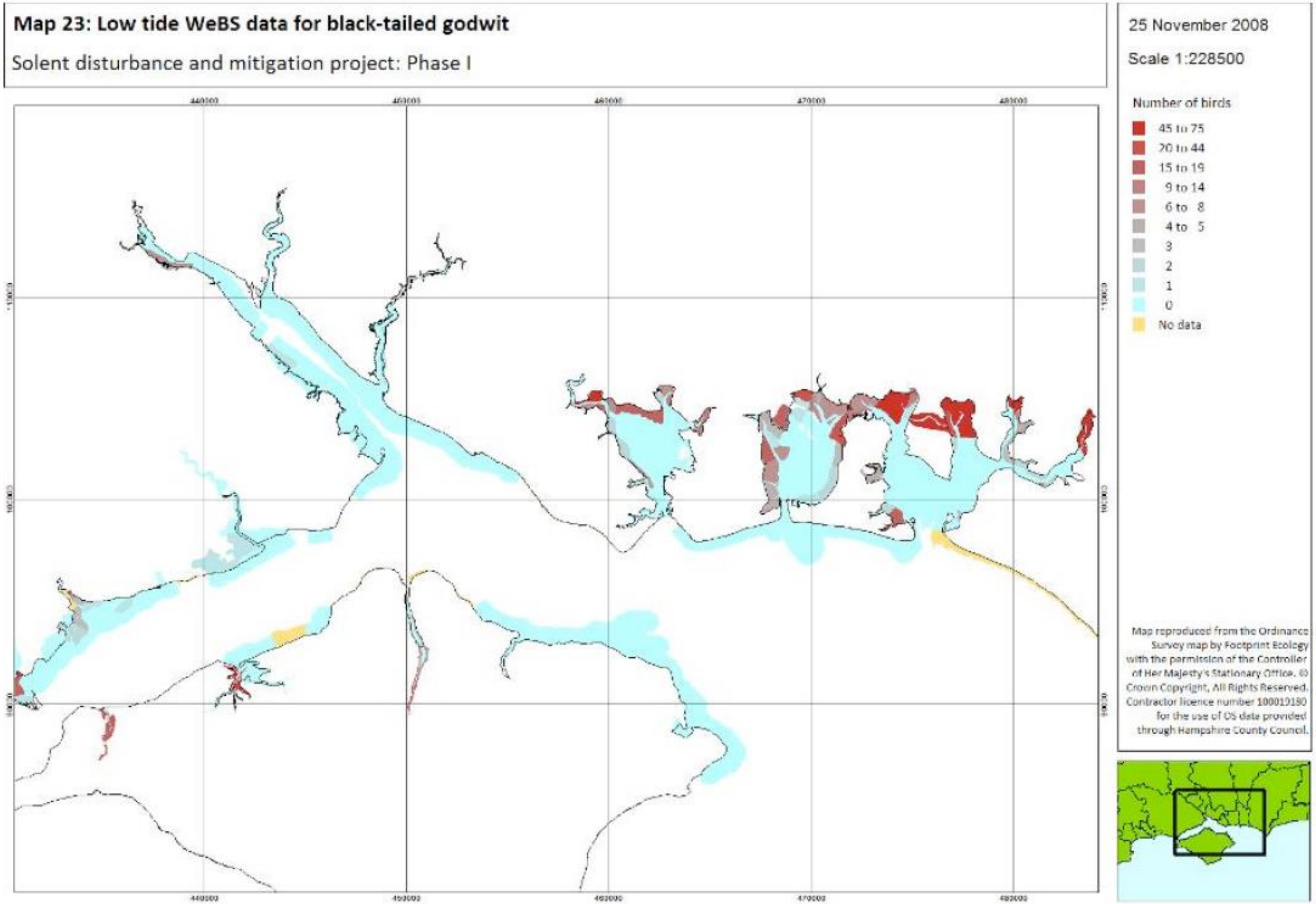

Co-location of Clam Dredging and Features/Sub-features
Clam Dredge Sightings 2012-2015
Portsmouth Harbour SPA
Mudflats and sandflats not covered by seawater at low tide (H1140) polygons
Intertidal coarse sediment (A2.1)
Intertidal sand and muddy sand (A2.2)
Intertidal mud (A2.3)
Intertidal mixed sediments (A2.4)
Intertidal seagrass beds (A2.61)
Saltmarsh polygons
Saltmarsh (A2.5)
0 0.5 1 2 NM
N
Southern
IFCA
Inshore Fisheries and Conservation Authority

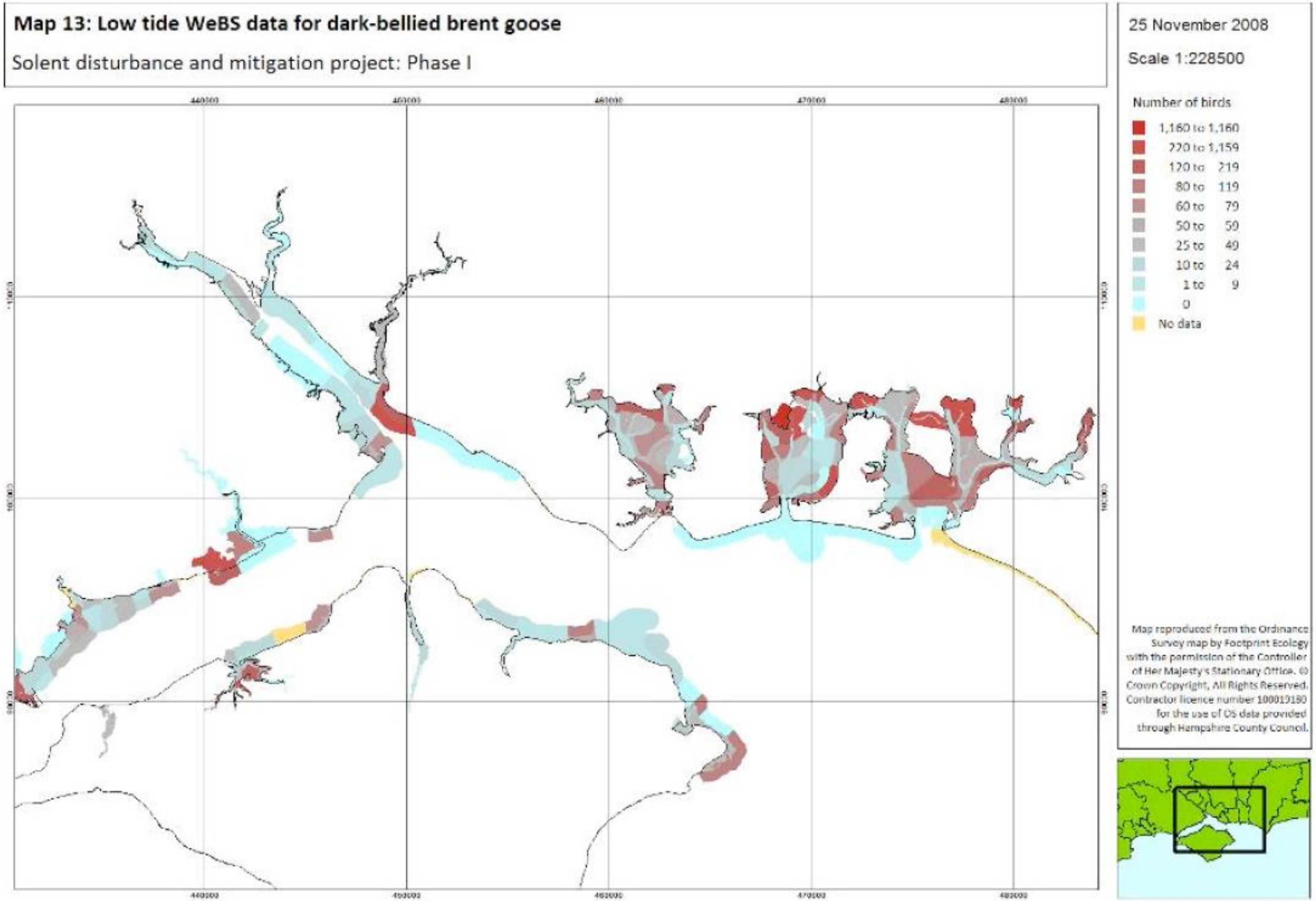
Annex 7: Low tide WeBS data distribution maps for Dunlin, Dark-bellied brent goose and Black-tailed godwit in the Solent taken from Stillman *et al*., (2009).


Map 22: Low tide WeBS data for dunlin
Solent disturbance and mitigation project: Phase I
25 November 2008
Scale 1:228500
Number of birds
1,000 to 2,500
500 to 999
250 to 499
150 to 249
100 to 149
60 to 99
30 to 59
10 to 29
1 to 9
0
No data
Map reproduced from the Ordnance Survey map by Footprint Ecology with the permission of the Controller of Her Majesty's Stationary Office. © Crown Copyright, All Rights Reserved. Contractor licence number 100019180 for the use of OS data provided through Hampshire County Council.

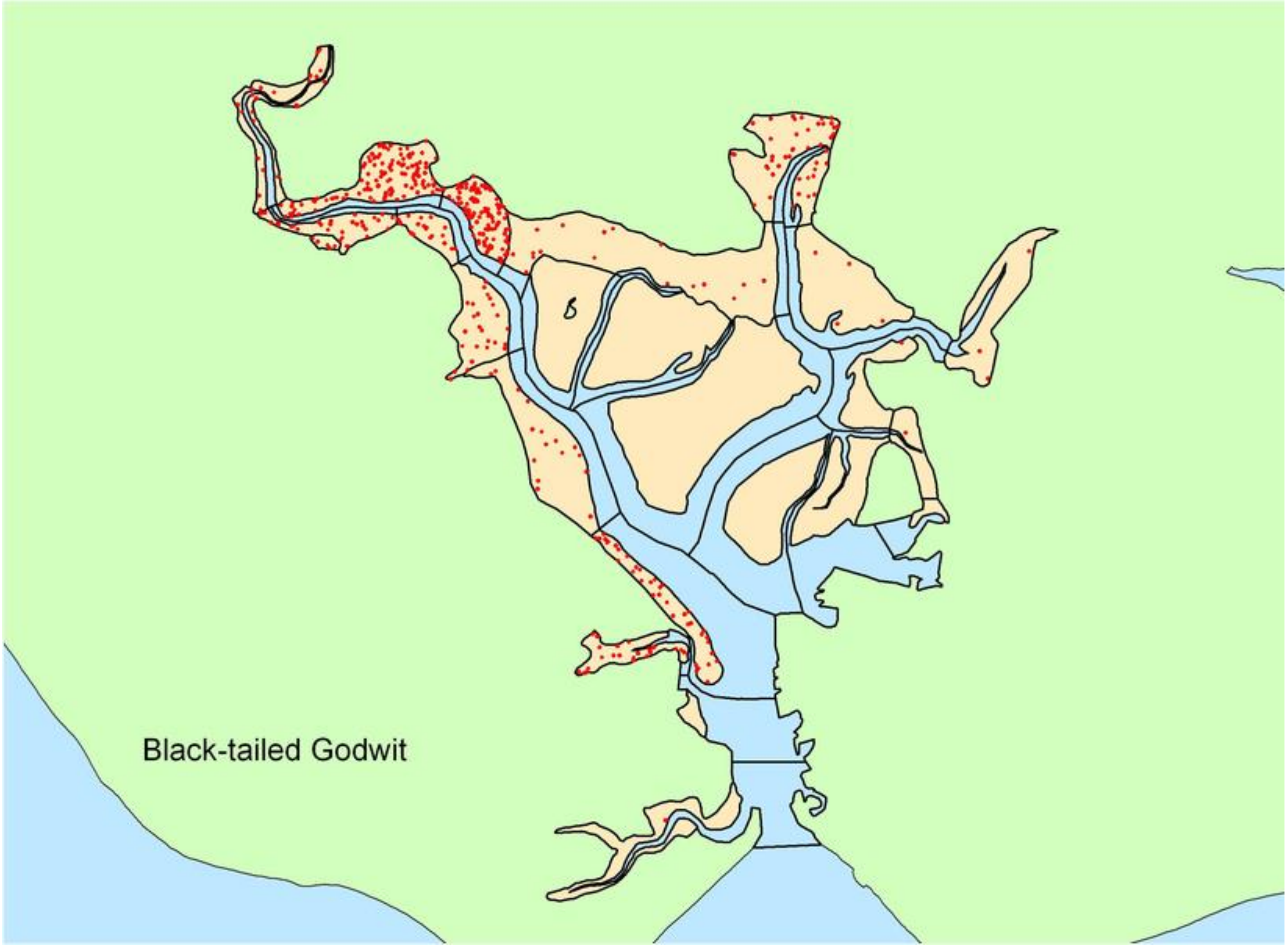
Map 23: Low tide WeBS data for black-tailed godwit

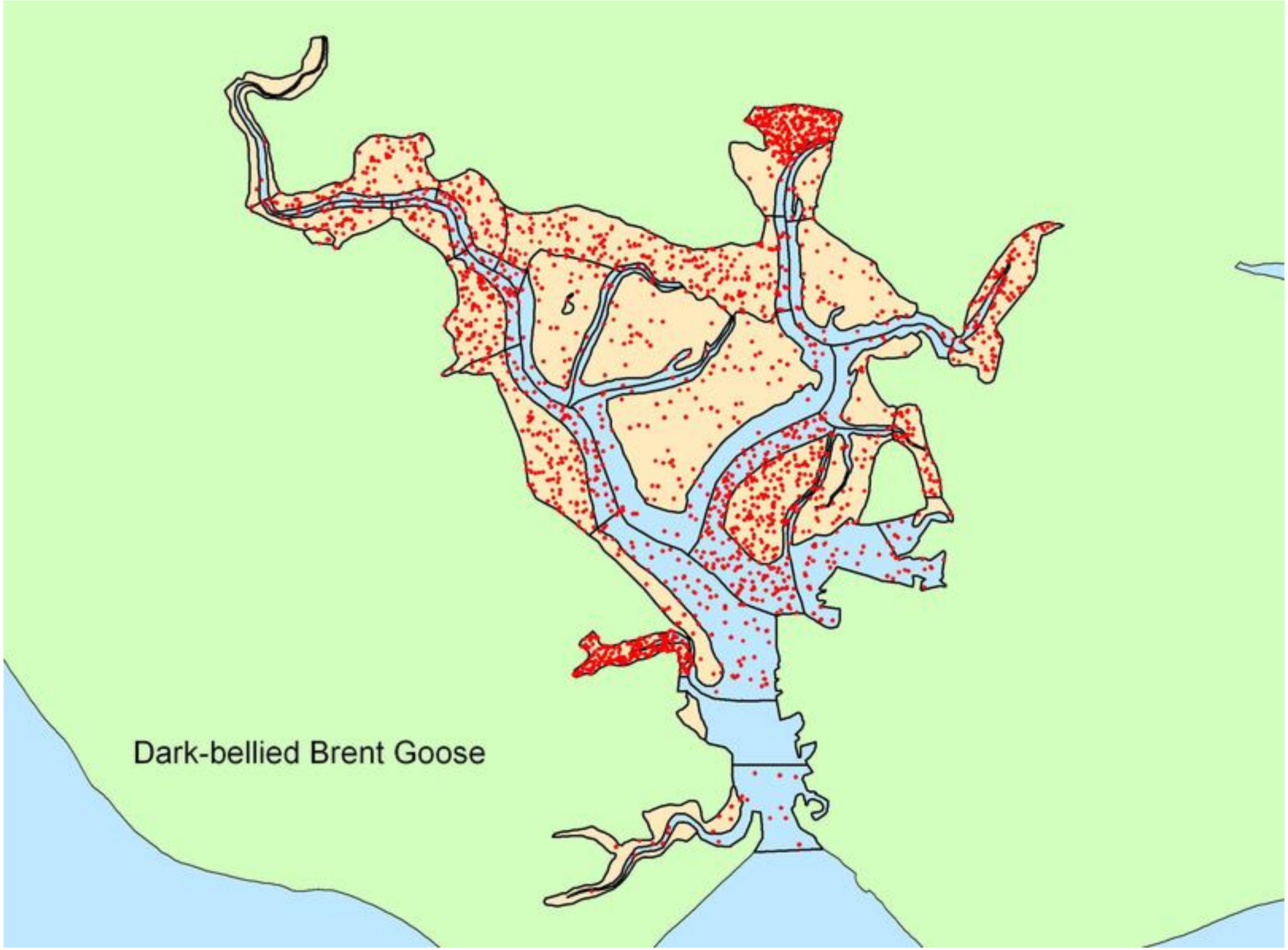
Solent disturbance and mitigation project: Phase I

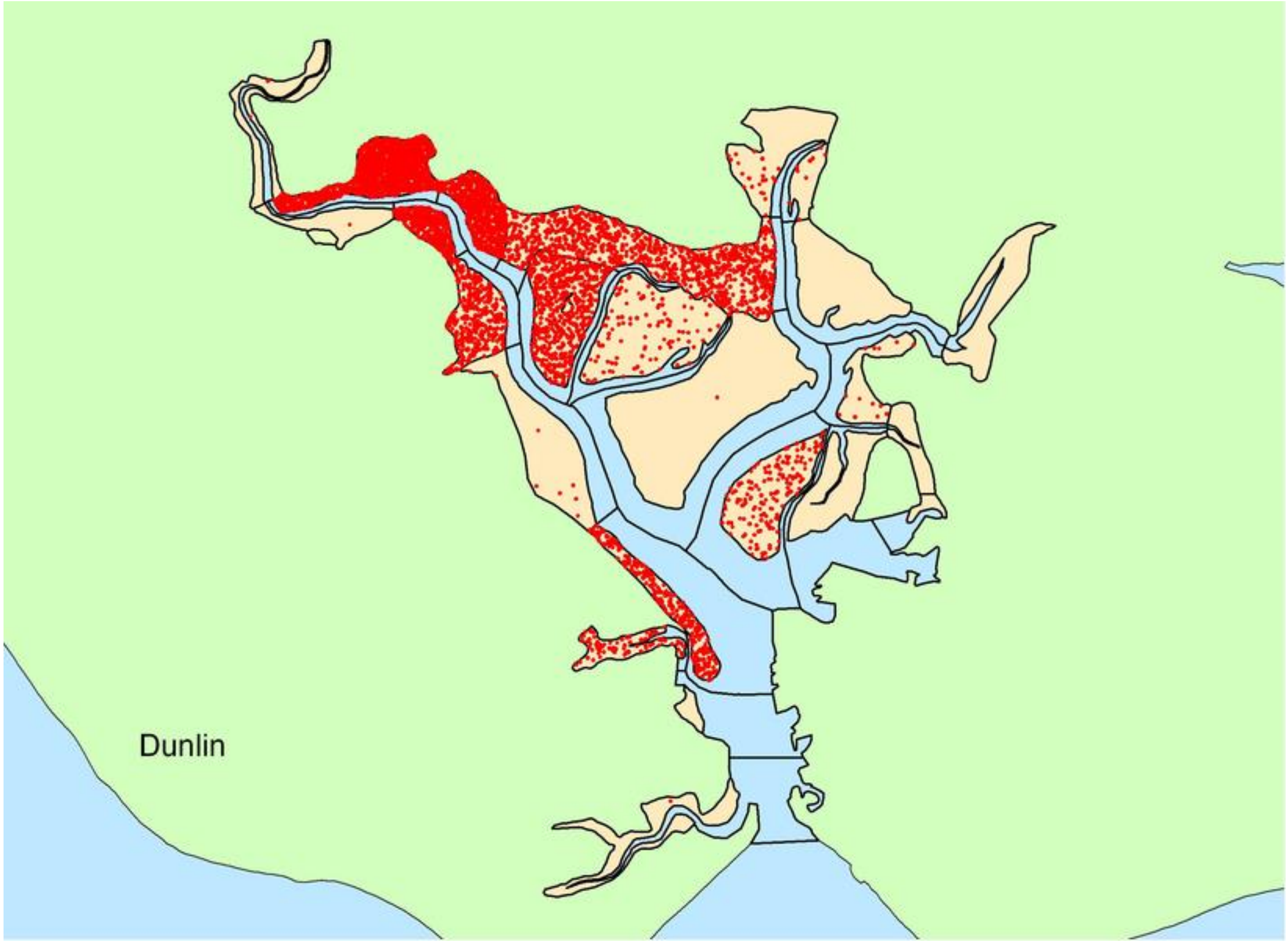



Map 13: Low tide WeBS data for dark-bellied brent goose
Solent disturbance and mitigation project: Phase I
25 November 2008
Scale 1:228500
Number of birds
1,160 to 1,160
220 to 1,159
120 to 219
80 to 119
60 to 79
50 to 59
25 to 49
10 to 24
1 to 9
0
No data
Map reproduced from the Ordinance Survey map by Footprint Ecology with the permission of the Controller of Her Majesty's Stationary Office. © Crown Copyright, All Rights Reserved. Contractor licence number 100019180 for the use of OS data provided through Hampshire County Council.

Annex 8: WeBS Low Tide Count (LTC) scheme point data distribution maps from 2008/09 for Black-tailed godwit, Dark-bellied Brent goose and Dunlin in Portsmouth Harbour. Taken from http://blx1.bto.org/webs-reporting/?tab=lowtide.


Black-tailed Godwit


Dark-bellied Brent Goose

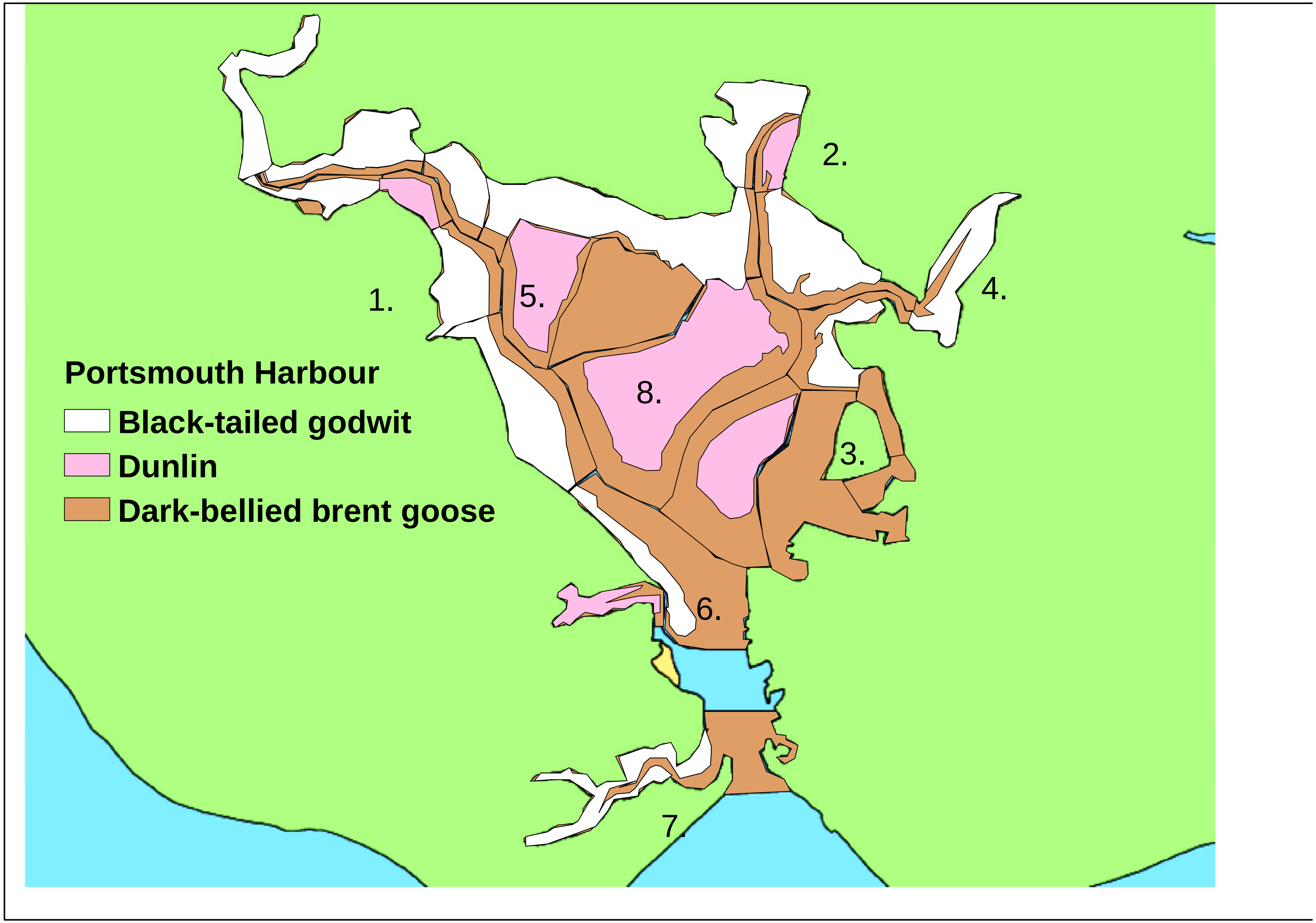

Dunlin

Annex 9: Important Feeding Sites for Overwintering Bird Species within Portsmouth Harbour. Taken from the Solent Overwintering Birds Workshop Report (Draft) (Natural England, In Press)

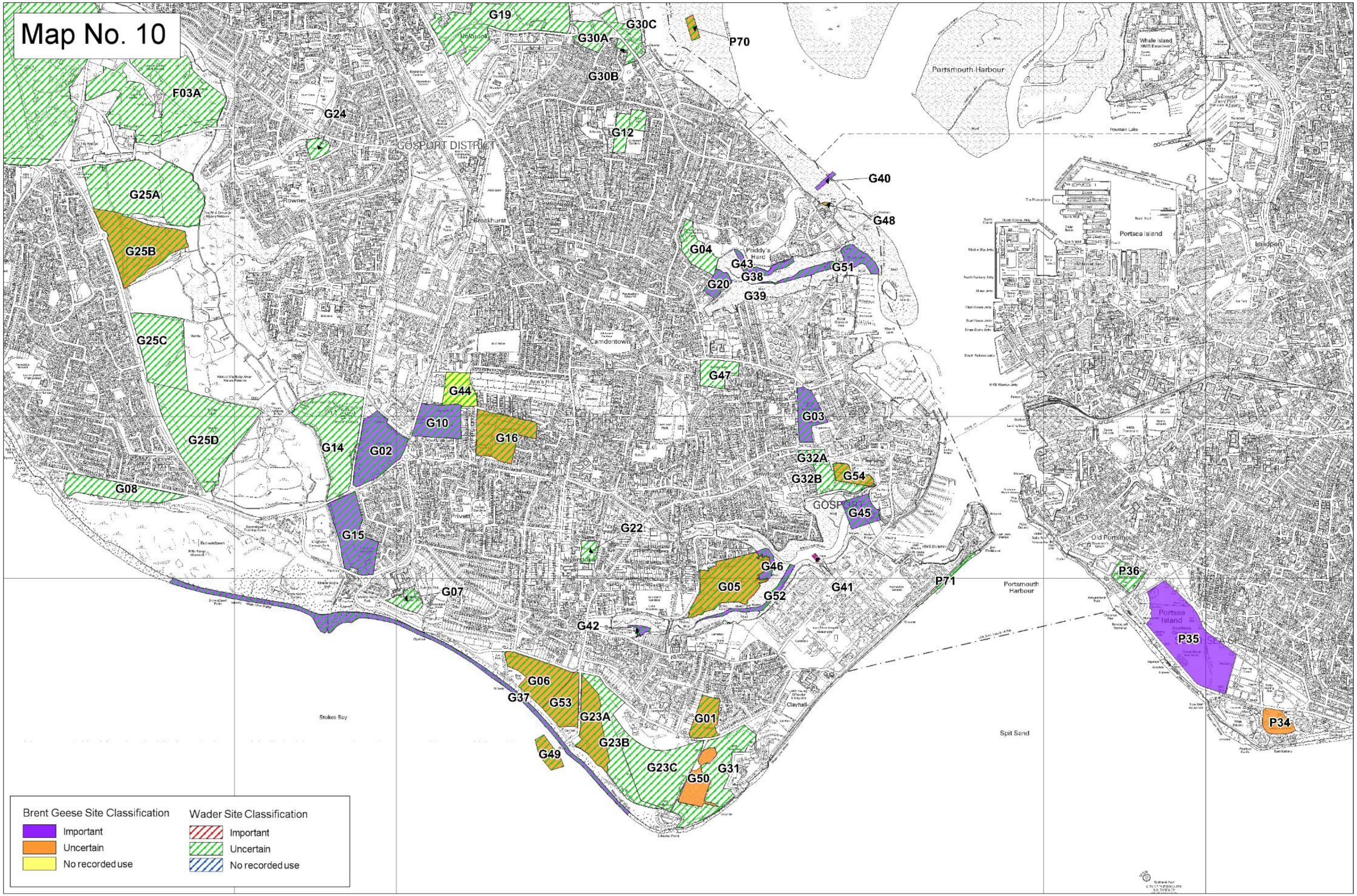
Portsmouth Harbour notes (map provided on page 77)

1. RNAD Gosport – grassland feeding by brent geese and godwit and roost on saltmarsh fringe by godwit and dunlin. Dunlin also roost on pontoons off Wicor Shore.
2. Dark-bellied brent geese - feed here on grassland – Port Solent.
3. Dark-bellied brent geese - Whale island - grassland feeding.
4. Black-tailed godwit - Can be important at certain times of year. Can vary depending on food supply – age dois of bivalves?
5. Dunlin - Pewitt Island roost.
6. Can be a Dunlin roost here – South Priddys Hard on string BS land.
7. Dunlin - roost on sea wall.
8. No Godwit counts as covered with water – hardly get data as often covered on neap tides.

Many of the black-tailed godwits feeding on Portsmouth Harbour roost at Farlington Marshes, also interchange with Titchfield Haven.
Much movement/interchange with Langstone Harbour/Farlington by dunlin.
Fareham Creek & Portchester were key sites for black-tailed godwit.
Lowest flats will hardly get data as often covered on neap tides
Portsmouth Harbour has very low mudflats so only uncovered on lowest tides. Low tide counts are on neaps so will miss use of these lower mudflats.
Langstone has high mudflats so little extra exposed toward extreme low water when some birds will move to Portsmouth Harbour.

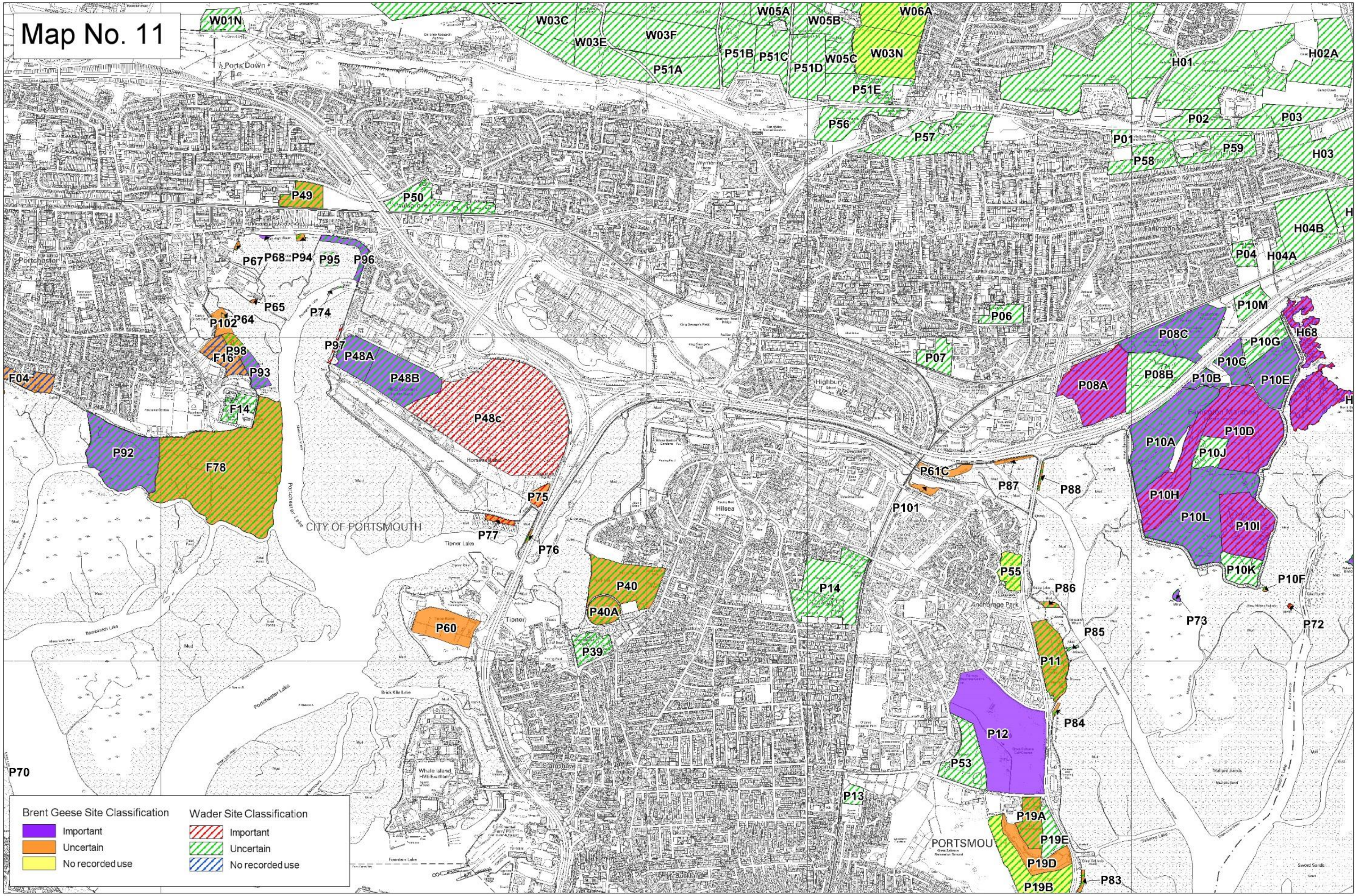

Portsmouth Harbour
Black-tailed godwit
Dunlin
Dark-bellied brent goose
1.
2.
3.
4.
5.
6.
7.
8.

Annex 10: Bird roosting sites from the Solent Waders and Brent Goose Strategy. Taken from http://www.solentforum.org/forum/sub_groups/Natural_Environment_Group/Waders%20and%20Brent%20Goose%20Strategy/.



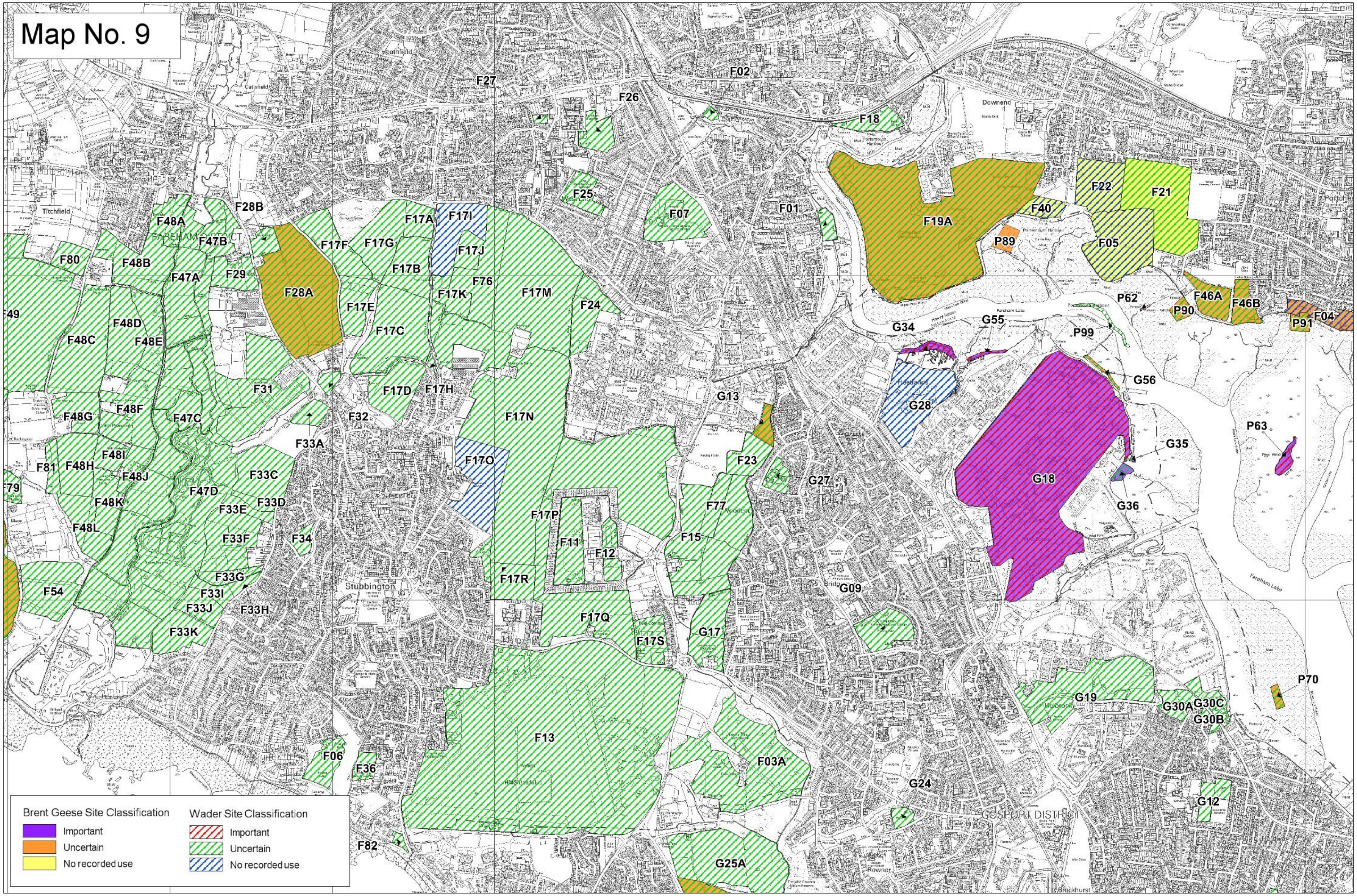
Current Use Analysis: Important Sites for Waders and Brent Geese

N



Current Use Analysis: Important Sites for Waders and Brent Geese

N



Current Use Analysis: Important Sites for Waders and Brent Geese

N

Annex 11: Classification of Bivalve Mollusc Production Areas interacting with the Portsmouth Harbour SPA

Portsmouth Harbour - Tapes spp.

Scale - 1:50000

Classification Zones: Class A / Class B / Class C / Prohibited / LT Class B

Classification of Bivalve Mollusc Production Areas: Effective from 30 April 2015

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

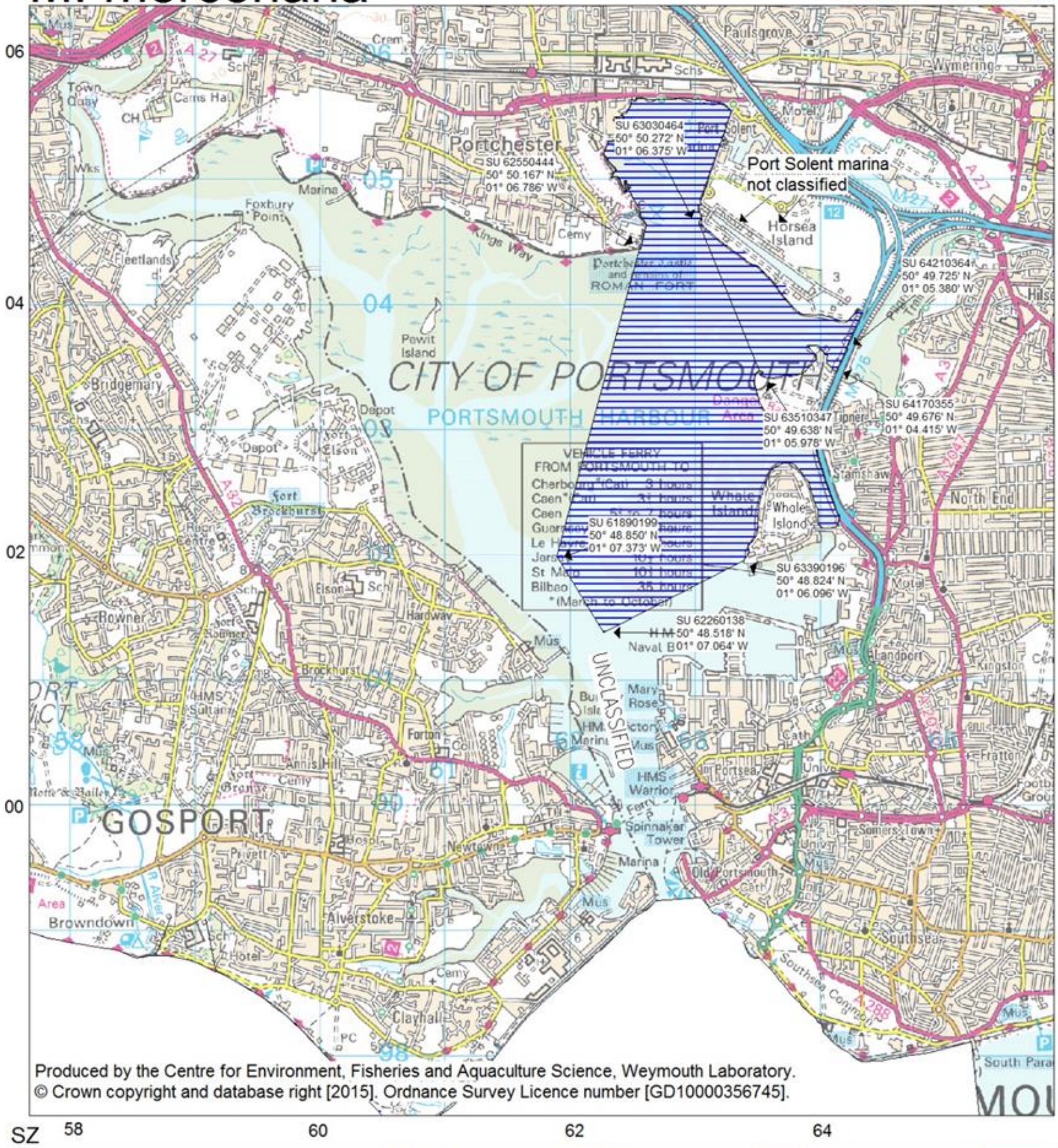
Further details on the classified species and the areas may be obtained from the responsible Food Authority. Enquiries regarding the maps should be directed to: Shellfish Microbiology, CEFAS Weymouth Laboratory, Barrack Road, The Nothe, Weymouth, Dorset DT4 8UB. (Tel: 01305 206600 Fax: 01305 206601)

N.B. Lat/Longs quoted are WGS84
Seperate maps available for C. edule, and M. mercenaria at Portsmouth Harbour

Food Authority: Portsmouth Port Health Authority

Portsmouth Harbour - M. mercenaria

Scale - 1:50000



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

Classification of Bivalve Mollusc Production Areas: Effective from 4 June 2015

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 Nothe, Weymouth, Dorset DT4 8UB.
(Tel: 01305 206600 Fax: 01305 206601)

N.B. Lat/Longs quoted are WGS84
Seperate maps available for C. edule and Tapes spp. at Portsmouth Harbour

Food Authority: Portsmouth Port Health Authority

Annex 12. 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 Portsmouth Harbour SPA. Taken from Ferns *et al*., (2000).

Species	% Change After Harvesting – Muddy Sand	% Change After Harvesting – Clean Sand	Recovery Period
Crangon crangon	-	-38%*	>86 days (muddy sand)
Macoma balthica	55%	-6%	0 days (muddy sand) >86 days (clean sand)
Cerastoderma edule	-35%	-15%	>86 days (muddy sand) 0 days (clean sand)
Hediste diversicolor	-	-33%*	-
Hydrobia ulvae	-60%	-56%	>86 days (muddy sand) 8 days (clean sand)

*Low abundances were found

Annex 13. Table of studies investigating the impacts of shellfish dredging and recovery rates.

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

					days *Nephtys homergii* - <86 days *Carcinus maenas* - <86 days
Kaiser, M.J., Edwards, B. & Spencer, B.E. 1996. Infaunal community changes as a result of commercial clam cultivation and harvesting. *Aquatic Living Resources*, 9, 57-63.	Whitestable, Kent, south-east England	Suction dredge Manila clam – *Tapes philippinarum*	Clay interspersed with patches of shell debris and lignin deposits (from local paper mill) overlaid with fine sand and silt. Exposed to prevailing north easterly winds.	Seven months after harvesting, no significant differences in infaunal communities were found between the harvested clam lay and either of the control sites (near and far). After seven months, sediment fractions in the harvested plot did not significantly differ from the sediment in control areas, as sedimentation had nearly restored sediment structure.	*Nephtys hombergii* contributed to the most similarity between samples taken from the clam lay 7 months after harvesting and was also dominant in control areas.
Hall, S.J. & Harding, M.J.C. 1997. Physical disturbance and marine benthic communities: the effects of mechanical harvesting of cockles on non-target benthic infauna. *Journal*	Auchencairn Bay, Solway Firth, Dumfries, Scotland	Suction dredge & tractor dredge Common cockle – *Cerastoderma edule*	Sediments generally become coarser in the centre of the bay and low water mark (median diameter = 3.5ø, 88μm) (near to the study area). Silt/clay fraction (<62.5 μm)	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	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

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

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

Annex 14. 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.

Species	Recolonization Strategy	Reproductive Season	References
Arenicola marina	Above-surface migration	Autumn to winter	McLusky *et al*. (1983) http://www.marlin.ac.uk/biotic/browse.php?sp=4238
Macoma balthica	Active migration of adults and larval settlement/recolonization	Spring and autumn	http://www.marlin.ac.uk/species/detail/1465 http://www.marlin.ac.uk/biotic/browse.php?sp=4272
Hydrobia ulvae	Active migration	March to October	http://www.marlin.ac.uk/habitats/detail/206/cerastoderma_edule_and_polychaetes_in_littoral_muddy_sand http://www.marlin.ac.uk/biotic/browse.php?sp=4186
Pygospio elegans	Larval recolonization	December to May or January to August	http://www.marlin.ac.uk/habitats/detail/206/cerastoderma_edule_and_polychaetes_in_littoral_muddy_sand http://www.marlin.ac.uk/biotic/browse.php?sp=6530
Hediste diversicolor	Adult migration and juvenile recruitment	Spring to summer	Lewis *et al*. (2002) http://www.marlin.ac.uk/biotic/browse.php?sp=4253
Scrobicularia plana	Larval recolonization	May to September	Lewis *et al*. (2002) Santos *et al*. (2011)
Nephtys hombergii	Passive and active migration	Variable; May and September (Tyne Estuary), throughout the year peaking in July and November (Southampton Water), August and September (Århus Bay, Denmark)	Hall and Harding (1997) http://www.marlin.ac.uk/biotic/browse.php?sp=4414

Annex 15. 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).

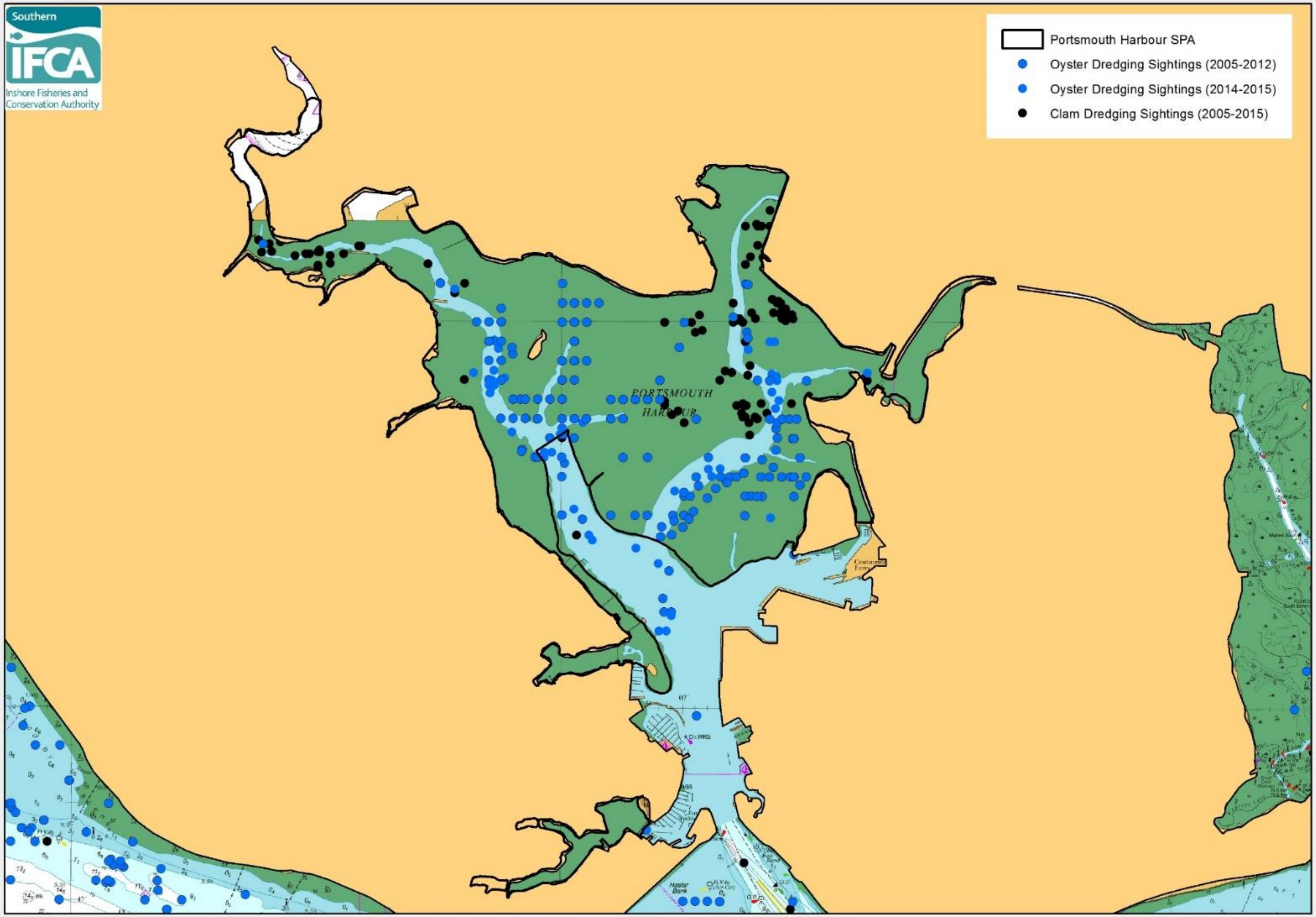
SAC Species (Summary of key biotopes for SAC sub-features – Appendix XI):
Pontocrates spp.
Bathyporeia spp.
Lanice conchilega
*Corophium**
*Macoma balthica**
*Arenicola marina**
*Cerastoderma edule**
*Hediste diversicolor** (previously *Nereis diversicolor*)
Mya arenaria
Pygospio elegans
*Scrobicularia plana**
Streblospio shrubnsolii
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.
Tubiflex spp.
Nerine spp.
Hydrobia ulvae

Annex 16: Co-location of Recent Clam Dredging (2012-2015) and Oyster Dredging (2012, 2014-2015) Sightings in the Portsmouth Harbour SPA


Southern
IFCA
Inshore Fisheries and Conservation Authority
PORTSMOUTH HARBOUR
Oyster Dredging Sightings (2012)
Oyster Dredging Sightings (2014-2015)
Clam Dredging Sightings (2012-2015)
Portsmouth Harbour SPA

Annex 17: Co-location of Recent Clam Dredging (2005-2015) and Oyster Dredging (2005-2012, 2014-2015) Sightings in the Portsmouth Harbour SPA


Southern
IFCA
Inshore Fisheries and Conservation Authority
Portsmouth Harbour SPA
Oyster Dredging Sightings (2005-2012)
Oyster Dredging Sightings (2014-2015)
Clam Dredging Sightings (2005-2015)
PORTSMOUTH HARBOUR